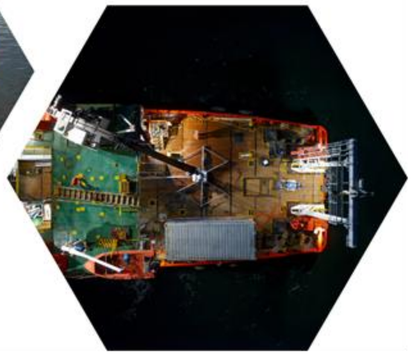
Environmental Impact Assessment

Report for

the Baltic East Offshore Wind Farm



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ISO 45001

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Declaration

I declare that I meet the requirements referred to in Article 74a(2) of the Act of 3 October 2008 on the provision of information on the environment and its protection, public participation in environmental protection and environmental impact assessments (consolidated text: Journal of Laws of 2024, item 1112) and I am aware of criminal liability for making a false declaration.

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ORLEN Neptun | BalticEast ORLEN GROUP | MEWO SUBSEA SOLUTIONS

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Abbreviations and definitions

ABBREVIATION	EXPLANATION
AIS	Automatic Identification System
AMC POLSKA	civil–military authority performing airspace management tasks at pre-tactical and tactical levels
APV	Applicant Proposed Variant
HOPN	Hydrographic Office of the Polish Navy
BIAS	Baltic International Acoustic Survey
Bq	becquerel, the SI unit of radioactivity
CLV	cable laying vessel
CTV	crew transfer vessel
decibel (dB)	logarithmic unit of measurement of sound intensity / sound pressure. The decibel value for sound pressure is 20 log10 (P / P0), where P = measured pressure value and P0 = reference pressure
DIN	dissolved inorganic nitrogen
DPD	detection positive days
DPM	detection positive minutes
CIEP	Chief Inspectorate of Environmental Protection
HELCOM	Helsinki Commission, Baltic Marine Environment Protection Commission
HLCV	heavy lift crane vessel
HLJV	heavy lift jack-up vessel
IAC	inter array cables
MI GMU	Maritime Institute of the Gdynia Maritime University
IMWM–NRI	Institute of Meteorology and Water Management – National Research Institute
ISO	International Organization for Standardization
SWB	surface water body
EC	European Commission
kW	kilowatt(s)
kW cruise	number of cruises times engine power
LOI	organic matter content in a sample, marked as loss on ignition
LOQ	limit of quantification
LPS	lightning protection system
MARPOL	International Convention for the Prevention of Pollution from Ships
OWE	offshore wind energy
OWF	offshore wind farm
Baltic East OWF	Baltic East Offshore Wind Farm
MW	megawatt, unit of power
Baltic East OWF Area	area covered by decision no. MFW/46.E.1 of the Minister of Infrastructure, dated 29 September 2023 (ref.: DGM-3.530.20.2022), on the permit for the construction and use of artificial islands, structures and devices in Polish Sea Areas, defined by the coordinates set out in Part II of the permit
OSS	offshore substation
PCB	polychlorinated biphenyls
PLB	post-lay burial – cable burial after its installation on the seabed
PLGR	pre-lay grapnel run

ABBREVIATION	EXPLANATION
SEM	State Environmental Monitoring
PSA	Polish Sea Areas within the meaning of the Act of 21 March 1991 on the marine areas of the Republic of Poland and maritime administration (consolidated text: Journal of Laws of 2024, item 1125).
source level	sound pressure at standard distance of 1 m; unit: dB re 1 µPa at 1 m
PSzW	permit for the construction and use of artificial islands, structures and devices in Polish Sea Areas, within the meaning of the Act of 21 March 1991 on the sea areas of the Republic of Poland and maritime administration (consolidated text: Journal of Laws of 2024, item 1125, as amended)
PSzW Baltic East OWF	decision no. MFW/46.E.1 of the Minister of Infrastructure, dated 29 September 2023 (ref.: DGM-3.530.20.2022), on the permit for the construction and use of artificial islands, structures and devices in Polish Sea Areas
MSPPSA	Spatial development plan for internal sea waters, territorial sea and exclusive economic zone, at a scale of 1:200 000, adopted by the Regulation of the Council of Ministers of 14 April 2021 (Journal of Laws of 2021, item 935)
Report/EIA Report	Environmental Impact Assessment Report within the meaning of the Act of 3 October 2008 on the provision of information on the environment and environmental protection, public participation in environmental protection and on environmental impact assessments (consolidated text: Journal of Laws of 2024, item 1112)
SAMBAH	Static Acoustic Monitoring of the Baltic Sea Harbour Porpoise
SLB	simultaneous lay and burial of the cable in the seabed
SOV	service operation vessel
SPL	sound pressure level
SPRAS	*SPRat Acoustic Survey* – acoustic survey cruises carried out by the National Marine Fisheries Research Institute within the Baltic Proper area
NRS	noise reduction system
TBT	tributyltin
POP	persistent organic pollutants
UNFCCC	United Nations Framework Convention on Climate Change
EEZ	exclusive economic zone
PAH	polycyclic aromatic hydrocarbons

1 INTRODUCTION

1.1 Introduction

The proposed Project entitled 'Baltic East Offshore Wind Farm in area 46.E.1 together with the necessary infrastructure' (hereinafter: Project or Baltic East OWF) with a maximum installed capacity of 966 MW, is to be implemented in the sea areas of the Republic of Poland. On 29 September 2023, Orlen Neptun VIII sp. z o.o. obtained decision no. MFW/46.E.1, dated 29 September 2023 (ref.: DGM-3.530.20.2022), from the Minister of Infrastructure for the construction and use of artificial islands, structures and devices in the Polish Sea Areas for the project entitled 'Baltic East Offshore Wind Farm in area 46.E.1 together with the necessary infrastructure' (hereinafter: PSzW Baltic East OWF).

The Baltic East OWF Area has a surface of approximately 111.7 km^2 and is located opposite Sasino and Białogóra villages, at a distance of approximately 22.5 km from the coast [Figure 1].

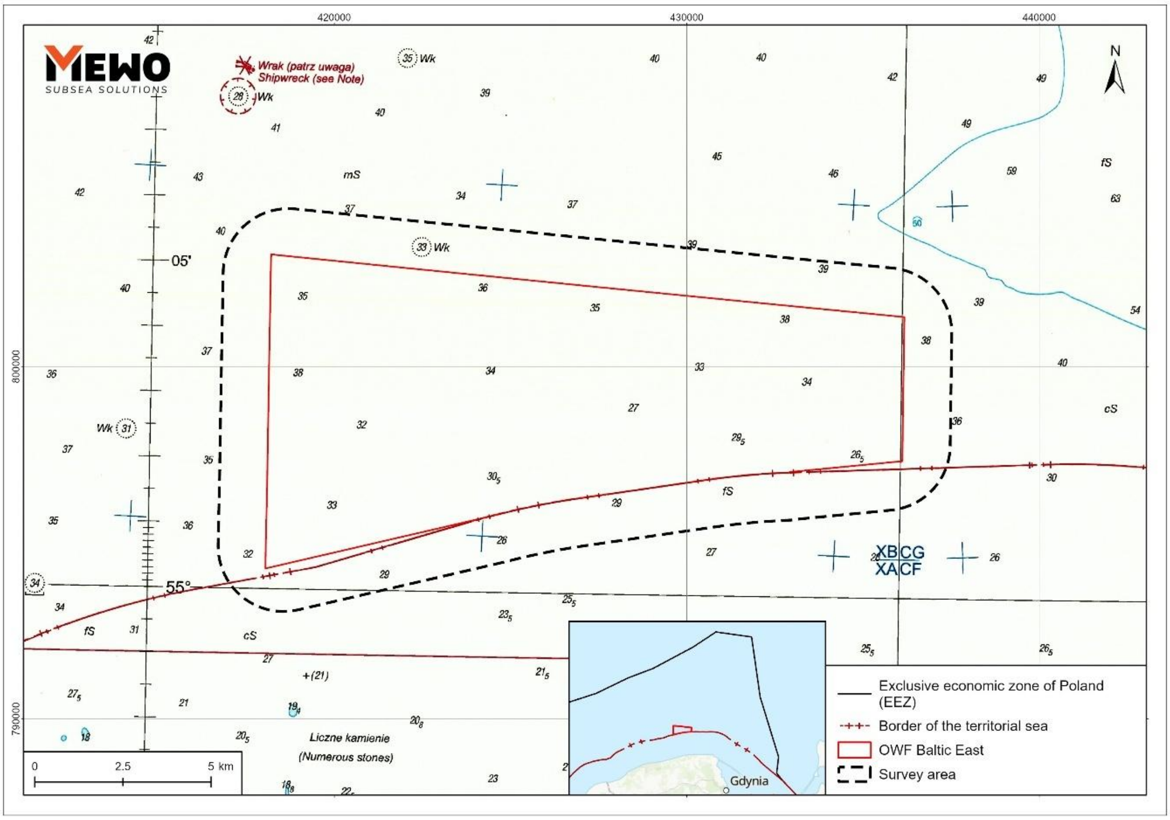

Figure 1 Location of the proposed Baltic East OWF project
[Source: internal materials based on HOPN data]

The proposed Project covers the construction, operation and decommissioning of the Baltic East OWF. It will consist of up to 64 wind turbines, up to 150 km of inter array cable routes and up to 2 offshore substations (hereafter: OSS).

Table 1 summarises the basic parameters of the proposed Project in the Applicant Proposed Variant (hereinafter referred to as the APV). The study adopted the concept of a boundary condition envelope, which is described in detail in Section 1.4 hereof.

Table 1 Key parameters of the Baltic East OWF for the Applicant Proposed Variant [Source: internal materials]

PARAMETER	UNIT	VALUE
Maximum number of wind turbines	-	64
Single wind turbine capacity (minimum–maximum)	MW	18–25
Rotor diameter (minimum–maximum)	m	236–360
Maximum length of inter-array cables between the wind turbines and the OSS	km	150
Number of offshore substations	-	2

1.2 Purpose of the Project

The main purpose of the proposed Project is the generation of electricity using a renewable energy source – wind. This purpose is consistent with the strategic objective of the ORLEN Group, to which the Applicant Orlen Neptun VIII sp. z o.o. belongs, and is also in line with the implementation of the objectives of the Energy Policy of Poland until 2040 (EPP2040), which assumes the construction of offshore wind farms with a total capacity of 5.9 GW by 2030, and approximately 11 GW by 2040, in the Polish exclusive economic zone (hereinafter: EEZ). These activities will enable the transformation of the Polish energy sector towards the use of zero-emission energy sources, which is a response to the current climate challenges facing Poland, Europe and the world.

An important premise for the Project is the possibility of avoiding emissions of pollutants into the atmosphere. With a conservative assumption of 40% of power utilisation and 55 years of OWF operation, the Baltic East OWF with a maximum capacity of 966 MW can produce 186.17 TWh/670.21 PJ of electricity, which would help prevent the emission of over 66.37 million Mg CO_2, over 911 thousand Mg SO_2, over 121 thousand Mg of nitrogen oxides and nearly 2.21 million Mg of particulate matter from lignite-fired power plants, assuming the emissions indicated by the European Environment Agency (EEA 2008). The project will therefore contribute to Poland's compliance with international regulations at global and regional levels.

1.3 Project classification

According to the Regulation of the Council of Ministers of 10 September 2019 *on projects that may have a significant impact on the environment* (Journal of Laws of 2019, item 1839, as amended), the Project qualifies as an undertaking which may always have a significant impact on the environment (in accordance with §2(1)(5)(b), i.e. plants using wind energy for electricity generation, located in maritime areas of the Republic of Poland.

Being classified as a project that may always significantly affect the environment entails the obligation to obtain a decision on environmental conditions after an obligatory conduct of proceedings regarding the assessment of the project environmental impact.

1.4 Purpose, scope and basis for the preparation of the EIA Report

The main purpose of this EIA Report is to present the environmental, social, economic or cultural conditions and, on their basis, to assess the impact of the Project described in the EIA Report on the broadly understood biotic and abiotic environment, as well as on the health and living conditions of people. In order to perform this assessment, the following were determined:

- character and scale of the proposed Project;
- environmental conditions, such as:
  - the existing state of the biotic environment, including on the basis of the environmental inventory survey conducted;
  - the existing state of the abiotic environment, including on the basis of the environmental surveys conducted;
  - cultural heritage and landscape values;
  - existing and planned use and development of sea basins.

On the basis of information about the Project and the existing environmental conditions, the following were determined:

- the character, extent and significance of the expected environmental, spatial and social impacts related to the Baltic East OWF construction and operation in two variants;
- the possibility of avoiding, preventing, limiting and possibly compensating for adverse Project impacts or threats identified, including potential emergency situations;
- the environmental monitoring programme proposed to be implemented in all phases of the Project.

In addition, the EIA Report accounts for the conditions imposed on the Project Owner by the PSzW Baltic East OWF decision, such as:

- consideration of the Project impact on the resources and recruitment of fish important for the fishing sector;
- consideration of the impact of generating physical fields (electromagnetic field), possible cumulative negative impacts with the neighbouring offshore wind farms, and the risk of collision-related accidents, also in emergency situations.

The scope of the EIA Report corresponds with the requirements of the law, in particular containing elements referred to in Article 66 of the Act of 3 October 2008 *on the provision of information on the environment and environmental protection, public participation in environmental protection and on environmental impact assessments* (consolidated text: Journal of Laws of 2024, item 1112) (hereinafter: the EIA Act). During its preparation, the authors' experience in preparing reports for other projects of this type was also taken into account.

Pursuant to Article 74(1)(1) of the EIA Act, the EIA Report constitutes an appendix to the application for the issuance of the decision on environmental conditions for the proposed Project and is a necessary element enabling the proceedings on the environmental impact assessment of a project, in accordance with the requirements of the EIA Act, as well as with the Regulation of the Council of Ministers of 10 September 2019 *on projects that may have a significant impact on the environment* (Journal of Laws of 2019, item 1839, as amended).

The formal basis for the EIA Report is the agreement between the contractor and the Project Owner, namely Orlen Neptun VIII sp. z o.o.

The preparation of the EIA Report was based both on the technical documents provided by the Project Owner and on the applicable laws, strategic, programme and planning documents at international, national, regional and local levels, as well as on literature data and environmental impact reports or other documentation for the existing, ongoing or planned projects located in the vicinity of the proposed Project.

The EIA Report is based on the concept of an envelope description of the Project, i.e. provision of an impact assessment for the largest values describing the undertaking in question. This is due to the fact that offshore wind energy projects are considerably extended over time – in the case of offshore wind farms, investment processes last many years, often exceeding 10 years from the decision to begin preparations for the project to the beginning of construction. During that time, the technologies used in OWFs undergo significant changes, mainly aimed at reducing the environmental impact by increasing the efficiency of a power generation by a single wind power station, and reducing their total number necessary to obtain the OWF power assumed. The parameters of the Project had to be described in such a way so as to allow taking advantage of technological progress in the future, and applying solutions not worse than the ones existing at present.

The envelope concept means that in the case of the evaluating a given parameter and the possibility of applying different technical solutions, the environmental impact assessment was carried out for the solution that is potentially most burdensome to the environment. It was assumed that if the most burdensome solution would not have a significantly negative impact on the environment, the remaining solutions – being less burdensome – would also be acceptable, as they would lead to lower impacts than the ones assumed in the EIA Report.

The main assumption of the envelope concept applied was to determine which parameters of the Baltic East OWF are significant for the scale of its impact, and consequently to determine the conditions for the project implementation in the decision on environmental conditions (DEC) as well as to ensure that its implementation will not cause significant environmental impact, regardless of the technology ultimately selected from among the ones considered in this Report.

1.5 Documents relevant to the Project

This section presents the findings of strategic documents or provisions of legal acts established at the international, European and national level, which may be relevant or which set the framework for the implementation of the Project. The section also outlines the environmental protection and energy transition objectives of these documents, along with an analysis of their consistency with the objectives of the Project. As for the scope of the documents indicated below, they relate to energy issues, climate change mitigation and adaptation, as well as sustainable development.

1.5.1 Requirements at international and community level

In addition to the strategic documents, first of all, it is justified to refer to legal acts establishing requirements or objectives at international level, which are adopted in the form of international agreements between states. These acts allow making arrangements on issues that either constitute shared objectives or regulate matters that are relevant in a broader than national context.

2012 United Nations Conference: Rio+20

The Conference on Sustainable Development adopted an outcome document entitled 'The future we want', containing resolutions on sustainable development. The Conference concluded with the signature of, among others, the following declarations of the participating countries:

- to continue the process of implementing sustainable development goals using the concept of the green economy as a tool to achieve sustainable development, taking into account the importance of combating and adapting to climate change;
- to develop financing strategies for sustainable development;
- to establish structures to meet the challenges of sustainable consumption and production, applying the principle of gender equality, emphasising the need for civil society involvement, integrating science into policies and considering the importance of voluntary commitments in the area of sustainable development.

United Nations Framework Convention on Climate Change

Within the framework of the Convention, all parties, including Poland and the European Union, made a commitment to achieve the ultimate objective of the Convention, namely to stabilise greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. In order to avoid endangering food production and to enable sustainable economic development, such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change.

The Convention adopted the so-called Kyoto Protocol, in which the parties undertook to reduce greenhouse gas emissions by 2012 by a negotiated amount of no less than 5% in relation to the 1990 base year (EU by 8%, Poland by 6% in relation to 1989). Negotiations are still ongoing on either a new protocol to the Convention or the conclusion of a new agreement to further reduce greenhouse gas emissions.

Convention on the Protection of the Marine Environment of the Baltic Sea Area, signed in Helsinki on 9 April 1992 – the Helsinki Convention

The Convention on the Protection of the Marine Environment of the Baltic Sea Area (hereinafter: Helsinki Convention), was signed in 1992 by countries in the Baltic Sea catchment area, replacing the earlier 1974 Convention. It was ratified by Poland in October 1999 and entered into force on 17 January 2000.

The purpose of the Helsinki Convention is to protect the marine environment of the Baltic Sea area, which comprises the water-body and the seabed, including their living resources and other forms of marine life. The governing body of the Helsinki Convention is the Helsinki Commission.

In order to restore the good environmental status of the Baltic Sea, the Helsinki Commission adopted the Baltic Sea Action Plan in 2007, updated in 2021. The priorities of the Baltic Sea Action Plan are:

- protection against excessive eutrophication (reduction of excess nutrients in the water, affecting algal growth);
- reduction of hazardous substances and litter;
- protection of biodiversity and nature;
- sea-based activities.

International Convention on the Control of Harmful Anti-fouling Systems on Ships

International Convention on the Control of Harmful Anti-fouling Systems on Ships, signed in London on 5 October 2001 (Journal of Laws of 2008, No. 134, Item 851, as amended). Poland is a signatory to the Convention. This framework act establishes the basis for implementing a prohibition on the application of harmful anti-fouling systems (organotin compounds) on ships.

Directive 2014/89/EU – establishing a framework for maritime spatial planning

Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 establishing a framework for maritime spatial planning (OJ EU L 257 of 2014, p. 135) (hereinafter: Directive 2014/89/EU) aims to promote the sustainable growth of maritime economies, the sustainable development of marine areas and the sustainable use of marine resources. It places a legal requirement on EU Member States to establish transparent maritime planning systems and to cooperate with other countries in this regard.

When establishing maritime spatial planning, Member States shall have due regard to the particularities of the marine regions, relevant existing and future activities and uses and their impacts on the environment, as well as to natural resources, and shall also take into account land-sea interactions (Article 4(5) of the Directive). Directive 2014/89/EU emphasises the need to maintain an integrated approach in the planning process, to involve and consult stakeholders, to use the best available data and information, to account for land-sea interactions, to ensure cross-border cooperation between Member States, and to promote cooperation with third countries.

These provisions were implemented into the Polish legal system primarily by the Act of 21 March 1991 *on the maritime areas of the Republic of Poland and maritime administration* (consolidated text: Journal of Laws of 2024, item 1125).

In addition to the legal acts mentioned, it is also necessary to indicate documents of strategic nature or others, which, due to their character, define the directions of activities or objectives relevant from the point of view of the Project.

International and European energy and climate policy

Climate change, but also the international community's response to it, is currently the most important subject of discussion in international cooperation forums. The need for solutions at the global level is not only demanded by the scientific community but is reflected in international documents. Concluded in December 2015 as part of the United Nations Framework Convention on Climate Change, the Paris Agreement (UNFCCC 2015) is now the main document setting out the objectives of its signatories – the parties to the Agreement – in terms of combating climate change. The strategic environmental goal of the Agreement is to keep the increase in global temperature in the second half of this century below 2°C compared to pre-industrial levels, and if possible, even at 1.5°C. As part of this objective, the European Union introduced a system of national targets for the reduction of greenhouse gas emissions by Member States by 2030.

In October 2014, EU leaders adopted a Policy Framework as a follow-up to the 2020 Climate and Energy Package, in line with the long-term perspective set out in:

- the Roadmap for moving to a competitive low-carbon economy by 2050;
- the Energy Roadmap 2050;
- the 'Clean Energy for All Europeans' package (the so-called 'Winter Package');
- Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (OJ EU L 2018 No. 328, p. 82, as amended).

The framework strategy for a resilient energy union with a forward-looking climate change policy stipulates, among others, the reduction of emissions by promoting investment in new technologies such as offshore wind farms.

The key environmental targets for 2030 are to:

- reduce greenhouse gas emissions (compared to 1990 levels);
- ensure an increase in the share of renewable energy in total energy consumption;
- improve energy efficiency and reduce final energy consumption.

With regard to the last objective, it is to be supported by Directive (EU) 2023/1791 of the European Parliament and of the Council of 13 September 2023 *on energy efficiency and amending Regulation (EU) 2023/955* (OJ L 231 of 20.9.2023), which defines targets in this regard with an emphasis on increasing and achieving an adequate share of energy from renewable sources.

EU Climate Adaptation Strategy

In February 2021, the European Commission adopted a new EU Climate Adaptation Strategy (COM2021). This strategy sets out a pathway to prepare for the inevitable impacts of climate change and achieve climate resilience by 2050. It builds on the 2013 climate change adaptation strategy, but places greater emphasis on developing solutions and moving from planning to implementation. The strategy has three main objectives related to climate change adaptation: smarter adaptation, more systemic adaptation and faster adaptation.

The objectives are based on a series of actions to be taken for the purpose of implementation, primarily of a political, organisational as well as educational nature (EEA Climate ADAPT).

Climate neutrality by 2050

Adopted in November 2018, the EU long-term strategy 'Going climate-neutral by 2050' (EC 2050) aims to achieve zero greenhouse gas emissions by 2050. The Baltic East OWF also addresses the challenges posed by the idea of a European Green Deal (EU 2019), including in particular the proposals in the 'Fit for 55' package aiming to meet the climate and energy targets for 2030 (emissions reduction target of at least 55%) and for 2050 (net climate neutrality). The 'Fit for 55' package proposes an increase of the current EU target of a share of renewable energy sources in the overall energy mix be raised from 32% to at least 40% by 2030.

White Paper – Adapting to climate change

The White Paper (EC 2009) provides the basis for the development of national adaptation strategies of individual EU Member States. The document sets out policy priorities in terms of adaptation to climate change. The document indicates the need to focus on the following areas: health and social policy; biodiversity, ecosystems and water management; agriculture and forestry; coastal and marine areas; and physical infrastructure. The document also establishes a system for the exchange of adaptation-related information and best practices between EU Member States. Among other things, the strategy emphasises the need for adaptation measures, especially in cities as areas of particular vulnerability to climate change. The document also calls for the involvement of EU funds, including structural funds, in financing adaptation measures.

The EU Adaptation Strategy focuses on three key objectives:

- promoting action by Member States to adopt comprehensive adaptation strategies;
- driving action at EU level to further support adaptation in key vulnerable sectors such as agriculture, fisheries and cohesion policy, ensuring that Europe's infrastructure becomes more resilient to climate change; actions include promoting insurance and other financial products for resilient investment and business decisions;
- making informed decisions at all levels of decision-making by addressing gaps in the knowledge about adaptation.

Energy security

The 'Clean Energy for Europeans' strategy was adopted by Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 *on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No. 663/2009 and (EC) No. 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No. 525/2013 of the European Parliament and of the Council* (OJ L 328, 21.12.2018, p. 1, as amended). The regulation indicates targets to be met by individual EU Member States regarding:

- proportion of renewable energy production to 32%;
- improvements in energy efficiency to 32%.

As a result of the regulations, by 31 December 2019 and subsequently every ten years thereafter, each Member State shall present an integrated national energy and climate action plan with a 2050 horizon, covering the five dimensions of the energy union: decarbonisation, energy efficiency, energy security, internal energy market, as well as energy research, innovation and competitiveness.

EU Strategy for the Baltic Sea Region

The EU Strategy for the Baltic Sea Region, or so-called EUSBSR, is one of the four macro-regional strategies implemented in the European Union and involves 8 EU Member States bordering the Baltic Sea. The Strategy is implemented through an Action Plan. It is based on three main thematic pillars: Save the Sea, Connect the Region, and Increase Prosperity. Specific objectives of the strategy include:

- clear water in the sea;
- rich and healthy wildlife;
- clean and safe shipping;
- reliable energy markets.

EUSBSR activities are implemented through 14 Thematic Areas within which international consortia implement projects, platforms and processes targeted at the objectives for which the Strategy was established. Such a structure makes it possible to activate stakeholders from different fields and institutions in the Baltic Sea Region, promoting cooperation at multiple levels: governmental, regional and local, involving research centres, academia, regional structures, institutions managing operational programmes, as well as the private sector.

Vision and Strategies Around the Baltic Sea (VASAB)

VASAB is a form of intergovernmental cooperation between the Baltic Sea Region ministers responsible for development and spatial planning, which developed a strategy document entitled 'VASAB Vision for the Territorial Development of the Baltic Sea Region in 2040' (VASAB 2022). The document sets out directions for the region's development in the 2040 perspective. In the document, offshore wind energy is identified as one of the key methods of electricity production. The document indicates that offshore energy development in the Baltic is carried out in accordance with the existing and planned uses of the sea basins, with respect for the protection of the maritime environment and for the concept of ecosystem services. Bearing this information in mind, the Project should be considered compliant with the directions of the Baltic Sea region development, as suggested by VASAB.

HELCOM Recommendation 34E/1

The document entitled 'Safeguarding important bird habitats and migration routes in the Baltic Sea from negative effects of wind and wave energy production at sea' [HELCOM 2013] was adopted by the 2013 HELCOM Ministerial Meeting in Copenhagen. The provisions of the document refer to safeguarding important bird habitats and migration routes in the Baltic Sea from negative effects of wind and wave energy production at sea. The positive aspect of wind energy development in the context of climate change is emphasised in this document, recommending specific steps that may help to reduce the negative impact of investments on the environment. It should be emphasised that the Project will be implemented in accordance with HELCOM Recommendation 34E/1. The provisions of this recommendation relate mainly to the activities of the States Parties to the Helsinki Convention and as such are not directly relevant to the Project. However, bearing in mind the objectives expressed therein, the need to avoid or minimise the impact of the Project on the environment, including in particular on important bird habitats and migration routes, was taken into account while planning the Project.

1.5.2 Documents at the national and regional level

National Development Concept 2050

The National Development Concept 2050 (hereinafter: NDC 2050) is a document developed by the Ministry of Development Funds and Regional Policy in cooperation with the Institute of Urban and Regional Development and the Institute of Environmental Protection – National Research Institute, as part of the GOSPOSTRATEG – PL2050 project.

The NDC 2050 will present a long-term vision of Poland's development combining socio-economic, spatial and environmental development planning by identifying the most important trends shaping development in the context of existing challenges as well as presenting development scenarios and recommendations. The concept aims to outline the management of the following issues:

01. Society and quality of life,
02. Transformation of the economy,
03. Environment and green transformation,
04. New technologies,
05. World, Europe and Poland.

'Transformation of the economy' is a theme discussing energy decentralisation and new sources, energy decarbonisation, fair transformation and energy stability, directly connected with the implementation of offshore wind energy projects.

Strategy for responsible development

The Strategy for Responsible Development until 2020 (with an outlook until 2030) was adopted by the Council of Ministers on 14 February 2017 and is an update of the National Development Strategy

2020. It is a key binding document of the Polish state in the area of medium- and long-term economic policy.

The main objective of the Strategy is ‘Creating conditions for an increase in the income of the Polish population with a simultaneous increase in cohesion in the social, economic, environmental and territorial dimensions’. Within this objective, three specific objectives were defined:

- Specific Objective I – Sustainable economic growth increasingly driven by knowledge, data and organizational excellence;
- Specific Objective II – Socially sensitive and territorially sustainable development;
- Specific Objective III – Effective state and economic institutions contributing to growth as well as social and economic inclusion.

Energy was mentioned among the areas influencing the achievement of the Strategy objectives, while the challenges identified included ‘assuring the economy, institutions and citizens with stable supply of energy adjusted to the needs, at an economically accepted price’ as well as ‘sustainably reducing pollutant emissions and transitioning towards a low- and zero-carbon economy’. This is to be fostered by, among others, the use of renewable energy sources.

Energy Policy of Poland until 2040

The direction of the Energy Policy of Poland until 2040 (hereinafter: EPP2040) is energy security, while ensuring economic competitiveness, energy efficiency, and reducing the environmental impact of the energy sector, taking into account the optimal use of domestic energy resources. One of the Specific Objectives indicated in the Policy is ‘6: Development of renewable energy sources’.

One of related themes is Direction 2: ‘Expansion of electricity generation infrastructure’, which will include measures enabling the use of electricity generated from renewable energy sources through distribution and optimisation.

According to EPP2040, more than half of the installed capacity in 2040 will be zero-emission sources. In this context, an important role will be played by the implementation of offshore wind energy into the Polish electricity system. According to EPP2040, the installed offshore capacity in our country is expected to reach approximately 5.9 GW in 2030 and 11 GW in 2040.

The proposed Project consisting in generation of electricity from a renewable energy source, namely wind in sea areas, is aligned with the energy policy of Poland, contributing to the mitigation of negative environmental impacts and greenhouse gas emissions from the power sector. It is consistent with the EU’s 2030 climate and energy policy.

National Environmental Policy 2030

On 16 July 2019, the Council of Ministers adopted the National Environmental Policy 2030 (hereinafter: PEP2030) – a development strategy in the realm of the environment and water management, which is one of the foundations for conducting environmental policy in Poland, as well as one of the strategies constituting the basis for managing the country's development. Within the system of strategic documents, PEP2030 is a clarification and operationalisation of the provisions of the Strategy for Responsible Development, therefore the main objective of PEP2030, i.e. 'Developing the potential of the natural environment for the benefit of citizens and entrepreneurs', was transferred directly from that Strategy. The horizontal objectives of PEP2030 are:

- Environment and education. Developing the environmental competences (knowledge, skills and attitudes) of the society;
- Environment and administration. Improving the effectiveness of environmental protection instruments.

The specific objectives of PEP2030 are defined as follows:

- Environment and health. Improvement of environmental quality and environmental safety;
- Environment and economy. Sustainable management of environmental resources;
- Environment and climate. Climate change mitigation and adaptation as well as disaster risk management.

The specific objectives will be implemented through the directions of intervention:

- sustainable water management, including ensuring access to clean water for society and the economy, as well as achieving good water status;
- elimination of sources of pollutant emissions to air or significant reduction of their impact;
- protection of land surface, including soils;
- countering environmental threats and ensuring biological, nuclear and radiological safety;
- management of natural and cultural heritage resources, including protection and enhancement of biodiversity and landscape;
- promotion of multifunctional and sustainable forest management;
- waste management towards a circular economy;
- management of geological resources through the development and implementation of a national raw materials policy;
- supporting the implementation of eco-innovation and dissemination of best available techniques (BAT);
- combating climate change;

- adaptation to climate change and disaster risk management;
- environmental education, including development of sustainable consumption patterns;
- improvement of the environmental protection control and management system and enhancement of the financing system.

Among the intervention directions of particular significance from the perspective of connection with the proposed Project, there is Direction 7.10 'Counteracting climate change'. It assumes further efforts to reduce greenhouse gas emissions, while indicating renewable energy sources as one of the measures, together with an appropriate management system.

National Energy and Climate Plan for the years 2021–2030

The National Energy and Climate Plan for the years 2021-2030 (NECP) was adopted by the European Affairs Committee at a meeting dated 18 December 2019. It presents assumptions and objectives as well as policies and actions for the implementation of the 5 dimensions of the energy union, namely:

- energy security;
- internal energy market;
- energy efficiency;
- decarbonisation of the economy;
- research, innovation and competitiveness.

The document sets the following climate and energy targets for 2030:

- 7% reduction of greenhouse gas emissions in the sectors not covered by the ETS system in comparison to the level from 2005;
- 21–23% share of RES in the gross final consumption of energy (target 23% will be possible to achieve when Poland is awarded additional EU funds, including those intended for equitable transformation), taking into consideration:
    - 14% share of RES in transport;
    - annual increase in the share of RES in heating and cooling by 1.1% on average per year;
- increase in energy efficiency by 23% compared to PRIMES 2007 projections;
- reduction of the share of coal in electricity production to 56–60%.

An update of the document, a draft of which can be found on the website of the Ministry of Climate and Environment, was proceeded with. The draft document is awaiting adoption.

National Programme for the Protection of Marine Waters

The currently applicable National Programme for the Protection of Marine Waters (hereinafter: NPPMW) was adopted by the Regulation of the Council of Ministers of 11 December 2017 on the adoption of the National Programme for the Protection of Marine Waters (Journal of Laws 2017, item 2469). It is a strategic document developed by member states in accordance with the Marine Strategy Framework Directive (MSFD). The objective of NMWPP is to specify the optimal set of measures, which will lead to the achievement of good environmental status of marine waters within a given period of time. As of 19 July 2023, a process is underway to adopt, by way of regulation, an update to the NMWPP developed as part of the second planning cycle. The NMWPP update is developed on the basis of the previously prepared planning documents in the MSFD planning cycle.

Set of environmental targets for marine waters

The set of environmental targets for marine waters is defined by the Regulation of the Minister of Infrastructure of 25 February 2021 *on the adoption of the update of the set of environmental objectives for marine waters* (Journal of Laws of 2021, item 569). In its Appendix 1, this act contains a compilation of the environmental objectives relating to the status characteristics ranked in accordance with Commission Decision 2017/848 according to the criteria relating to the assessment of species (D1C1, D1C2, D1C3, D1C4 and D1C5), as well as pelagic (D1C6) and benthic habitats, which are assessed on the basis of the criteria relating to characteristic D6. The environmental targets for characteristic D1 are defined at a general level for each criterion in Commission Decision 2017/848, and as specific targets for the ecosystem components and their related indicators used for assessment in the update of the preliminary assessment of the environmental status of marine waters.

Maritime Spatial Plan of Polish Sea Areas

The Baltic East OWF Area is covered by the provisions of the development plan implemented by way of the Regulation of the Council of Ministers of 14 April 2021 *on the adoption of the Maritime Spatial Plan for Internal Sea Waters, Territorial Sea and Exclusive Economic Zone, at a scale of 1:200 000* (Journal of Laws of 2021, item 935, as amended) (hereinafter: MSPPSA). This document stipulates the implementation of offshore wind energy as an element of the National Power System.

The MSPPSA was prepared jointly by the directors of the maritime offices in Szczecin, Słupsk and Gdynia to ensure consistency in spatial development of the entire area covered by it. It covers the entirety of internal waters, territorial sea and the exclusive economic zone under the jurisdiction of the Polish maritime administration, excluding areas covered by more detailed plans. Before the adoption of the MSPPSA, strategic environmental impact assessment was carried out. In the

MSPPSA, areas for offshore wind energy were designated, as well as the locations of transmission infrastructure connecting OWFs to land.

For area POM.46.E, where the Baltic East OWF is situated, generation of renewable energy (E) was established as the primary function. Permissible functions in this sea basin include:

1) aquaculture (A);
2) scientific research (N);
3) cultural heritage (D);
4) technical infrastructure (I);
5) prospecting and exploration of mineral deposits and extraction of minerals from deposits (K);
6) fisheries (R);
7) artificial islands and structures (W);
8) transport (T);
9) tourism, sport and recreation (S).

In terms of renewable energy generation, the following conditions for the use of the sea basin were introduced:

- an area intended for wind power generation by offshore wind turbines. Both the internal and external technical infrastructure are integral parts of a project;
- upon the commencement of a project involving the construction of artificial islands and structures, the requirement arises to impose, by a decision of the territorially competent director of the maritime office, a prohibition on fishing and navigation in the sea basin where construction activities take place, which also applies to a 500-metre safety zone around the sea basin, throughout the duration of the construction works;
- during the operation of offshore wind farms, the requirement arises to impose, by decision of the territorially competent director of the maritime office, restrictions on fishing and navigation in the safety zones designated for each structure as well as in places which can pose a threat to the security of the internal technical infrastructure.

2030 Pomorskie Voivodeship Development Strategy

The 2030 Pomorskie Voivodeship Development Strategy defines three complementary and equally important strategic objectives: sustainable security, open regional community, and resilient economy. Within each of the strategic objectives, four operational objectives are identified. Among the operational objectives, ‘energy security’ was identified under the objective ‘sustainable security’.

The operational objective 'energy security' includes, among others, the pursuit of climate neutrality as well as good conditions for the development of renewable energy sources in the voivodeship, including offshore wind energy in the Baltic Sea.

2030 Pomorskie Voivodeship Spatial Management Plan

2030 Pomorskie Voivodeship Spatial Management Plan (hereinafter: PVSMP) was adopted by Resolution no. 318/XXX/16 of the Pomorskie Regional Assembly of 29 December 2016. In the field of spatial policy, the focus is, among others, on the growth of electricity production and the transformation of the region into the national leader in renewable energy generation. Among the spatial policy measures and undertakings, the PVSMP mentions:

- construction of transmission and distribution networks as well as substations for power transport from new system and renewable energy sources (wind farms, including offshore structures);
- extension of the 400/110 kV Żarnowiec substation to enable connecting offshore wind farms to the National Power System (NPS).

The PVSMP outlines a vision for spatial transformation of the region. One of the elements of the vision is the thesis that as a result of the installation of large power capacities within the voivodeship, in the form of a nuclear power plant, coal-fired power plant and OWFs, as well as due to the development of distributed power sector, the security of energy supply of Northern Poland will be improved and the voivodeship will become energetically self-sufficient. It is indicated that in the ports in Łeba, Ustka and Władysławowo, the shipyard areas should be activated for the activities related to the management of maritime areas (e.g. logistic and service and maintenance centre for OWFs).

On 25 March 2024, the Pomorskie Regional Assembly adopted a resolution on initiation of the drafting of an amendment to the Pomorskie Voivodeship Spatial Management Plan (Resolution No. 783/LXIII/24).

1.5.3 Environmental objectives resulting from strategic documents relevant for the implementation of the Project

The strategic documents contain a number of diverse arrangements regarding environmental protection. For the purpose of the EIA Report, the strategic environmental protection objectives were synthesised. Analysing the strategic and planning documents discussed above, the directions they set and the environmental objectives they contain were divided into the following aggregated environmental objectives:

- objectives related to the prevention of climate change and the achievement of climate neutrality;
- objectives related to the reduction of pollutant emissions into the air;
- objectives related to the conservation and protection of the natural environment.

The implementation of the Project will strongly support the fulfilment of the main objectives included in the first two of the groups mentioned. Wind energy, as a renewable and emission-free source of energy, will contribute to the reduction of the environmental impact of power generation, due to the substitution of the use of fossil fuels in energy production. By contributing to the reduction of emissions, it will thus contribute to halting gradual climate change associated with, among others, the emission of greenhouse gases into the atmosphere.

Offshore wind energy will indirectly contribute to environmental objectives related to the protection of the natural environment, by contributing to the halting of climate change and the reduction of negative impacts associated with the extraction and combustion of fossil fuels.

The construction and operation of the Project may involve negative impacts on the marine environment and therefore on conservation objectives. However, these impacts will be predominantly local, with the exception of those occurring during the construction phase of the Project, and short-term for most environmental features, so their scale will be small enough to be deemed insignificant in the context of the objectives defined for the Baltic Sea. This issue is discussed extensively later in the Report, in particular in Sections 5, 6, 7, 8, 14.

1.5.4 Summary of findings of strategic and planning documents

The proposed Project, consisting in the construction and operation of an offshore wind farm, is in line with the expectations and contributes to the objectives of several policies and strategies at international, EU, national and regional levels, in particular those related to air pollution protection, climate neutrality, and energy security. At the same time, while maintaining all mitigation measures indicated in the EIA Report regarding potential negative impacts, it does not conflict with documents strictly aimed at protecting the natural environment of the Baltic Sea.

The proposed Project is consistent with the assumptions of environmental objectives arising from the applicable strategic and planning documents, and will not hinder them, and in many cases will contribute to their achievement.

1.6 Methodology of developing the EIA Report

The primary purpose of preparing an EIA Report is to assess the environmental impact of a project and to identify ways of avoiding or mitigating its negative impacts. The assessment is a desk study performed by a team of specialists.

The work was carried out in accordance with the method of preparation of the EIA Report [Figure 2], which involved:

- the provisions of programme and planning documents at the international, national and regional level, as well as the results of environmental impact forecasts of these documents, which may have an impact on the proposed Project;
- the concept of the Project, including the activities in the following phases: construction, operation and decommissioning, together with the determination of threats to the environment and their potential effects;
- environmental information, including the results of environmental surveys and inventory surveys;
- the results of the modelling of changes in the environment resulting from the Project implementation;
- information on projects completed, underway and planned.

The preparation of the EIA Report was based primarily on the results of a comprehensive environmental inventory surveys carried out between 2022 and 2024, along with guidelines, manuals and other materials on the subject of its development, as well as the experience of the authoring team and good practices in the area of the work. In particular, the guidelines available on the website of the General Directorate for Environmental Protection regarding the preparation of environmental impact reports were used, as well as the methodological guidelines for the assessment of impacts on Natura 2000 sites (EC 2021).

Figure 2 presents a diagram illustrating the preparation of the EIA Report on the basis of the data concerning the proposed Project and the environmental surveys / inventory surveys conducted. The term 'environmental surveys' used in the figure means that the EIA Report uses both the results of environmental surveys and inventory surveys carried out for the purpose of this study, as well as the results of other studies available to the public or in literature, e.g. for the projects closest to the proposed Project, or related to the development of such documents as conservation plans for protected areas.

While developing the EIA Report, the analysis of descriptive and cartographic materials was carried out, the results of the surveys, inventory surveys and modelling conducted were interpreted, and the original methodology for assessing the Project impact on individual elements of the environment was used.

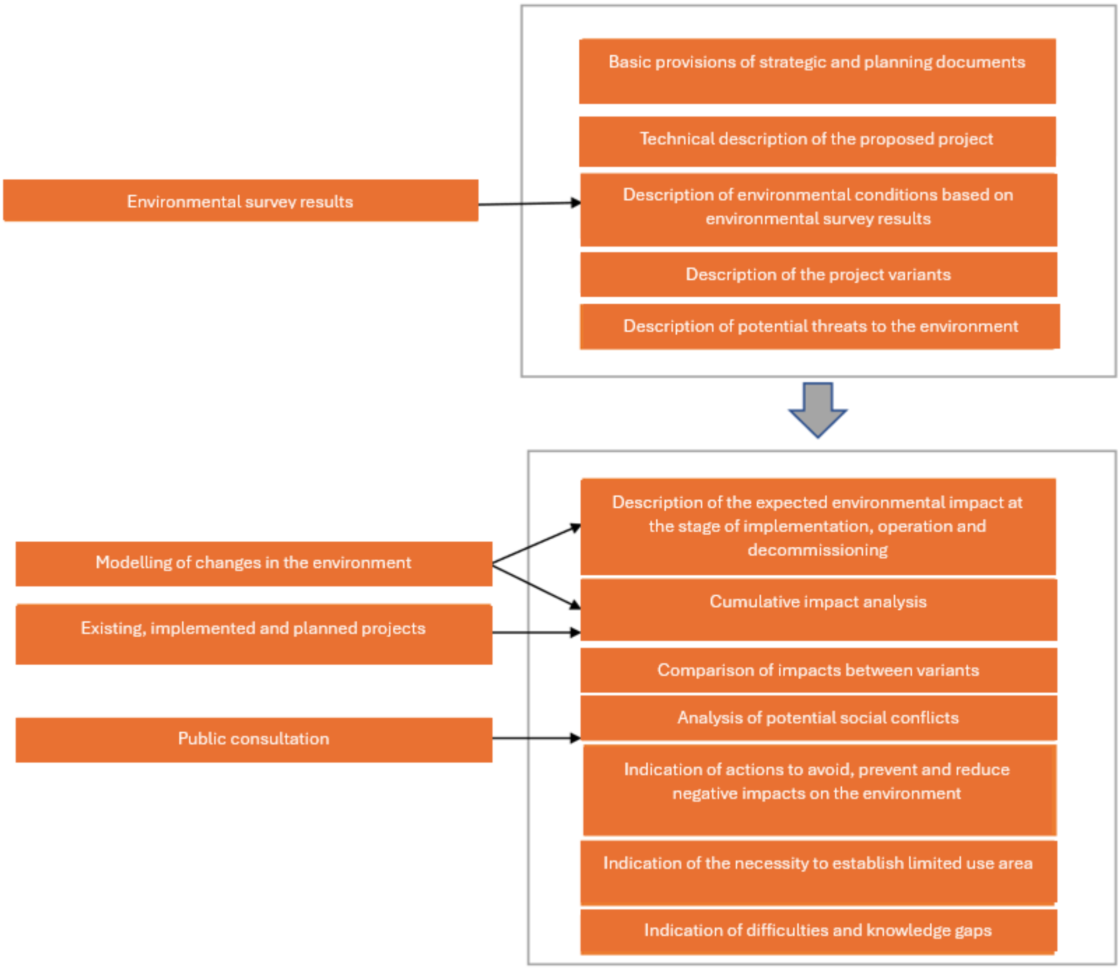

Figure 2 Outline of the Environmental Impact Assessment Report preparation [Source: internal materials]

When preparing the EIA Report, the following elements were primarily analysed:

- technical and technological aspects of the proposed Project affecting the type and size of the impact on individual environmental components in the phases of implementation, operation and decommissioning;
- environmental, spatial and social conditions of the proposed Project;
- possibility of preparing different Project variants (regarding location, as well as technical, technological and organisational solutions);
- type, size and significance of potential impacts on the environment;
- possibility of avoiding and reducing adverse environmental impacts;
- need to record possible future environmental changes as a result of the Project implementation (scope of monitoring).

The EIA Report contains an analysis of the proposed Project in terms of techniques and technologies applied as well as operating conditions. Among others, the information contained in the Project documentation was used, and the potential impact of similar activities was analysed, including those which may accumulate.

When developing this EIA Report, the following were used:

- the results of environmental surveys and inventory surveys performed in the years 2022–2024 by MEWO S.A.;
- the results of environmental surveys and inventory surveys carried out for projects located near the Baltic East OWF Area, the potential impact of which might cover the area of the proposed Project.

1.6.1 Compliance with Article 66 of the EIA Act

An EIA Report must contain the elements specified in Article 66 of the EIA Act, be characterised by clarity and consistency of the findings and contain a summary describing – in an accessible way, in a non-technical language – the most important information about the findings made by its authors and presented in the individual sections. The scope of the work carried out in practice is highly individualised and dependent on a number of technical and locational factors. Therefore, in practice it is difficult to build the structure of an EIA Report directly on the elements indicated in the referenced article. Table 2 lists specific requirements of the EIA Act regarding the content of an EIA Report, cites the numbers of paragraphs, points and letters of Article 66, and the numbers of sections containing the relevant information are provided in the next column. The second part of the table also refers to the provisions of Article 62(1) of the EIA Act.

Table 2 Compliance with Article 66 and Article 62(1) of the EIA Act [Source: internal materials]

PARAGRAPH / POINT / LETTER	CONTENT OF ARTICLE 66 OF THE EIA ACT	SECTIONS
1.	The Environmental Impact Assessment Report shall contain information enabling the analysis of the criteria listed in Article 62(1), and shall contain:	
1)	description of the proposed project, including in particular:	
a)	characteristics of the entire project and conditions for the land use during implementation and operation or use phases, also in relation to the flood risk areas within the meaning of Article 16.34 of the Act of 20 July 2017 – the Water Law,	2.1
b)	main characteristics of production processes,	2.3.1
c)	anticipated types and quantities of emissions, including waste, resulting from the implementation and operation or use phases of the proposed Project,	2.6
d)	information on biodiversity, the use of natural resources, including the use of soil, water and earth surface,	2.5; 3.11.4
e)	information on energy demand and consumption,	2.5
f)	information on dismantling works concerning projects likely to have a significant impact on the environment,	2.4.4
g)	the risk assessed on the basis of scientific knowledge regarding major failures, natural or construction disasters, taking into account the substances and technologies used, including those related to climate change;	2.7

PARAGRAPH / POINT / LETTER	CONTENT OF ARTICLE 66 OF THE EIA ACT	SECTIONS
2)	description of natural elements of the environment covered by the scope of the anticipated impact of the proposed project on the environment, including:	
a)	description of environmental elements under protection pursuant to the Act of 16 April 2004 on nature protection and ecological corridors within the meaning of this Act,	3.11.2
b)	hydromorphological, physico-chemical, biological and chemical properties of waters;	3.1, 3.2, 3.3
2a)	results of environmental inventory surveys understood as a set of field surveys carried out in order to characterise elements of the natural environment, if such surveys were carried out, along with the description of the methodology applied; the results of environmental inventory surveys together with the description of methodology are attached as an appendix to the Report;	Appendix 1
2b)	other data on which the description of the natural elements is based;	3.11
3)	description of heritage monuments protected under the regulations concerning monument protection and care for monuments, located within the immediate vicinity of the proposed project and in its impact range;	3.7
3a)	description of the landscape within which the project is to be located;	3.9
3b)	information on relations with other projects, in particular on the accumulation of impacts of the implemented, completed or proposed projects, for which a decision on environmental conditions has been issued, located in the area where the project is to be implemented and in the area of the project impact or the impacts of which fall within the area of the proposed project – to the extent to which their impacts may lead to the accumulation of impacts with the proposed project;	6
4)	description of the environmental impacts anticipated in the case the project is not implemented, taking into account the available environmental information and scientific knowledge;	4
5)	description of variants taking into account the specific characteristics of the project or its impact, including:	
a)	Applicant Proposed Variant and Reasonable Alternative Variant,	2.2.1.1
b)	environmentally preferable rational variant – together with a justification of their choice;	2.2.1.2
6)	determination of the predicted impact of the analysed variants on the environment, including the case of a major industrial accident or a natural disaster or structural collapse, as well as impacts on the climate, including greenhouse gas emissions and impacts important in terms of adaptation to climatic changes, and possible transboundary environmental impacts, and in the case of a road within the trans-European road network, also the impact of the planned road on road safety;	5
6a)	comparison of the impacts of the variants considered on:	9
a)	people, plants, animals, fungi and natural habitats, water and air,	
b)	ground surface, including mass movements of the earth, and landscape,	
c)	tangible property,	
d)	historical heritage monuments and cultural landscape, covered by the existing documentation, in particular a register or inventory of monuments,	
e)	forms of nature protection, referred to in Article 6(1) of the Nature Conservation Act of 16 April 2004, including the objectives and the subject of protection in the Natura 2000 sites as well as the continuity of the ecological corridors connecting them,	
f)	elements listed in Article 68(2)(2)(b), if included in the environmental impact assessment report or if required by the competent authority,	
g)	interactions between the elements mentioned in items a–f above;	
7)	justification for the Applicant Proposed Variant, accounting for the information referred to in points 6 and 6a;	9.3

PARAGRAPH / POINT / LETTER	CONTENT OF ARTICLE 66 OF THE EIA ACT	SECTIONS
8)	description of forecasting methods applied by the Applicant and the description of the expected significant impacts of the proposed project on the environment including direct, indirect, secondary, cumulative, short-term, medium-term and long-term environmental impacts, resulting from:	1 and 5.
a)	the existence of the project,	
b)	the use of environmental resources,	
c)	emissions;	
9)	description of the actions planned with an aim to avoid, prevent, mitigate or environmentally compensate for the adverse impacts on the environment, in particular on the forms of nature conservation referred to in Article 6(1) of the Act of 16 April 2004 on nature conservation, including the impact on the objects and subjects of protection of Natura 2000 sites, and on the continuity of wildlife corridors connecting them, along with assessing their effectiveness during the implementation, operation, or decommissioning of the project, respectively;	10
11)	if the proposed project is related to the use of the installations, a comparison of the proposed technology with the technology meeting the requirements referred to in Article 143 of the Act of 27 April 2001 – Environmental Protection Law;	
11a)	reference to the environmental objectives resulting from strategic documents relevant to the implementation of the project;	1.5
11b)	justification for meeting the conditions referred to in Article 68(1), (3) and (4) of the Act of 20 July 2017 – Water Law, if the project affects the possibility of achieving the environmental objectives referred to in Article 56, Article 57, Article 59 and Article 61(1) of that Act;	-
12)	indication whether it is necessary, for the proposed project, to establish a limited use area, referred to in the Act of 27 April 2001 - Environmental Protection Law, and to define the boundaries of such an area, the restrictions on the use of land, the technical requirements for buildings and ways of their employment; this does not apply to undertakings consisting in the construction or reconstruction of a road and projects consisting in the construction or reconstruction of a railway line or public use airport;	12
13)	graphical presentation of the issues;	Figures in respective sections
14)	presentation of the issues in the cartographic form in the scale corresponding to the subject and the detailed scope of issues analysed in the Report, also enabling a comprehensive presentation of the analyses conducted regarding the environmental impact of the project;	5
15)	analysis of possible social conflicts related to the proposed project;	14
16)	presentation of proposals for monitoring the impact of the proposed project in the phase of its implementation and operation or use, in particular on the forms of nature protection referred to in Article 6(1) of the Act of 16 April 2004 on nature conservation, including the impact on the objectives and the subject of protection of the Natura 2000 site, and the continuity of wildlife corridors connecting them, as well as the information on other monitoring results available which may be relevant for the determination of responsibilities in this respect;	11
17)	indication of difficulties resulting from technical shortcomings or gaps in the state of the art encountered during the preparation of the report;	15
18)	non-technical summary of the information contained in the report, for each element of the Report;	19
19)	date of preparation of the report, the name and signature of the author, and if the report is authored by a team – the name and signature of the team leader, as well as the names, surnames and signatures of the members of the team of authors;	In the introduction to the EIA Report

PARAGRAPH / POINT / LETTER	CONTENT OF ARTICLE 66 OF THE EIA ACT	SECTIONS
19a)	declaration of the author, and if the report is authored by a team – declaration of the team leader, on meeting the requirements referred to in Article 74.a.2, as appended to the Report;	In the introduction to the EIA Report
20)	sources of information providing the basis for the Report.	16
2.	The information referred to in paragraph 1 points 4–8 should take into account the predicted impact of the analysed variants on the objectives and the subject of protection of the Natura 2000 site as well as the integrity of that site.	5.3
3.	If the possibility of a transboundary environmental impact is identified, the information referred to in paragraph 1 points 1–16 should take into account the determination of the impact of the proposed project outside the territory of the Republic of Poland.	8
6.	The Environmental Impact Assessment Report should account for the impact of the project at the stage of its implementation, operation or use, and decommissioning.	5
7.	The Environmental Impact Assessment Report should account for environmental information resulting from the strategic environmental impact assessment, relevant to the project.	1.7.2

PARAGRAPH / POINT / LETTER	CONTENT OF ARTICLE 62(1) OF THE EIA ACT	SECTIONS
1.	The environmental impact assessment shall identify, analyse and evaluate:	
1)	the direct and indirect effects of the project on:	5
a)	the environment and the population, including human health and living conditions,	
b)	tangible property,	
c)	historical monuments,	
ca)	landscape, including the cultural landscape,	
d)	interactions between elements mentioned in items a–c above,	
e)	accessibility of mineral deposits;	
1a)	risk of major accidents as well as natural disasters and structural collapses;	2.7
2)	possibilities and methods of preventing and reducing the negative impact of the project on the environment;	10
3)	scope of monitoring required.	11

1.6.2 Environmental information resulting from the strategic environmental impact assessment relevant to the Project

The EIA Report accounted for the environmental information relevant to the Project contained in the documents prepared for the strategic environmental impact assessment carried out before the adoption of the MSPPSA.

1.7 Methodology of the work performed

1.7.1 Introduction

The environmental impact assessment carried out by a competent authority for large-scale projects – which unquestionably include the offshore wind farm constituting the proposed Project – will contain a simplified yet comprehensive and exhaustive analyses presented in the EIA Report, among others. This approach will allow identifying impacts and potential losses in terms of environmental assets, but also, where possible, maintaining their function.

The methodology used in the EIA Report aims to provide a holistic view of the impacts shaped primarily by the structural elements of the wind farm, which, in the short term, will significantly alter the development and use of the seabed, the sea basin and the space above it.

The assessment of the impact on individual receptors was carried out according to the diagram presented below [Figure 3]. An actual impact occurs when a specific receptor is present within the impact range. Receptors are individual components of the environment (e.g. species of plants and animals, natural habitats, abiotic elements, and landscape), as well as people.

At the first stage, impacts that may affect individual receptors resulting from the implementation, operation and decommissioning phases of the Project were identified. On the basis of environmental surveys and inventory surveys conducted for the purposes of the EIA Report, the receptors which may be affected by such operations were also determined, both in a quantitative and qualitative context.

At the second stage of the assessment, based on the literature and the authors' experience, the links between sources of potential impacts and individual receptors were identified, as presented in Section 5 of the EIA Report.

A similar analysis was carried out for the proposed Project in combination with other projects to identify and assess cumulative impacts.

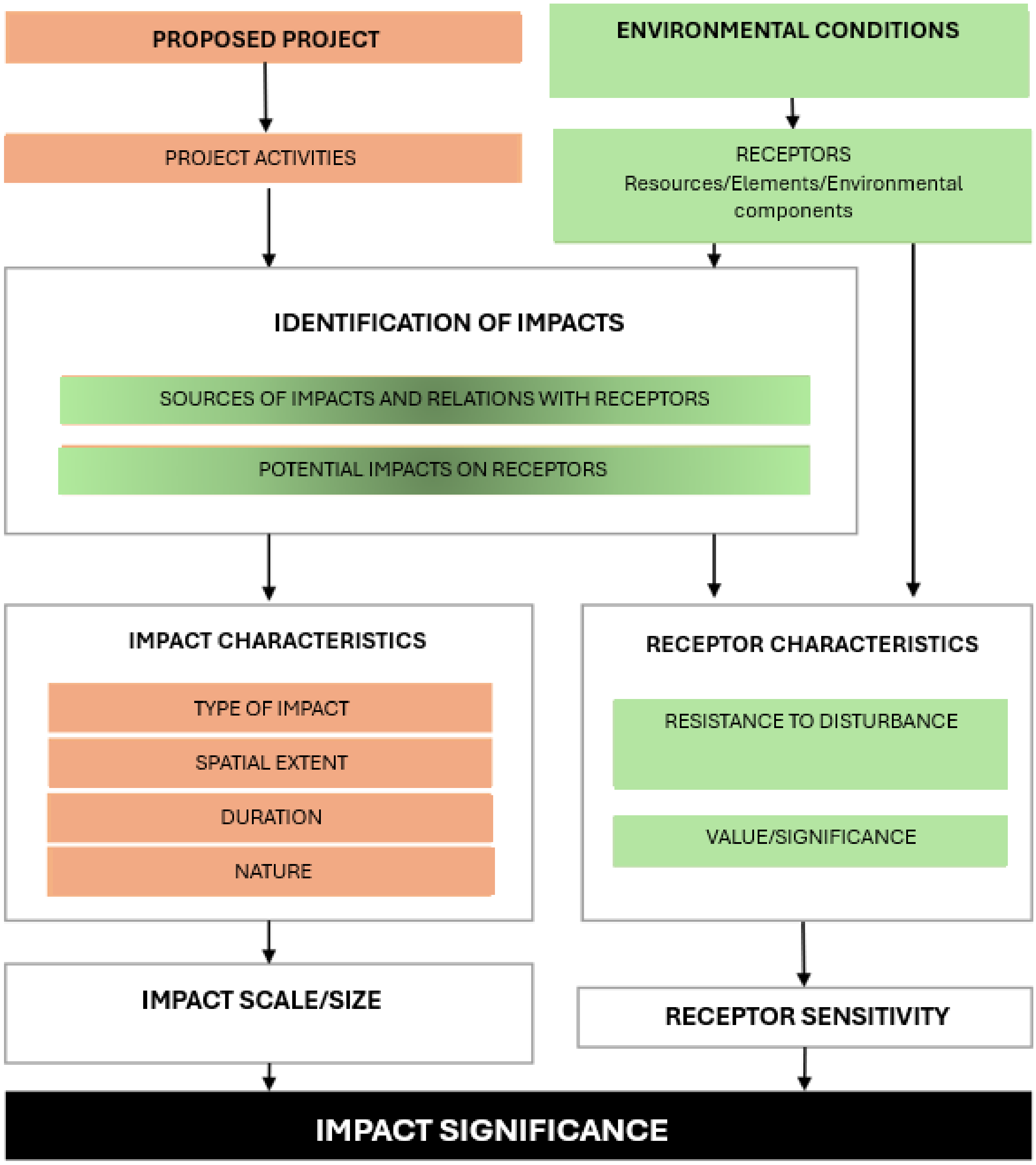

Figure 3 *Outline of environmental impact identification and impact assessment, including the determination of impact significance [Source: internal materials based on ESPOO REPORT (2017)].*

1.7.2 Time horizons of the analyses

The analyses for the purpose of the environmental impact assessment of the Project were performed for three phases:

- implementation phase – it is assumed that the preparation and construction of the Project will last 2 years;
- operation phase – it is assumed that the operation period will last approximately 55 years;
- decommissioning phase – it is assumed that the decommissioning of the Project will last approximately 2 years.

1.7.3 Impact definitions

In accordance with the provisions (Article 66(1)(8)) of the EIA Act, regarding the indication in the EIA Report of the description of anticipated significant impacts of the planned Project on the environment, including direct, indirect, secondary, cumulative, short-, medium- and long-term, permanent and temporary impacts on the environment, their definitions are presented below and the quantities which will allow describing the above-mentioned significant impacts are specified. These impacts were defined on the basis of the following indicators:

- **Type of impact**: direct, indirect, secondary, cumulative;
- **Extent of impact**: local, regional and transboundary;
- **Duration of impact**: short, medium and long-term, as well as permanent and temporary;
- **Nature of impact**: positive, negative.

Consistent terminology was adopted to describe the different types of impacts. However, in specific cases when the definition may differ from the generally accepted definition, it is described in the specific thematic section of the EIA Report.

Table 3 Definitions of characteristics of the proposed Project impacts [Source: internal materials].

CATEGORY	CHARACTERISTIC	DEFINITION
Type (kind)	**Direct**	Impact resulting from a direct interaction between the activities related to the implementation, operation or decommissioning of the Project, and the elements of the environment
	Indirect	Impact resulting from an indirect interaction between the activities related to the implementation, operation or decommissioning of the Project, and the elements of the environment
	Secondary	Impact resulting from the interaction between the implementation, operation or decommissioning of the Project, and the elements of the environment, postponed in time, which may occur as a result of direct or indirect impact
Relation to other projects	**Cumulative**	Impacts resulting from an overlap of impacts of the same nature and type, and occurring in similar time and space (extent of impacts), affecting the same components of the environment, originating from the Project and from projects carried out by third parties
Spatial extent	**Local**	Impact occurring in the immediate vicinity of an activity associated with the Project, not extending beyond the boundaries of the Project or not extending beyond 2 nautical miles from the Project boundary

CATEGORY	CHARACTERISTIC	DEFINITION
		*due to the specificity of the marine environment, the spatial extent of a local impact may be greater for certain impacts; in such cases it is defined in detail under the description of the impact in question
	Regional	Impact greater than a local impact, but not extending beyond the Polish sea areas
	Transboundary	Impact the effects of which are felt outside Poland on the territory of other countries
Duration	**Short-term**	Impact which is limited in time and its effects are noticeable (measurable) for a relatively short period but no longer than 1 year or 1 vegetation period from the beginning of the activity related to the Project
	Medium-term	Impact which is limited in time and its effects are noticeable (measurable) either constantly or cyclically for 1 to 3 years or 1 to 3 vegetation periods from the beginning of the activity related to the Project
	Long-term	Impact which is limited in time and its effects are noticeable (measurable) either constantly or cyclically for 3 years or 3 vegetation periods from the beginning of the activity related to the Project
	Permanent	Impact, which will not subside after the conclusion of the activities related to the Project
	Temporary	Impact which is limited to the duration of the activity related to the Project
Nature	**Negative**	Negative/significantly negative impacts – any change causing a deterioration in the quality of the environment (relating e.g. to existing regulatory quality standards), a reduction in valuable biodiversity, an imbalance in a natural habitat or species habitat, a deterioration of key structures, processes or (impairment of) key functions that a habitat performs, impacts that are detrimental to health, but also impacts resulting in nuisance, as well as impacts on property
	Positive	Positive/beneficial impacts – a change improving the quality of the environment (e.g. by removing a particular stressor or environmental nuisance, e.g. removing a source of noise, increasing the abundance of a species, improving the quality of habitat, or permanently eradicating a site of non-native invasive species)

1.7.4 Presentation of the environmental impact assessment

The assessment of the Project impact on individual receptors was performed using various assessment methods (on the basis of conducted surveys and analyses, calculations and mathematical modelling, as well as expert assessments). A unified presentation of the obtained results was applied, consisting of five steps.

Step 1: **Identification of key activities** associated with the implementation of the Project that may generate impacts in each phase (implementation, operation, decommissioning) of the Project variants considered, and identification of the environmental effects in case the Project is not implemented.

Step 2: **Identification of key impacts** in each phase of the Project (implementation, operation, decommissioning), and for each Project variant – the so-called stressors, and relating them to the different environmental components – the so-called receptors.

Step 3: Characteristics and **scale of impact** according to the following categories:

- Type of impact: direct, indirect, secondary, cumulative (note: cumulative impacts are discussed in a separate section – Section 6);

- Extent of impact: local, regional and transboundary;
- Duration of impact: short, medium and long-term, as well as permanent and temporary;
- Nature of impact: negative/positive.

In Step 3, the characteristics of individual impacts are identified for each of the environmental components, in accordance with the table below [Table 4].

Table 4 Characteristics of individual impacts affecting receptors [Source: internal materials]

IMPACT CHARACTERISTICS	TYPE OF IMPACT			SPATIAL EXTENT			DURATION					NATURE	
	Direct	Indirect	Secondary	Local	Regional	Transboundary	Short-term	Medium-term	Long-term	Permanent	Temporary	Negative	Positive
Impact 1.													
Impact 2.													
Impact n													

The above characterisation made it possible to determine the scale of each impact – the size of the change it introduces from irrelevant to very high.

Step 4: **Environmental sensitivity** as the differentiated capacity of the environment to respond to pressures – stressors (physical interference, substance and energy emissions, waste water discharges and water abstractions, events, incidents, disasters, etc.). Where a potential impact is identified, the resilience of the receptors to individual impacts as well as their significance and role in the environment, including the conservation status in relation to environmental components, were determined. As a result, the resilience and significance of the receptors contributed to the determination of environment (receptor) sensitivity, which was determined, using the expert method, according to a five-point scale: (1) irrelevant, (2) low, (3) moderate, (4) high and (5) very high.

A sensitivity assessment was based on the knowledge of the existing state of the environment. That assessment was performed by experts for each environmental component, and presented in Section 3, in the summaries of each subsection.

Step 5: Impact significance = impact relevance.

The final outcome of the impact assessment carried out was the identification of significance of a given impact on the individual environmental components, as a resultant of the impact scale and receptor sensitivity.

A five-point scale was adopted for the assessment of impact significance (impact relevance):

- negligible impact;
- low impact;
- moderate impact;
- important impact;
- significant impact.

The relationships between the scale / magnitude of the impact and the receptor sensitivity indicating the significance of the impact are shown in Table 5. It should be taken into account that, irrespective of the impact significance, the impact can be positive or negative – in the table below, a letter designation (P/N) was added next to the impact significance.

Table 5 Matrix defining impact significance in relation to the impact scale and the receptor sensitivity [Source: internal materials]

IMPACT SIGNIFICANCE		RECEPTOR SENSITIVITY				
		Irrelevant	**Low**	**Moderate**	**High**	**Very high**
Impact scale / magnitude	**Irrelevant**	Negligible (P/N)	Negligible (P/N)	Negligible (P/N)	Low (P/N)	Low (P/N)
	Low	Negligible (P/N)	Negligible (P/N)	Low (P/N)	Low (P/N)	Moderate (P/N)
	Moderate	Negligible (P/N)	Low (P/N)	Low (P/N)	Moderate (P/N)	Important (P/N)
	High	Low (P/N)	Low (P/N)	Moderate (P/N)	Important (P/N)	Significant (P/N)
	Very high	Low (P/N)	Moderate (P/N)	Important (P/N)	Significant (P/N)	Significant (P/N)

In accordance with the assessment presentation methodology, a significant impact may occur if a 'very high' scale/magnitude of impact is determined and at the same time at least a 'high' sensitivity of the receptor, as well as in the case when 'high' scale of impact is determined with a 'very high' sensitivity of the receptor.

In the case of Natura 2000 sites, it should be noted that according to Article 3(1)(17) of the EIA Act, significant negative impacts are understood as impacts affecting the conservation objectives of a Natura 2000 site, including in particular activities which may:

- deteriorate the condition of natural habitats or habitats of plant and animal species, for the protection of which the Natura 2000 site was established, or
- negatively affect the species, for the protection of which the Natura 2000 site was established, or
- deteriorate the Natura 2000 site integrity or its interconnection with other sites.

The standardisation of the assessment of the environmental impact of different types of activities, and emissions with regard to different types of receptors, enables an effective comparison of the impacts of the Project and the assessment of the Project as a whole. When interpreting the results of the assessment of the emission scale, receptor sensitivity and impact significance, the entries in the tables in Section 5 should be interpreted together with the detailed descriptions of the impacts that precede the tables.

Where significant negative environmental impacts were identified, mitigation measures were proposed (Section 10).

A separate category, not subject to assessment with regard to impact characteristics, are cumulative impacts occurring in combination with the impacts resulting from other current and/or planned projects, concerning the same receptors. They were identified regardless of their characteristics and assessment.

The next step was to use the results of the assessment in a multi-criteria analysis of the variants considered, with the aim of identifying the most environmentally beneficial option. As part of the analysis of each environmental component, an independent and holistic assessment of the impact of the proposed Project on that component was carried out, and the methodology presented allows standardisation of the assessment process and comparison of the impacts of the Project variants.

2 DESCRIPTION OF THE PROPOSED PROJECT

2.1 General characteristics of the proposed Project

2.1.1 Subject and scope of the Project

The proposed Project will involve the construction and operation of the Baltic East OWF with a maximum installed capacity of 966 MW, in order to generate renewable energy from wind. The scope of the subject matter covers the construction of the Baltic East OWF together with the technical, survey and service infrastructure. The proposed Project will comprise the following elements:

- wind turbines consisting of the following elements: nacelle with a rotor, tower, transition pieces (if they are not an integral part of the foundation), and foundations with a monopile or jacket structure;
- offshore substations (OSS);
- inter-array power and telecommunication cable lines and accessories.

The wind turbines, together with the substations and inter-array cables, will be installed in or on the seabed.

The Project will consist of three main phases: implementation, operation and decommissioning, which are described in Section 2.4.

Table 6 contains a detailed scope of parameters characterising the Baltic East OWF.

Table 6 List of key Project parameters of the Baltic East OWF in the Applicant Proposed Variant [Source: internal materials]

PARAMETER	DATA CHARACTERISING THE PARAMETER	UNIT	VALUE
Installed capacity	(maximum)	[MW]	966
Number of wind turbines	(maximum)	[pcs]	64
Wind turbine capacity	(minimum – maximum)	[MW]	15 – 25
Rotor diameter	(maximum)	[m]	310
Clearance between the rotor operation area and the water surface	(minimum)	[m]	22.5
Wind turbine height	(maximum)	[MASL]	347.5
Number of MV/HV offshore substations	(maximum)	[pcs]	2
Length of inter-array cables within the OWF	(maximum)	[km]	150
Area of seabed disturbance	(maximum)	%	5
Total rotor swept area	(minimum – maximum)	million m^2	2.79 – 2.87

2.1.2 Location of the Project, surface area of the sea basin occupied and conditions of the sea basin use

According to the MSPPSA (Journal of Laws of 2021, item 935), the Baltic East OWF Area is located within the Polish sea area, in the exclusive economic zone in the POM.46.E sea basin, the primary function of which is renewable energy generation (E) [Figure 4].

The surface of the Baltic East OWF Area is 111.7 km^2. The Baltic East OWF Project will be implemented in its entirety within the area indicated in the PSzW Baltic East OWF.

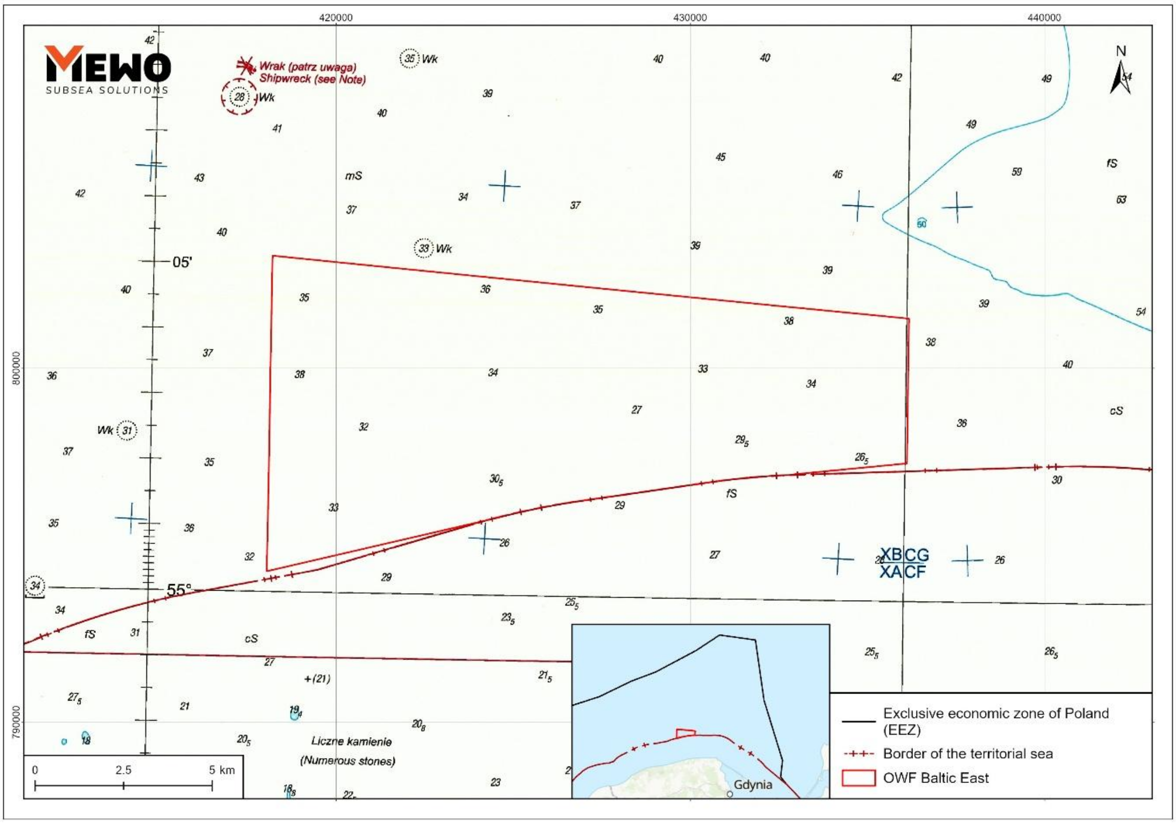

Figure 4 Location of the Baltic East OWF Area [Source: internal materials]

Table 7 contains the coordinates of boundary corner points of the Baltic East OWF Area.

Table 7 Coordinates of boundary corner points of the Baltic East OWF Area, by the type of development area [Source: internal materials]

BOUNDARY MARKER SYMBOL	COORDINATES IN THE ETRS89 REFERENCE SYSTEM	
	Longitude	Latitude
Area A		
1	17° 43' 6.000" E	55° 1' 42.750" N
2	17° 43' 5.640" E	55° 3' 24.394" N
3	17° 43' 5.639" E	55° 5' 6.379" N
4	17° 45' 2.381" E	55° 5' 0.851" N
5	17° 45' 52.819" E	55° 4' 58.466" N
6	17° 43' 5.827" E	55° 1' 10.598" N
Area B		
1	17° 43' 5.643" E	55° 0' 17.984" N
2	17° 43' 5.827" E	55° 1' 10.598" N

BOUNDARY MARKER SYMBOL	COORDINATES IN THE ETRS89 REFERENCE SYSTEM	
	Longitude	Latitude
3	17° 45' 52.819" E	55° 4' 58.466" N
4	17° 49' 49.457" E	55° 4' 47.284" N
5	17° 46' 55.973" E	55° 0' 51.146" N
6	17° 43' 7.006" E	55° 0' 18.149" N
Area C		
1	17° 51' 30.273" E	55° 4' 42.490" N
2	17° 56' 28.930" E	55° 4' 28.352" N
3	18° 0' 0.359" E	55° 4' 18.343" N
4	18° 0' 0.360" E	55° 3' 38.548" N
5	18° 0' 0.360" E	55° 2' 6.000" N
6	17° 57' 0.960" E	55° 1' 54.527" N
7	17° 56' 59.692" E	55° 1' 54.034" N
8	17° 56' 55.710" E	55° 1' 53.920" N
9	17° 56' 49.220" E	55° 1' 53.695" N
10	17° 56' 42.730" E	55° 1' 53.470" N
11	17° 56' 38.156" E	55° 1' 53.283" N
12	17° 56' 36.245" E	55° 1' 53.205" N
13	17° 56' 29.760" E	55° 1' 52.940" N
14	17° 56' 23.280" E	55° 1' 52.640" N
15	17° 56' 16.800" E	55° 1' 52.340" N
16	17° 56' 10.325" E	55° 1' 51.995" N
17	17° 56' 3.850" E	55° 1' 51.650" N
18	17° 55' 57.385" E	55° 1' 51.270" N
19	17° 55' 50.920" E	55° 1' 50.890" N
20	17° 55' 44.460" E	55° 1' 50.475" N
21	17° 55' 38.000" E	55° 1' 50.060" N
22	17° 55' 31.545" E	55° 1' 49.600" N
23	17° 55' 25.531" E	55° 1' 49.020" N
24	17° 55' 25.090" E	55° 1' 49.140" N
25	17° 55' 18.650" E	55° 1' 48.645" N
26	17° 55' 12.210" E	55° 1' 48.150" N
27	17° 55' 5.775" E	55° 1' 47.615" N
28	17° 55' 4.173" E	55° 1' 47.482" N
29	17° 54' 59.340" E	55° 1' 47.080" N
30	17° 54' 58.112" E	55° 1' 46.971" N
31	17° 54' 52.915" E	55° 1' 46.510" N
32	17° 54' 46.490" E	55° 1' 45.940" N
33	17° 54' 35.801" E	55° 1' 44.953" N
34	17° 54' 25.113" E	55° 1' 43.965" N
35	17° 54' 14.424" E	55° 1' 42.978" N
36	17° 54' 3.736" E	55° 1' 41.990" N
37	17° 53' 53.048" E	55° 1' 41.002" N
38	17° 53' 42.360" E	55° 1' 40.016" N
39	17° 53' 31.672" E	55° 1' 39.022" N
40	17° 53' 20.985" E	55° 1' 38.036" N
41	17° 53' 10.297" E	55° 1' 37.046" N
42	17° 52' 59.610" E	55° 1' 36.057" N
43	17° 52' 48.923" E	55° 1' 35.067" N
44	17° 52' 38.235" E	55° 1' 34.077" N

BOUNDARY MARKER SYMBOL	COORDINATES IN THE ETRS89 REFERENCE SYSTEM	
	Longitude	Latitude
45	17° 52' 27.549" E	55° 1' 33.087" N
46	17° 52' 16.862" E	55° 1' 32.096" N
47	17° 52' 6.175" E	55° 1' 31.106" N
48	17° 51' 55.489" E	55° 1' 30.115" N
49	17° 51' 44.802" E	55° 1' 29.123" N
50	17° 51' 34.116" E	55° 1' 28.132" N
51	17° 51' 23.430" E	55° 1' 27.140" N
52	17° 51' 17.158" E	55° 1' 26.548" N
53	17° 51' 16.230" E	55° 1' 26.460" N
54	17° 51' 9.825" E	55° 1' 25.825" N
55	17° 51' 3.420" E	55° 1' 25.190" N
56	17° 50' 57.025" E	55° 1' 24.515" N
57	17° 50' 50.630" E	55° 1' 23.840" N
58	17° 50' 44.250" E	55° 1' 23.130" N
59	17° 50' 42.833" E	55° 1' 22.972" N
60	17° 50' 37.870" E	55° 1' 22.420" N
61	17° 50' 32.824" E	55° 1' 21.821" N
62	17° 50' 31.505" E	55° 1' 21.665" N
63	17° 50' 25.140" E	55° 1' 20.910" N
64	17° 50' 18.785" E	55° 1' 20.125" N
65	17° 50' 12.430" E	55° 1' 19.340" N
66	17° 50' 6.095" E	55° 1' 18.510" N
67	17° 49' 59.760" E	55° 1' 17.680" N
68	17° 49' 53.435" E	55° 1' 16.815" N
69	17° 49' 47.110" E	55° 1' 15.950" N
70	17° 49' 40.805" E	55° 1' 15.045" N
71	17° 49' 34.500" E	55° 1' 14.140" N
72	17° 49' 28.210" E	55° 1' 13.200" N
73	17° 49' 21.920" E	55° 1' 12.260" N
74	17° 49' 19.920" E	55° 1' 11.949" N
75	17° 49' 15.650" E	55° 1' 11.285" N
76	17° 49' 10.889" E	55° 1' 10.545" N
77	17° 49' 9.380" E	55° 1' 10.310" N
78	17° 46' 55.973" E	55° 0' 51.146" N
79	17° 49' 49.441" E	55° 4' 47.263" N
80	17° 49' 49.457" E	55° 4' 47.284" N

Due to the need for taking into account the limitations arising from the binding environmental decisions issued for the neighbouring OWFs, the Baltic East OWF development area will be divided into two types [Figure 5]:

1) Development area A and C, within which, apart from the linear infrastructure, other elements of the OWF will be installed (i.e. wind turbines, offshore substations, etc.);
2) Development area B, on/in the seabed of which only linear infrastructure (cables) will be installed;

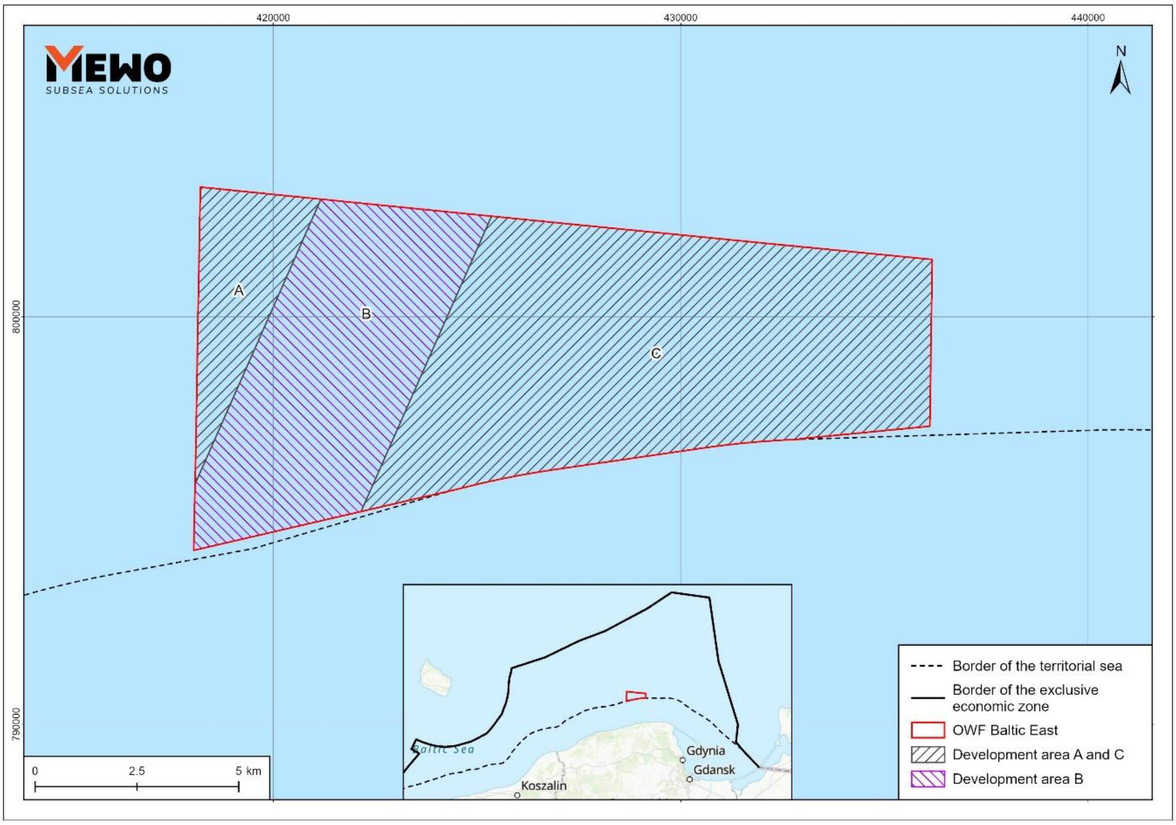

Figure 5 Proposed types of the Baltic East OWF development area [Source: internal materials]

2.1.3 Stages of Project implementation

The Applicant allows for the implementation of the Project in a continuous process as well as in stages, in accordance with the construction law, in order to:

- mitigate the risk of failure to meet the time frames indicated in the Act of 21 March 1991 on maritime areas of the Republic of Poland and maritime administration (Journal of Laws of 1991 No. 32, item 131, as amended) to maintain the PSzW Baltic East OWF for Orlen Neptun VIII Sp. z o.o. in force;
- economically optimise the entire Baltic East OWF Project;
- enable the comprehensive contracting of the necessary services and supplies;
- consider limitations in the access to essential services and supplies (specialist vessels, port infrastructure and other components in the supply chain) related to the possible implementation of similar investment plans in the offshore wind energy sector by other entities;
- account for the possibility of problems during the installation itself, e.g. pile drive refusal, the need to replace structural components damaged in the event of incidents;
- respond to potential constraints related to weather conditions preventing work execution;
- account for the long development process and the scale of the Project.

2.1.4 Project schedule

The construction itself is assumed to last 2 years, with some overlapping phases; this time does not include possible interruptions.

The schedule of the Project implementation phase assumes the following components:

1) preliminary and preparatory works;
2) construction/installation work.

The construction phase must be preceded by seabed preparation prior to the installation of foundations or support structures for the wind turbines and OSSs, and the laying of inter-array cables.

The type of preparatory works will result from geological conditions at the foundation sites, cable layout, the foundation type used, and the technology available. The Applicant allows for preparatory works to be performed sequentially or simultaneously. A detailed description of activities for individual stages of works is provided in Section 2.4.

The Baltic East OWF operation phase will last up to 55 years.

At the end of operation, decommissioning of the Baltic East OWF is assumed, expected to last approx. 2 years. This period does not include possible interruptions in the works, similarly to the operation phase.

2.2 Project variants considered

For the purpose of this study, two variants were selected for analyses:

- variant proposed for implementation – i.e. the Applicant-proposed variant (APV), which was also found to be the most environmentally beneficial reasonable variant in the environmental impact assessment performed for the purpose of this EIA Report;
- reasonable alternative variant (RAV).

Both alternatives were described with the same parameters for which the maximum possible values were assumed. This assumption allows for an Environmental Impact Assessment to be carried out with a large safety margin, as the maximum individual parameters will always be considered in the assessment, even if they do not actually occur cumulatively.

In accordance with the requirements of the EIA Reports, both variants subject to assessment are reasonable, i.e. feasible under the existing legal status (including the decision PSzW no. MFW/46.E.1), technical and technological conditions and with the current state of knowledge about environmental conditions.

2.2.1 Approach to establishing Project options

In the case of the APV, the parameter values corresponding to the maximum parameters of the Baltic East OWF were assumed (the variant is based on the use of wind turbines with the highest power rating, which will be available on the market during the years of the Baltic East OWF implementation). On the other hand, the rated capacity of the wind turbines in the RAV corresponds to the rated capacity of turbines installed at present. This assumption enables the preparation of an environmental impact assessment accounting for the highest expected environmental impact of the Project.

The Project was characterised by the following parameters specified for each variant:

- maximum total installed capacity of the OWF;
- maximum total number of wind turbines – parameter resulting from the maximum installed capacity of the OWF;
- maximum diameter of the wind turbine rotor – parameter specifying the rotor diameter (size);
- minimum clearance between the rotor operation area and the water surface – parameter specifying the distance between the offshore wind turbine blade in its lowest position and the mean sea level;
- maximum height of the wind turbine structure with the rotor – parameter specifying the maximum height of the wind turbine structure from the mean sea level to the tip of the offshore wind turbine blade in its highest position;
- maximum length of the OWF inter-array cables – parameter specifying the total horizontal length of the inter-array cables;
- number of offshore substations – parameter specifying the number of enclosed structures within the OWF area;
- volume of sediments necessary to be removed or filled in for the proper installation of the foundation – parameter specifying the volume of material to be removed/filled in;
- maximum seabed footprint area – parameter specifying the area of the seabed occupied for the OWF implementation.

2.2.1.1 Applicant Proposed Variant (APV)

The Applicant Proposed Variant assumes the application, to the greatest extent possible, of the most optimal solutions available on the market at the stage of the development of a construction project. This variant involves the use of wind turbines with different power ratings, i.e. wind turbines with a rated power of a single turbine ranging from 15 MW to 25 MW. In terms of foundation technology, the use of large-diameter monopiles and/or jacket foundations is planned. The implementation of the Baltic East OWF Project with a total maximum capacity specified in the PSzW Baltic East OWF (up to 966 MW), assumes the installation of up to 64 wind turbines.

The Applicant Proposed Variant takes into account the continuous intense development of OWF technology in recent years, in terms of increasing the size of rotors, generators and structural elements, as well as in terms of increasing the effectiveness of the technical and technological solutions applied.

According to the results of the environmental impact analyses presented in this Report, the APV is the environmentally preferable option compared to the RAV.

2.2.1.2 Reasonable Alternative Variant (RAV)

The main premise of the Reasonable Alternative Variant was to apply existing technological solutions that are currently used and commercially available on an industrial scale. This variant assumes the installation of wind turbines with a rated capacity of 14 MW. With the maximum total rated capacity of the offshore wind farm complex of 966 MW, indicated in the PSzW Baltic East OWF, the total number of wind turbines in this variant is 69.

The RAV assumes that one type of wind turbines can be used on different types of foundations (monopiles and/or jacket structures).

2.2.1.3 Summary of the technical parameters of the Project variants considered

Table 8 below presents key parameters of the Baltic East OWF for both variants analysed in this EIA Report.

Table 8 Summary of key parameters of the Baltic East OWF for the Applicant Proposed Variant (APV) and the Reasonable Alternative Variant (RAV) [Source: internal materials].

PARAMETER	UNIT	APV	RAV
Maximum installed capacity	MW	966	966
Maximum number of wind turbines	-	64	69
Rotor diameter	m	236 – 310	236
Minimum clearance between the rotor operation area and the water surface	m	22.5	20
Swept area	million m^2	2.79 – 2.87	3
Maximum wind turbine height	MASL	347.5	256
Maximum length of inter-array cables within the OWF	km	150	160
Number of stations	-	2	3
Maximum volume of sediments to be displaced for the proper installation of foundations	m^3	240 thousand	260 thousand
Maximum area of seabed disturbance	%	5	5

2.3 Description of technological solutions

The following subsections present the technological solutions in terms of electricity generation planned for the Baltic East OWF, available at the time of the Report preparation.

2.3.1 Description of the production process

Offshore wind turbines are devices designed to generate renewable energy by converting the kinetic energy of the wind into electricity. The process of electricity production begins in the wind turbine, where the kinetic energy of the wind flowing through its blades is converted into rotational movement of the rotor (conversion of kinetic energy into mechanical energy). Next, this motion is transferred to a generator where it is transformed into electricity (conversion of mechanical energy into electrical energy). After being transformed to high voltage at the offshore substation (OSS), the electricity is then exported to the power grid on land.

In terms of definition, an offshore wind farm is an installation constituting a separate set of energy generation facilities consisting of **one or more offshore wind turbines** and a medium- or high-voltage grid together with substations located at sea, **excluding the equipment on the higher voltage side of a transformer or transformers located at this substation**.

Given the conditions of their location (in offshore areas), offshore wind farms are built comprehensively as assemblies of individual wind turbines together with a complex of power export facilities. The task of this infrastructure is to deliver the electricity produced at sea to the onshore substation and also to supervise the availability and productivity of the OWF [Figure 6].

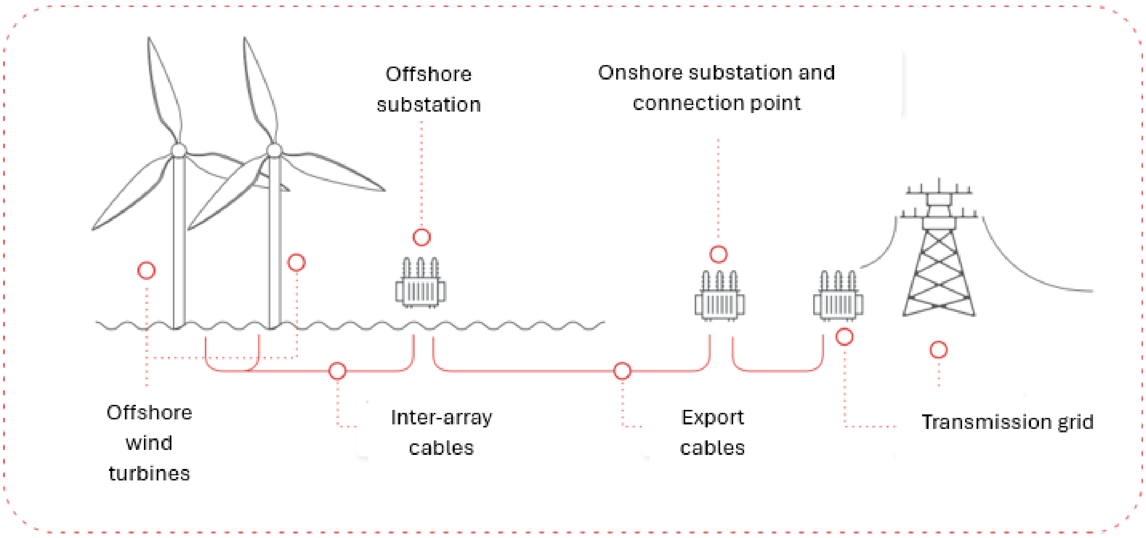

Figure 6 Main elements of an offshore wind farm along with the transmission infrastructure [Source: Orsted, 2021]

Wind turbines are used exclusively to generate electricity and, importantly, they do not require the supply of other fuels and raw materials during the operation phase. Only during windless weather are they characterised by a low demand for electricity. The demand for raw materials and energy occurs during the OWF implementation phase, in the process of construction and installation of the structural elements of the individual wind farm components (i.e. the materials used for manufacturing, fuels and other materials required during the construction phase). Fuels and materials are normally used during the operation phase, for maintenance, and during decommissioning activities. Properly operated, offshore wind turbines do not generate environmental pollution.

2.3.2 Description of technological solutions for individual elements of the Project

An offshore wind farm consists of the following main components, connected functionally and structurally:

- wind turbines with support structures;
- inter-array cables (IAC);
- offshore substations (OSS).

The individual OWF components are characterised in the following sections.

2.3.2.1 Wind turbine

The figure below shows a schematic diagram of a wind turbine [Figure 7].

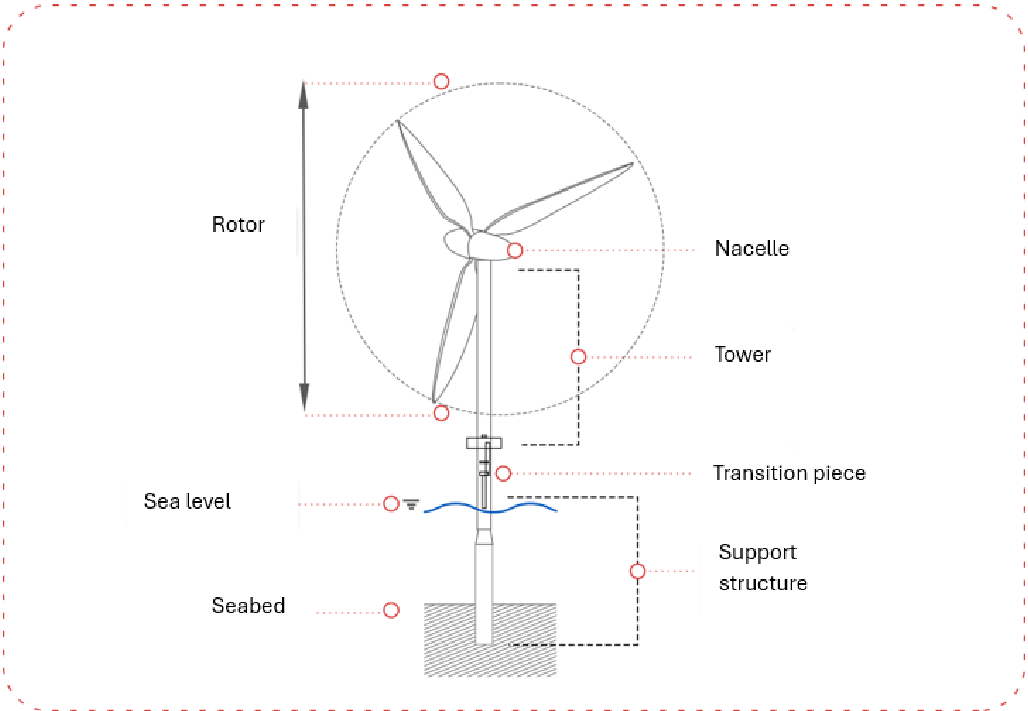

Figure 7 Schematic diagram of an offshore wind turbine with a support structure [Source: internal materials]

2.3.2.1.1 Nacelle with a rotor

The nacelle is a key component of a wind turbine. After being assembled on land into a complete unit, the nacelle is transported and installed on the wind turbine tower. It comprises drive train components and a housing protecting them from the weather [Figure 8]. The drive train is responsible for converting the energy of the rotating rotor into three-phase alternating current. The drive train components include the rotor, the rotating shaft with or without gearbox, and the generator.

The converter is responsible for converting the generator supply voltage, and for the power supplied from the generator to the grid. The current conversion that takes place in it involves changing the variable-frequency alternating current from the generator into a constant-frequency alternating current with the levels of active and reactive power as well as other parameters necessary to produce the electricity supplied to the grid.

Access to the top (roof) of the nacelle is provided by a ladder and a hatch located in the nacelle. This solution offers access to the cooling unit, wind sensors, and aircraft warning systems.

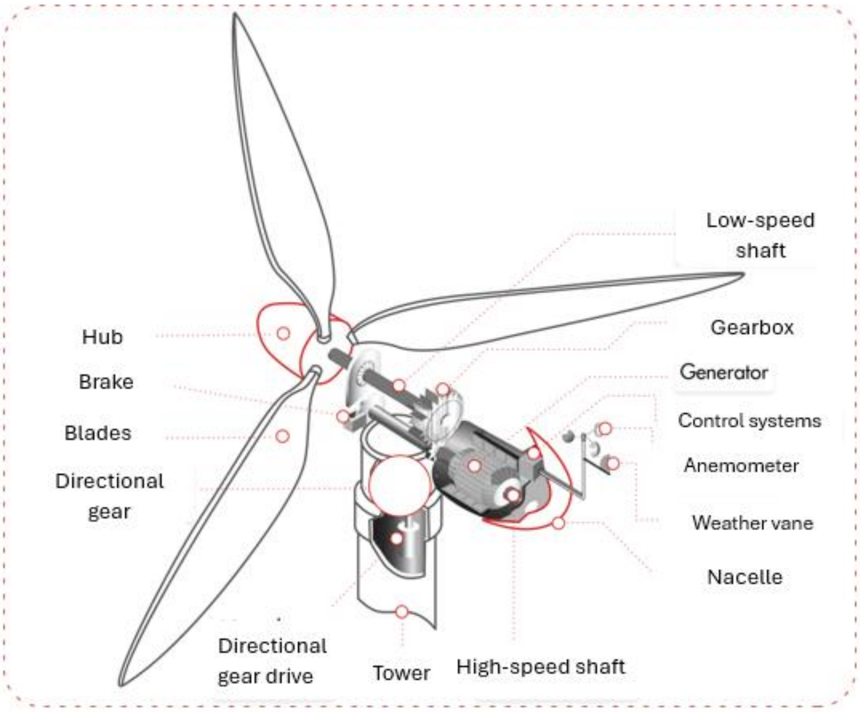

Figure 8 Schematic diagram of a nacelle with a gear drive system [Source: Areva]

The rotor is another essential component of a wind turbine, made up of three blades and a hub. Under the influence of wind, the rotor rotates, transferring its kinetic energy to other elements of the nacelle. The rotor is automatically adjusted against the wind. In order to optimise its operation, the rotor is equipped with aerodynamic brakes and the angle of attack of the blades is continuously adjusted depending on the existing wind conditions. The rotor plays a key role in the operation of the turbine, and its size (diameter) affects the power output.

In terms of materials, rotor blades are made of composites (glass fibre, carbon fibre, epoxy resins or polyester resins).

Two technologies for torque transmission from the rotor to the generator are currently applied on the market: with or without a gearbox. The former solution involves the use of lubrication oils with a volume of approximately 2000 litres for a turbine with a rated capacity of 15 MW. For wind turbines with higher capacities, the anticipated use of oil will not exceed 5000 l.

The generator converts the mechanical energy of the shaft into electrical energy.

The wind turbine is fitted with systems continuously monitoring and securing its operation. The two main systems ensuring the safe operation of the turbine are the overspeed protection system and the lightning protection system.

The overspeed protection system is a safety solution monitoring the rotor speed and initiating emergency braking of the rotor if the speed limit is exceeded, which occurs independently of the turbine controller, in accordance with applicable standards.

The other system is a lightning protection system (LPS) compliant with the IEC 61400-24 standard. It helps protect the wind turbine from physical damage caused by direct atmospheric discharges (lightning strikes).

In addition, a system enabling temporary turbine shutdown is to be provided, for periods of peak bird migration. Based on the detection of bird migrations (e.g. using radar equipment and cameras), the turbines can be slowed down to a speed of 2–4 revolutions per minute. For technological reasons, it is impossible to stop the rotor completely – only to slow it down significantly.

2.3.2.1.2 Tower

The tower is the structural element connecting the nacelle with the foundation. Structurally, the tower is a steel tube tapering upwards, consisting of sections connected by bolted flange connections.

The tower performs the load-bearing function for the wind turbine, and provides the basis for routing the necessary cabling, i.e. control cables, power cables as well as other installations and equipment essential for the operation of the entire plant. The internal and external equipment of the tower includes platforms, supports, a lift, etc., allowing service crews to access the nacelle and components of the tower itself.

2.3.2.1.3 Support structures

In the case of the Baltic East OWF, the wind turbine is permanently attached to the seabed by means of a steel or concrete support structure (monopile or jacket structure). The selection of an appropriate support structure depends on the size and weight of the wind turbine, as well as on the prevailing environmental conditions at the OWF location, such as: depth of the sea basin, geological conditions of the seabed and other environmental conditions, i.e.: wave action, currents, ice cover, biotic characteristics; the economic aspect is also important. The support structure is designed to perform the following functions:

- ensure adequate rigidity and strength of the wind turbine;

- provide support for wiring systems;
- serve as a connection between the wind turbine and the seabed;
- ensure efficient installation of the wind turbine.

In the offshore wind turbine installation process, the support structure is installed first, followed by the subsequent wind turbine components.

The Baltic East OWF is to use large-diameter piles (monopiles) and/or jacket structures as the foundation of turbines and offshore substations [Figure 9].

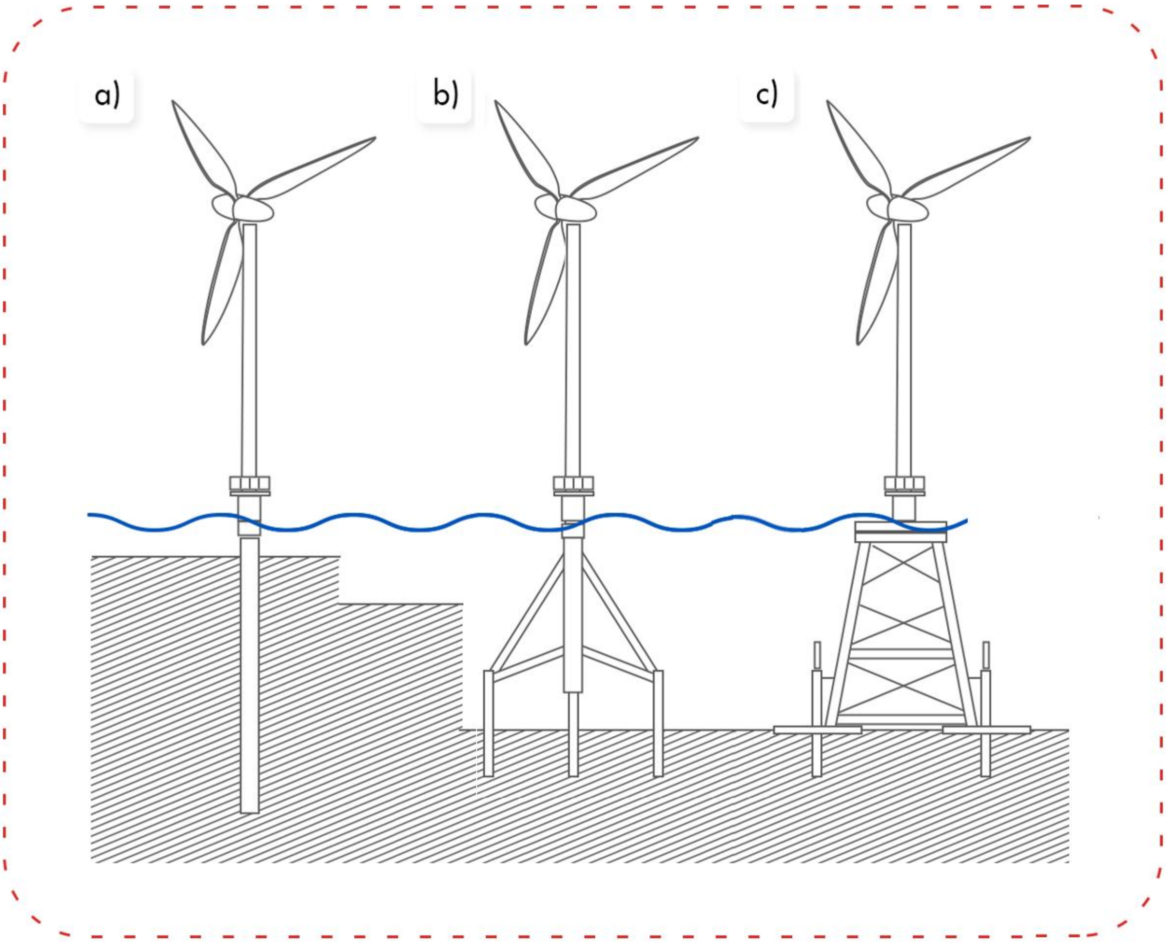

Figure 9 Types of OWF foundations. a) monopile b) tripod c) jacket structure [Source: internal materials]

The monopile foundation (large-diameter pile) intended for the Baltic East OWF is a steel structure composed of cylindrical sections welded together. The length of the monopile, depending on the foundation conditions of a specific wind turbine, will be up to approximately 120 m. The installation of the monopiles involves driving them (or, in the case of challenging geological conditions, partially drilling them) into the seabed to an appropriate depth, after which a transition piece is installed on the part of the monopile protruding above the sea surface, on which the wind turbine tower is mounted. Among the technological solutions available, there is also a possibility of mounting the tower directly on the foundation with an integrated transition piece (TP-less design). The Baltic East

OWF is to use monopiles with diameters up to 12 m, seabed penetration depths up to approx. 60 m, weighing up to 2400 t.

A jacket structure consists of a number of tubular elements connected by K, X or Y joints. The entire structure is braced by tubular elements with a diameter of approximately 1 m. The jacket structure is founded indirectly on the seabed. The brackets of the main girders are rigidly connected to the piles buried in the seabed. If a jacket structure is used in the Baltic East OWF, such structures may have diameters ranging from 1.8 m (seabed penetration depth of approx. 70 m) to 4.0 m (seabed penetration depth of approx. 40 m).

The advantages of using monopiles are the simple structure and universal applicability. The disadvantages, on the other hand, include the limited possibilities of complete removal from the seabed during the wind farm decommissioning phase, while during the construction phase, when the structure is driven into the seabed, underwater noise is generated, affecting marine animals. What should also be noted is the possible need for drilling works if the installation of the piles is hampered by challenging ground conditions. During the operation phase, sea currents are modified in the immediate vicinity of the monopiles, affecting the movement of sediment on the seabed.

The advantages of using a jacket foundation are mainly related to the way in which the loads are transferred to the ground by the structure, i.e. better performance characteristics are obtained as the forces within the support structure are distributed to 3 or 4 independent pile supports. This type of support structure is more stable and less susceptible to bending moment generated by horizontal forces, in comparison with monopiles. There is also a larger support area for the technological load-bearing capacity of the structure.

The choice of the foundation type will depend on the geotechnical conditions and depth at specific locations. Moreover, depending on the depth of the sea basin and the weather conditions anticipated, the installation of scour protection may be necessary.

Additionally, in areas where the seabed is subject to hydrodynamic processes, it may be necessary to provide scour protection on the seabed surface around the pile, e.g. using rip-rap.

2.3.2.2 Inter-array cables

The inter-array cables (IAC) of an OWF connect wind turbines with substations located within the wind farm area.

The Baltic East OWF will use inter-array cables with a voltage rating of 66 kV, which is the current standard for offshore wind power projects. If wind turbines with higher power ratings than those currently installed are used, an increase in voltage to 132 kV is considered. It is planned to use cables consisting of three insulated conductive cores (copper or aluminium) and additionally equipped with fibre optic cables. The use of newer technologies, available at the time of the Project implementation, is also admissible.

2.3.2.3 Offshore substations

An offshore substation (OSS) [Figure 10] is one of the main elements of an offshore wind farm. The primary function of offshore substations is to receive the electricity generated by offshore wind turbines via inter-array cables and to transmit the electricity to shore via export cables (offshore and onshore), while maintaining voltage stability and minimising transmission losses. At the offshore substation, lower-voltage alternating current (e.g. 66 kV), which is not suitable for long-distance transmission, is converted to higher-voltage alternating current (e.g. 220 kV or more) to reduce transmission losses.

The substations used in the Baltic East OWF will consist of the following key elements:

1. support structure (jacket foundation or monopile described in Section 2.3.2.1.3) for the foundation of the offshore substation and for transferring the loads generated during its operation to the seabed;
2. topside structure – situated on top of the support structure, containing the following components, among others:

- transformers – for voltage level transformation;
- auxiliary transformers – intended to provide power supply for the station equipment;
- grounding transformers – intended to obtain an artificial neutral point in networks grounded by a resistor or in compensated networks;
- high and medium voltage switchgear – intended to connect, break and distribute electrical circuits;
- back-up generators – intended to power supply in case of failure;
- reactors – intended to compensate for reactive power;
- AC filters – intended to eliminate higher harmonics.

In power, auxiliary and grounding transformers, transformer oil is used as a cooling and insulating medium. In total, the use of approximately 260 tonnes of oil is assumed for power transformers, and approximately 20 tonnes of oil for auxiliary and grounding transformers. In addition, each of the two OSSs is equipped with an emergency generator fuelled with diesel oil with a volume of approximately 15 m^3 per OSS.

Figure 10 Example of an offshore substation
[Source: https://www.flickr.com/photos/pshab/27738985766]

The offshore substation (topside structure) will be a facility measuring up to 25 m by 45 m, with a maximum height of 50 m above the water surface.

No permanent occupancy is anticipated on the offshore substations.

2.4 Description of the individual phases of the Project and conditions for the sea basin use during the implementation and operation phases

2.4.1 General information relating to all phases of the Project

Due to the location of the proposed Project, implemented entirely within the maritime area, all related activities, in all its phases will be conducted in a manner typical of maritime operations, accounting for their unique conditions and specificity. Deliveries to and from the Baltic East OWF Area will be carried out with the use of various types of vessels:

- construction and installation vessels – large specialist vessels, with an advanced safety level, equipped with dynamic positioning systems (with various degrees of protection); during operation, such vessels often offer the possibility of full stabilisation in a selected position thanks to systems of supports resting on the seabed, but the possibility of anchoring is not excluded;

- transport vessels – universal or specialist vessels adapted to transporting large structures (including monopiles, towers, nacelles, or blades), often equipped with dynamic positioning systems;
- transport barges (platforms) – vessels used for transporting large structural elements to the site, usually without their own drive, using pushers or tugs;
- pushers and tugs – auxiliary vessels used for manoeuvring larger vessels, transport barges or for transporting large structural elements (e.g. monopiles or other components of wind turbines) from ports to the place of installation;
- service vessels – usually smaller vessels, used for transporting OWF service personnel and/or consumable materials, adapted for mooring to the towers of wind turbines or accompanying platforms and enabling a safe transfer of people and smaller equipment to structural elements of OWFs.
- helicopters – can be used in certain cases, especially during the OWF operation phase, for transporting rescue personnel or in emergency situations.

Activities related to the transport of large-size structural elements of OWFs must be carried out from ports that meet specific requirements, including in terms of:

- length and bearing capacity of the quay, allowing the assembly, storage and loading of the OWF structural elements;
- appropriate depth of port basins, allowing for the operation of large construction vessels.

At the current stage of the Baltic East OWF development, the installation, transshipment and support ports under consideration are Świnoujście, Gdańsk, Gdynia, Władysławowo, Łeba, as well as Rønne and Aalborg. The port of Rønne in Denmark (on the island of Bornholm) is the nearest port with a complete and operational infrastructure for offshore wind energy activities.

During the Baltic East OWF operation phase, a smaller and closer port will be available for use, i.e. the port in Władysławowo or Łeba.

It should be emphasised that installation and service ports, along with their infrastructure, are not part of this Project. All activities carried out in the ports used in connection with the implementation, operation and decommissioning of the Baltic East OWF will be conducted on the terms and within the limits of permits, decisions, licences as well as other formal and legal conditions applicable to the aforementioned ports.

Pursuant to Article 24(1) of the Act of 21 March 1991 on maritime areas of the Republic of Poland and maritime administration, a competent director of the maritime office will be able to establish, by way of a regulation, safety zones around all OWF structures or around complexes of these structures located at a distance of up to 1000 m from one another, adjusted to the type and purpose of artificial islands, structures and devices or their complexes, reaching out not more than 500 m from each point of their external edge, unless a different range of the zone is permitted by generally accepted international standards or recommended by a competent international organisation. In the regulation issued, the director of the maritime office will define the conditions for navigation within the established zones, including in particular restrictions regarding navigation, fishing, water sports, and underwater work.

In each of the Baltic East OWF Project phases mentioned, currently applicable legal requirements and good practices will be applied regarding waste and sewage treatment. During various phases of the Baltic East OWF Project, various hazardous materials will be used. The list and assumed estimated quantities of waste generation are presented in Table 10.

Moreover, at the stage of the Baltic East OWF installation, measures will be applied to prevent the spillage of hazardous substances along with measures to eliminate the effects of a possible spillage of hazardous substances (e.g. trays capturing possible spillages of transformer oil) as well as measures to eliminate the effects of spillage of these substances (e.g. sorbents). The oil-polluted water produced during the works will be collected and separated to obtain oil-derivative concentrations below 15 ppm and the oil obtained from the separation process will be stored and transferred in appropriate containers to specialised waste disposal companies.

The same will apply to other waste, including other hazardous waste, which will be sorted, collected in specially marked and secured containers, transported ashore and handed over to specialist companies for disposal.

With regard to public information, information about activities conducted during the OWF construction phase, the establishment of safety zones around OWF structures, as well as a total or partial decommissioning of the OWF will be published in official publications of the Hydrographic Office of the Polish Navy.

All vessels involved in the works throughout the Project will comply with the requirements and regulations of the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78), including, in particular, the procedures contained in the ‘Hazard and Pollution Control Plans’ prepared in accordance with the Regulation of the Minister of Infrastructure of 15 December 2021 on the rescue plan and the hazard and pollution control plan for offshore wind farms and complex of facilities (Journal of Laws of 2021, item 2391).

The following subsections describe the activities and processes characteristic of and occurring during the various phases of the Project life.

2.4.2 Implementation phase

The OWF implementation phase is the project phase requiring the mobilisation and involvement of the largest number of vessels, equipment, and human resources. Therefore, it is necessary to develop a complex process of supply chain of both goods and specialist services in various areas: manufacturing, transport, construction, assembly and installation. Moreover, the implementation of this phase will require precise coordination of individual activities, taking into account specific conditions resulting from the implementation of projects in a maritime area. The implementation phase comprises two stages: preliminary and preparatory works as well as construction and installation works.

2.4.2.1 Preliminary and preparatory works

As part of the preliminary and preparatory works, prior to the construction works of the Baltic East OWF, the Project Owner will use a suitably developed land area (onshore construction site facilities and storage yards). Within this area, the pre-assembly of wind turbine components will be performed and the OWF structural elements will be stored. The area will be situated within port or shipyard infrastructure existing for the duration of the Project, with direct or very good access to a quay intended for the operations of loading and unloading of vessels involved in the construction process and subsequent maintenance of the OWF. Individual elements of the OWF will be transported by ships to the area of their foundation or installation. The arrangement of such a place within the boundaries of existing port or shipyard infrastructure will not affect their current functioning significantly.

The works will include activities related to the preparation and management of the construction site facilities and storage yards, and preparation of the seabed prior to the commencement of construction works.

Seabed preparation activities conducted before the installation of monopiles or jacket foundations of the Baltic East OWF and before the laying of inter-array cables will be performed in accordance with the depth and geological conditions identified in the Project area.

The Applicant is planning the following preliminary and preparatory works prior to the construction:

- clearance/displacement of boulders from inter-array cable routes and the installation zone of turbine and offshore substation foundations;
- clearance/displacement of other obstacles, e.g. ropes, cables and fishing nets;
- preparation of the locations of cable crossings with third-party infrastructure by providing reinforcement and appropriate protection;

- ground stabilisation using rip-rap, both for foundations (e.g. scour protection) and for the cable route;
- PLGR (pre-lay grapnel run);
- seabed preparation for foundations if unfavourable ground conditions are identified;
- preparation of structural fills/protection measures (gravel pads) for jack-up installation vessels;
- displacement of seabed sediment layers;
- other sediment-related works.

The Applicant allows for the use of other newer technologies, depending on their market availability.

An important issue resulting from the works involving seabed sediments is the method of their management. It is assumed that the sediment displaced will be fully managed within the Baltic East OWF Area. The sediment will be handled only in the closest vicinity of the work. There are no plans to transport it to dumping sites or waste deposit areas, as no sediment contamination has been identified in the Baltic East OWF Area.

2.4.2.2 Construction/installation works

The following range of activities are planned as part of the construction process:

- transport and installation of monopiles or jacket foundations in the seabed;
- transport and installation of transition pieces, wind turbine elements, and substations on monopiles or jacket foundations;
- transport and laying of inter-array cables connecting individual OWF structures;
- scour protection of foundations and cable crossings with third-party infrastructure;
- protection of cable lines laid on the seabed;
- seabed clearance.

Depending on the strategy adopted for the Project implementation, the above-mentioned stages and activities may be implemented sequentially or simultaneously. For example, after a foundation has been installed, the installation of a turbine and the piling for the next foundation may be carried out simultaneously. Hence, the organisation of the construction process, when individual works will be performed sequentially in the entire Baltic East OWF Area or in its specific fragment, i.e. at several (or all) locations of wind turbines and substations the works related to the seabed preparation will be performed simultaneously, after which piling will begin, and after the completion of the structure installation, the area around particular locations will be cleared.

The implementation phase is expected to be completed in the shortest possible time the assumed duration being 2 years.

2.4.2.2.1 Cable laying

Seabed intervention work technologies for cable laying:

- trenching – trench excavation;
- dredging – excavation and removal of sediments;
- ploughing – seabed ploughing;
- jetting – using high-pressure water jets for drilling holes;
- rock dumping – local seabed reinforcement along the cable route, e.g. using aggregate or mattresses filled with other material.

The following cable laying methods are considered:

- SLB (simultaneous lay and burial) method, i.e. simultaneous excavation, laying and burial of the cable – SLB is a method involving fewer vessels and devices needed to lay and secure the cable line. This method uses only one cable-laying vessel, hence there is no need for successive vessel runs along the laying route. This method may prove to be faster than the PLB method, as the cable burial speed using the SLB technology is approximately 4.5–5 km/day. A requirement affecting implementation time is a long weather window;
- PLB (post-lay burial) method, i.e. burial of the cable after it has already been laid on the seabed – PLB requires at least two cable-laying vessels. One vessel lays the cable on the seabed while the other, after drilling a hole in the seabed (with appropriate tools, suitable for the specific geomorphological structure of the seabed), lays and buries the cable in the trench. Its advantage is that the installation process can be divided into phases, which is useful for short periods of favourable weather conditions. The disadvantage of the PLB method is that the cable itself is unprotected during the period from laying to burial. Compared to the SLB method described above, the PLB technology requires the use of more equipment. Trenching speed is approximately 5.5–6.0 km/day and cable laying is 14–15 km/day, which means that for longer distances the PLB method may be slower than SLB. The advantages of this method include the reduced risk of laying and burial operations, as well as easier cable management during unwinding.

The choice of the method for particular cable line sections is determined by:

- environmental conditions, i.e. the seabed relief, geological structure and geotechnical conditions of the seabed along the planned route;
- level of certainty regarding the environmental conditions;

- required depth of cable burial resulting from the design and dictated by reliability requirements;
- environmental constraints – the impact of the method on the environment (disturbance of the seabed, increase in suspended sediments, destruction of organisms, disturbance of contaminants deposited on the seabed, noise);
- logistical considerations;
- technology recommended by the cable manufacturer or contractor carrying out the work, as well as the availability of specific technologies.

In terms of equipment, the following devices are used for subsea cable laying:

a) cable ploughs – mainly used in the SLB method. Operation of a plough requires simultaneous operation with a CLV (cable-laying vessel). The plough with the cable placed in the guide is deployed from the vessel to the seabed. The CLV sails away to a predetermined distance with the cable being uncoiled. Next, the vessel is anchored and the plough tow-line retrieval begins. In a single cycle, the plough produces a trench using mechanical force and places the cable in the trench. In order to reduce the pulling force of the plough, some ploughs feature jetting systems to pre-soften the ground. After the plough approaches the CLV, the operation of sailing away, anchoring and line retrieval is repeated. At the end of the planned cable-laying section, the cable is released from the guide and the plough is recovered onto the vessel deck.

Advantages of using a cable plough (SLB method):	Disadvantages of using a cable plough (SLB method):
• continuous cable protection; • simultaneous trenching and cable laying; • applicable to numerous types of substrate, from sands to compact clays.	• risk of the cable being damaged by the loading system; • due to the high pulling force required for the plough in compact soils, potential cable damage may be more severe than with other methods; • large CLV required and a robust connection to the plough; • potential stresses in the cable may accelerate its degeneration; • route direction change must be gradual.

Used mainly in the SLB method, ploughs with additional attachments can be used in the PLB method. The difference in performing the operation is the need to lift and load the cable after the plough has been deployed to the seabed, which is how all the advantages of the SLB solution are lost.

b) ROV trenchers:

These systems can be used for substrates susceptible to liquefaction (areas of sands and tills). The pressure equipment is powered from the vessel (CLV or auxiliary vessel) or by submersible pumps. When powered from the surface, the operating depth of the equipment is limited to 50 m due to the strength of the connecting pipes. When deployed from the vessel to the seabed, these units can be towed by a vessel anchored or operating in DP (Dynamic Positioning) mode. They can also have independent propulsion.

Advantages of using ROV trenchers:	Disadvantages of using ROV trenchers:
• Minimised risk of cable damage; • High burial speed; • Typically used in areas of sand banks and banks levelled before cable laying.	• Not suitable for use in hard soils; • In some nearshore areas, the use of this technology is prohibited (due to high levels of seabed disturbance/increased turbidity).

c) high pressure jetting trenchers:

Technologically similar to ROV trenchers, high pressure jetting trenchers are additionally used for remedial burial operations.

d) mechanical trenchers/cutters:

Mechanical trenchers/cutters are used when the seabed is made up of compacted, hard or rocky soils. The mechanical trencher excavates a trench using a wheel or chain cutter, after which the cable is laid in the trench.

Unlike sledges, mechanical trenchers are always self-propelled. There are universal devices combining the features of jet sledges with cutting capabilities.

Once the cable is laid by a CLV, the cutter is deployed to the seabed from the deck of a support vessel. The unit moves along the route of the cable laid on the seabed, depressing it into the seabed. Once the operation is complete, the cutter is recovered onto the deck.

Advantages of using mechanical trenchers/cutters:	Disadvantages of using mechanical trenchers/cutters:
• The possibility of using a smaller support vessel allows the large CLV to be relieved earlier; • Capability of operating in hard soils without the assistance of a large towing vessel; • Easier installation of bundled DC cables, compared with cable ploughs.	• Cable burial depth optimisation required due to the trenching speed decreasing with depth; • Increased risk of cable damage due to the need for lifting the cable and laying it in the trench;

A considerable volume of displaced sediments may be generated along the sections of the proposed cable route, in the case of cable burial using the jetting method involving the use of jet sledges. In sections where cables are laid by ploughing or mechanical trenching, smaller amounts of displaced sediment will occur.

2.4.2.2.2 Piling

The monopiles of the Baltic East OWF will be driven into the seabed using specialist equipment (floating piling rigs with a weight and impact energy appropriate to the size of the piles to be driven) from aboard vessels suitable for such works (self-elevating platforms, vessels or other solutions available during construction). The jack-up vessel intended for foundation installation is supported on the seabed in a position enabling piling at a given location. This type of vessel may have 6 or 4 spudcan foundations. The seabed often requires preparation beforehand (levelling and/or increasing its load-bearing capacity) – by providing gravel pads – in order to support the vessel.

The impact driving is a versatile method that can be used for practically any soil conditions. At the same time, this method ensures rapid installation of piles in the ground.

In order to minimise underwater noise during the installation of the Baltic East OWF foundations, a noise reduction system (NRS) will be applied, which is a set of noise mitigation solutions adjusted to the type of foundation and geological conditions for the location of wind turbines and substations, as well as to the seasonal variability of environmental conditions, among others.

2.4.2.2.2.1 Noise Reduction System

The installation in the seabed of the structural elements (foundations) of the Project generates significant underwater noise. Driving, vibro-hammering or screwing monopiles generates underwater noise, which can reach instantaneous SPL values of over 230 dB re 1 µPa at a distance of 1 m. Hence, various types of noise reduction solutions are planned during the installation of the piles, which will jointly constitute a Noise Reduction System (NRS) [Figure 11].

The underwater Noise Reduction System selected should take into account in particular:

- the schedule of the works, including works on other projects (piling activities within a 50 km radius),
- piling locations, including piling locations on adjacent developments (within a 50 km radius),
- the parameters of the pile driver (type, maximum energy and values during the operating cycle, frequency and number of strikes) or other technical solution used for driving the pile into the seabed,
- parameters of the piles being driven (geometry and materials),
- geotechnical parameters of the sediments,
- seasonal variability of environmental conditions (among others, underwater noise propagation parameters).

Depending on these conditions, a Noise Reduction System may include:

- visual and acoustic observations together with deterrent systems and a soft-start pile driving system;
- passive noise reduction systems with appropriate noise mitigation features, e.g. air bubble curtains, cofferdams, sound insulation, or other similar technologies available at the time of the Project implementation;
- organisation of the work progress, taking into account the schedules of works at other projects.

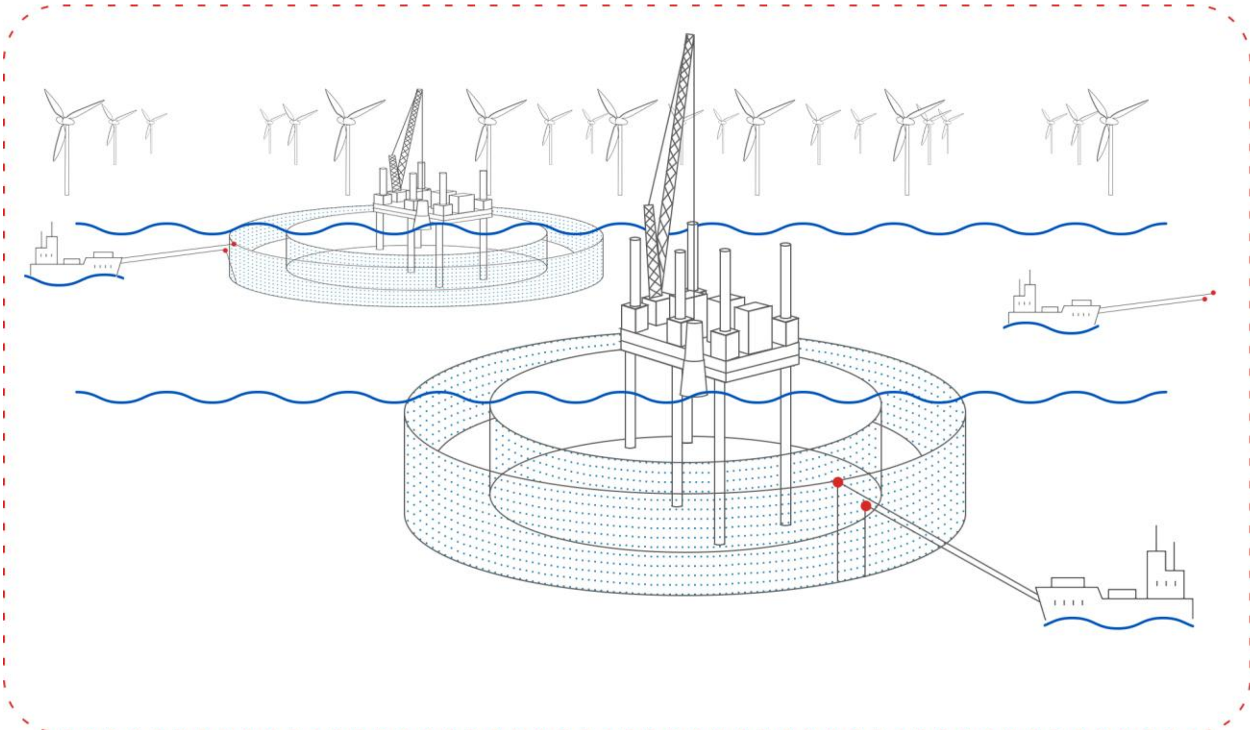

Figure 11 Example of a BBC-type air bubble curtain
[Source: https://www.grow-offshorewind.nl/project/bubbles-jip#modalDialog1]

The Noise Reduction System selected should minimise the impact of underwater noise on marine mammals and fish by ensuring that underwater noise levels generated during foundation piling are controlled throughout the year at a distance of 11 km from the source in the most favourable propagation direction, so as not to exceed maximum underwater noise levels, i.e. 140 dB re 1 µPa2s SEL_{cum} HF-weighted (HF-weighting function for marine mammals with high sensitivity to high frequency sounds – porpoise) and 170 dB re 1 µPa2s SEL_{cum} PW-weighted (PW-weighting function for pinniped marine mammals – seals).

Should noise measurements indicate the exceedance of the above-mentioned thresholds, the appropriate regional director for environmental protection must be notified immediately.

The technical solutions of the NRS, together with appropriately planned underwater noise monitoring (described in Section 2.4.2.2.2.1), will be submitted to the appropriate regional director for environmental protection at least 2 months prior to the commencement of piling.

2.4.2.2.3 Transport routes (offshore and onshore)

Depending on the selected supply concept, as well as supply and service ports, the transportation system will include transshipment activities and vessel traffic on routes such as port–OWF–port or between ports. Land transportation will be carried out using the existing transportation solutions. Most of the assembly or production of large-scale elements will take place in port or shipyard areas. Maritime transport traffic will take place along the routes where there has been little or negligible traffic to date. Maritime transport will be crucial and the impact of land transport can be estimated as minimal.

The number of specialist offshore operations related to the construction phase of the Baltic East OWF is proportional to the number of facilities installed and constructed in the OWF area, including also the length of the electricity grid installed. Therefore, the number of operations and their effects (e.g. fuel consumption, emissions related to transport) for the APV will be smaller than in the case of the RAV.

The analysis of vessel traffic during the construction phase was performed on the basis of the available literature and the authors' own experience, as no contracting of specific vessels has been performed at the present stage of the work or such data is confidential.

When calculating the number of cruises for the Baltic East OWF, it was tentatively assumed that:

- The installation will be preceded by a campaign to clear the seabed of stones, unexploded ordnance and other potentially hazardous materials lying on the seabed. For the purpose of these operations, transport vessels, specialist vessels, tugboats, multi-purpose vessels and various barges will be used, including small self-elevating jack-up barges. The number of cruises and the type of equipment required will depend on the amount of materials identified on the seabed requiring removal/displacement.
- Three basic methods of foundation installation were defined, namely monopiles or jacket structures. Both solutions are indicated as the most probable in the context of the initial morphology of the OWF area.
- A few (approx. 3–4) foundations will be transported at a time, using barges, and delivered to the heavy-lift crane vessel (HLCV), which, due to the very high daily charter rates, will not be involved in the logistics of the components.

- The foundations will be transported individually by wet towage using tugboats (for monopiles only) or sets of tugboats and pontoon barges (for jacket foundations). The foundations will be transported from the installation / marshalling port to the installation site, where they will be collected from the water / from the barge by an appropriate lifting vessel (scissor lift) or other vessel enabling installation.
- Alternatively, an HLCV can be used for the installation and offshore logistics of the components. Depending on the model, these vessels can load from 6 to 12 XXL monopiles or 4 to 10 jacket structures on their working deck (the latter being a much more expensive and time-consuming option, and hence the least desirable).
- Transition pieces (TP) are transported a few items at a time (approx. 5) per each installation cruise.
- The length of the inter-array cable is approx. 150 km, with a weight of approx. 5000 tonnes. It is possible to transport the entire cable on board a single cable-laying vessel or to make a maximum of two cruises to load the cable drum.
- Tower elements, nacelles and blades will be transported in 3 to 4 sets on board HLJVs, i.e. heavy-lift jack-up vessels.
- Seabed reinforcement in the context of foundations and cable routes: a large fallpipe vessel can carry between approx. 14 000 and approx. 31 000 tonnes of aggregates. Alternatively, the protection materials can be transported by barges / dump barges.

Based on the vessel presence time and the above estimates, it was assumed that during the 2 years of construction:

- an average of 2.5 vessels will be stationed at the OWF during the entire construction;
- approximately 360 (340+20) cruises will be made to the farm by 23+16 vessels, amounting to approx. 40 vessels involved. Most probably, the OWF installation port will be Świnoujście, but it will be possible to use other locations as marshalling ports.

For the individual components, the following assumptions were made:

- Some of the traffic related to simple preparatory works or delivery of individual components for the OWF will originate from different ports. At present, with no suppliers contracted, it is impossible to clearly indicate where components will be manufactured, or ports where they will be loaded onto installation or transport vessels. Considering the location of the production plants, deliveries of foundations and other components may originate from one of the foreign ports, i.e. Rostock, Sassnitz, Bremerhaven (GER), Odense or Aalborg (DK), Rotterdam or Hoboken (NL).
- Traffic associated with advanced operations such as:
  - turbine assembly – is expected to originate from the installation terminal in Świnoujście or may be located in another Polish port of primary importance to the national economy.
  - OSS – may partly originate from the ports of Gdynia or Gdańsk, although the final assembly may take place in one of the ports in Germany (Mukran, Rostock), Denmark (Rønne, Aalborg or other locations in the Danish Straits), or the Netherlands (Hoboken or Vlissingen).
  - For cable-laying vessels, it was assumed that the port of cable loading to the carousels on the installation vessels would be at the cable prefabrication site, e.g. Karlskrona, Halden (SWE), Hartlepool (UK), Pikkala (FIN), Drammen (NOR), Noredenham (GER), or Eemshaven (NL). Repeated cable rewinding is unjustified economically and technologically; hence these operations are kept to a minimum.

2.4.3 Operation phase

In addition to the general range of activities and conditions of the sea basin use during all phases of the Project, the issues of maritime transport, electromagnetic field emissions and cable heat emissions described below are specific to the operation phase.

2.4.3.1 Maritime transport

In contrast to the construction phase, the operation phase will be characterised by less intensive vessel traffic – the largest proportion in the overall maritime traffic will be attributable to small and medium-sized vessels involved in the operation and maintenance of the Baltic East OWF. The number of specialist offshore operations related to the operation phase of the Baltic East OWF will be proportional to the number of facilities installed and constructed in the OWF Area, and to the length of the electricity grid installed.

The following operation variants are possible in terms of maritime transport:

- the use of medium sized vessels – with the involvement of service bases that will perform periodic service duty in the OWF area and make cyclical trips to service ports to replenish the supplies and exchange service personnel or crew;
- the use of small vessels travelling between the service port and the OWF area as well as fast response units in the daily work cycle. The estimated number of cruises will increase the intensity of shipping along navigation routes and in ports;
- the use of larger vessels, equipped with cranes of adequate capacity in case of the need to remove breakdowns or repair components of the Project.

The start-up and operation of the OWF requires regular maintenance services. The following activities are planned during the OWF operation: (i) scheduled maintenance (ii) preventive maintenance and (iii) interventions undertaken as a result of malfunction or breakdown identification. OWF servicing comprises the servicing of the main components: wind turbines, direct foundations, i.e. foundations with support structures, substations, and subsea cables. These activities will be carried out with the use of, among others, specialist vessels, service vessels, working boats, and subsea ROVs. During the OWF operation, the number of cruises of vessels servicing the OWF may reach 700 per year. These vessels will travel between the port in Łeba/Władysławowo (or other) and the Baltic East OWF Area. The possible cruises between the Gulf of Gdańsk and the Baltic East OWF (and vice versa) during the operation phase will be far less numerous, at approximately 100 per year.

The service season is divided into two periods:

- high period from April to October, when an intensive service and maintenance campaign is planned, during which the number of CTVs may be higher (2 vessels) than in the low period;
- low period, when scheduled service and maintenance works are not carried out or are kept to a minimum. During this period, operations focus on ongoing problem solving and breakdown repair. The number of CTVs may be temporarily reduced to approx. one.

The start and end dates of these periods are arbitrary and may change following adaptation of the maintenance programme to current weather forecasts.

Cruise schedule for vessels servicing the wind farm:

- during the high season, there will be approximately two cruises per day;
- during the low season, there will be approximately one cruise per day.

This number is indicative and may be subject to change (adaptation) depending on specific meteorological conditions and the service strategy adopted (CTV/SOV).

2.4.3.2 Electromagnetic field (EMF)

In the case of offshore wind energy projects, the source of the electromagnetic field is the inter-array cable system transmitting electricity from each wind turbine to the offshore substation. The Baltic East OWF Project will use 66kV or 132kV cables.

Electric field emissions will be negligible due to the optimised installation of the cables on the seabed, involving burial or protection from damage on the seabed, if burial proves technically impossible.

2.4.4 Decommissioning phase

In technical terms, the decommissioning phase is a reversal of the OWF construction phase. In the reverse order of the construction phase, individual OWF components will be removed and transported to disposal sites.

The number of specialist offshore operations related to the decommissioning phase of the Baltic East OWF is proportional to the number of facilities installed and constructed in the OWF Area, and to the length of the electricity grid installed. Therefore, the number of operations and their effects (e.g. fuel consumption, emissions related to transport) will be smaller for the APV than in the case of the RAV.

It is assumed that the structures within the Baltic East OWF Area will be decommissioned to the seabed level, i.e. the parts of the foundations driven into the seabed will remain there, as they do not generate any environmental impacts, whereas their removal may cause such impacts, e.g. when using removal methods involving the use of explosives (the parts of the piles protruding above the seabed will be cut off during the decommissioning phase). At the same time, the underwater elements of the Baltic East OWF may constitute a habitat for communities of marine organisms.

In terms of waste generation during the Baltic East OWF decommissioning phase, it will mainly be associated with the physical removal of spent OWF elements and with the standard operation of vessels used in the decommissioning process.

The possibility of repowering, i.e. dismantling the wind turbines and replacing them with next-generation turbines, is not excluded.

2.5 Information on resource use

2.5.1 Demand for resources and materials

Activities aimed at seabed preparation prior to the installation of the Baltic East OWF foundations, and prior to the laying of inter array cables, will involve the movement of seabed sediments, or displacement of rocks. These materials will be managed entirely within the Baltic East OWF Area. Sediment will be displaced only in the immediate vicinity of the works and there are no plans to create a dumping site or waste deposit area.

The maximum volume of displaced sediments may be generated along the sections of the proposed cable route, in the case of cable burial using the jetting method, i.e. employing jet sleds. In sections where cables are laid by ploughing or mechanical trenching, smaller amounts of displaced sediment will occur.

The volume of sediment required to be removed for proper foundation installation for particular types of wind turbine foundations at the Baltic East OWF is as follows:

- Soil replacement for gravel pads – total volume of approx. 240 000 m^3;
- Volume of monopile drill cuttings – total volume of approx. 160 000 m^3.

Consideration should also be given to the need to remove/displace boulders deposited in or on the seabed in both the cable area and the area around the foundations as a separate task at the project implementation stage, prior to construction.

The **seabed area occupied** by gravel backfill in the foundation areas (to provide scour protection) is expected at:

- **Gravel pads/filling** – a surface area of approx. 300 000 m^2 for material with a volume of up to approx. 1.2 million m^3;
- **Scour protection** – a surface area of approx. 120 000 m^2, for material with a volume of up to approx. 240 000 m^3.

In addition, stone embankments are to be constructed to protect the inter array cables in areas where burial will be impossible. The estimated seabed area to be occupied by embankments with a volume of up to approx. 280 000 m^3 will be up to approx. 380 000 m^2.

Information on the deep-seabed structure will not be known until geotechnical surveys, which are planned to be carried out after obtaining the DEC, have been completed. On their basis, a development design with the layout of individual OWF components will be prepared, and the location of sites where hard geological formations may need to be drilled before the ultimate installation of the foundations will be known. With such data in hand, the Project Owner will be able to work out the detailed handling of the seabed material in cooperation with the maritime administration authorities. Should it be necessary to excavate the material to the sea surface, a sediment pollution survey programme will be developed (taking into account the possibility of using the survey data for the preparation of the EIA Report for the Project), which will be submitted to the Regional Director for Environmental Protection in Gdańsk for opinion.

2.5.2 Water demand (welfare needs, technological processes, fire-fighting)

Similarly to other power installations, the water demand in the implementation of the Baltic East OWF is related to the construction phase and to the welfare of the crew on land and at sea. During the construction phase, water can also be used for cleaning the onshore construction site facilities and storage yards.

2.5.3 Fuel demand

The fuel required for the construction and operation of the Baltic East OWF is nearly 100% the fuel used for transportation, transshipment and installation of components of wind turbines and other OWF structures.

Fuel demand estimates for the OWF are determined by the specificity of the project. Specialist vessels adapted for the construction and operation of industrial offshore structures, as opposed to commercial vessels, have a different operating profile. This is related to the need to perform complex marine operations (transshipments, working in dynamic positioning mode), which are not related to the distance travelled, but determined by the number of working hours. At the present stage, suppliers of individual OWF components are not known; therefore, it is impossible to precisely assess the quantity of pollution emissions, as the routes and distances to be covered by involved vessels are unknown. Therefore, the estimation of the planned fuel consumption depends on a very large number of variable factors and is virtually always subject to a significant error (the values given are approximate).

Average fuel consumption values for different types of vessels are presented in Table 9.

Table 9 Average fuel consumption for different types of vessels [Source: internal materials based on Borkowski 2009]

VESSEL SIZE	PURPOSE	AVERAGE FUEL CONSUMPTION (DIESEL) [KG·H^{-1}]	NOMINAL DAILY WORKING TIME [H]
Small vessels	Small supplies, personnel transport, one-day service, emergency operations – for each phase	50–200	8–10
Medium vessels	Supplies, support for construction works, towing operations, multi-day stationary service – for each phase	500–2000	12–18
Large vessels	Supplies, storage, construction work – mainly for the construction and demolition phase	2500–5000	12–24

Range of vessel fuel tank capacities:

- Installation vessels, including jack-up vessels, foundation installation vessels, cable-laying vessels – 5000 m^3;
- CSOV/SOV – 500 m^3;
- specialist vessels – 500 m^3;

- CTVs and other support vessels – 60 m^3 + optionally up to 0.5t H2 (CTVs can also be battery powered, electric motors can be used to support manoeuvring in the harbour). At this stage of the project, it is assumed that CTVs with alternative energy source can be used, so that fuel consumption can be reduced to a minimum.

2.5.4 Energy demand and consumption (electricity, heat)

As of the date of the EIA Report submission, it is impossible to calculate the energy consumption planned for all stages of the Baltic East OWF project. It is only possible to provide an estimation based on CO_{2eq} emission estimates for individual phases of the Baltic East OWF.

The CO_2 emission estimates presented in Section 2.6.2 cover all phases (implementation, operation and decommissioning) of the Baltic East OWF. The values provided originate from literature data. Based on the CO_2 emissions presented by Wagner *et al*. (2011), it can be assumed that the quantities in the individual phases of the Project will be as follows:

- production and implementation phase: from 0.59 to 3.36 million Mg CO_2;
- operation phase: from 0.15 to 0.87 million Mg CO_2;
- decommissioning phase: from 0.01 to 0.05 million Mg CO_2.

Due to the specificity of the above calculation of CO_2 emissions, it can be assumed that there will be no significant differences in CO_2 emissions in the options assessed (APV and RAV).

Thomson and Harrison (2015), citing Dolan and Heat (2012), indicated that the estimated CO_2-equivalent emissions for the offshore wind energy sector are between 7 and 23 g CO_{2eq}/kWh. Based on conversions of the indicated values according to Wagner *et al*. (2011) and given the expected production capacity of the Baltic East OWF, the CO_2-equivalent emissions in the individual phases will be as follows:

- production and implementation phase: from 0.69 to 2.27 million Mg CO_{2eq};
- operation phase: from 0.18 to 0.59 million Mg CO_{2eq};
- decommissioning phase: from 0.01 to 0.03 million Mg CO_{2eq}.

In the second case described, the emission volumes are indicated in CO_{2eq}, i.e. the estimated quantities of all greenhouse gases emitted during the subsequent phases of the proposed project. Moreover, in the above calculations the authors also included the stage of production of individual OWF components, which is not subject to assessment in the EIA Report.

At the moment, it is impossible to refer to the actual data on CO_2 emissions from vessels used for the implementation of OWFs.

Considering that the production of 1 MWh of energy results in the emission of 0.745 Mg of CO_2 [IEP-NRI 2021], the following energy consumption in individual phases of the OWF life can be assumed based on the above calculations of CO_{2eq} emissions:

- production and implementation phase: from 0.85 to 4.85 million MWh;
- operation phase: from 0.21 to 1.26 million MWh;
- decommissioning phase: from 0.01 to 0.08 million MWh.

Due to the specific nature of the project in question, i.e. the generation of electricity from renewable energy sources, its implementation will ultimately have a significant positive impact on the climate by reducing emissions from carbon-intensive electricity generation sources relying on fossil fuels.

2.6 Anticipated types and quantities of emissions, including waste, resulting from the implementation and operation phases of the Project

2.6.1 Noise emissions

Noise will be emitted during each phase of the Baltic East OWF project life. During the implementation phase, both at the stage of preparation and construction, the presence and movement of construction vessels and construction support vessels will be the source of noise. In addition, during the construction phase noise emissions will be associated with piling. During pile driving, a noise reduction system (NRS) appropriate to the technology and geological conditions will be applied (described in Section 2.4.2.2.2.1). These safeguards will be implemented for all wind turbine and offshore substation locations. Appropriate NRS elements will be applied for individual sites of wind turbine and offshore substation foundation installation, for which there is a possibility of exceeding the permissible values.

2.6.2 Emission of air pollutants

The emissions to ambient air in various phases of the Project comprise exhaust emissions from vessels, systems or equipment. As of the date of the submission of the EIA Report, it is impossible to calculate the planned fuel consumption and therefore it is impossible to estimate the emissions of air pollutants during all phases of the Baltic East OWF project.

All vessels involved throughout the Project will comply with the requirements and regulations of the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78), including in particular the procedures contained in the 'Hazard and Pollution Control Plans' prepared in accordance with the Regulation of the Minister of Infrastructure of 15 December 2021 on the rescue plan and the hazard and pollution control plan for offshore wind farms and complex of facilities (Journal of Laws of 2021, item 2391).

2.6.3 Electromagnetic radiation emissions

In the case of offshore wind energy projects, the source of the electromagnetic field is the inter array cable system transmitting electricity from each wind turbine to the offshore substation. The Baltic East OWF project will use 66 kV or 132 kV cables and their total horizontal length will not exceed 150 km.

Electric field emissions will be negligible due to the optimised installation of the cables on the seabed, involving burial or protection from damage on the seabed, if burial proves technically impossible. The possible magnetic component of the EMF of the cables is minimised by the installation of individual wires in the greatest proximity to each other (for individual phases for alternating current).

2.6.4 Heat emissions

Heat emission will occur during the Baltic East OWF operation phase, when the cable temperature exceeds the temperature of the surrounding environment. Accurate quantification of the heat emitted is difficult because of the following phenomena of heat conduction, convection and radiation, which are subject to different laws of physics [Stiller *et al*. 2006]. The heating of sediments may lead to a change in the taxonomic composition of the benthos living on and in the seabed in the immediate vicinity of the cables [Merck 2009]. The OSPAR Guidelines on Best Environmental Practice (BEP) in Cable Laying and Operation (2012) indicate that cable burial at a depth of 1 to 3 m below the seabed surface is sufficient to ensure that the rise in sediment surface temperature 0.2 m below the seabed surface, as a result of heat emission from power cables under load, does not exceed 2°C.

Inter array cables laid at depths up to 3 m within the Baltic East OWF remain in line with the above conditions.

2.6.5 Light emissions

Light emissions are associated with vessels used for wind farm construction and from the illumination of drilling rigs and other structures illuminated by artificial light, mainly during night-time. The impact scale will depend on the number of vessels involved in the implementation phase, their size, the configuration of lights and their intensity, the implementation phase duration as well as the phenological period in which the work is carried out.

In the Baltic East OWF operation phase, light emissions will originate from the wind turbine obstruction lighting (red lights). Also in this phase, an additional aspect of light emission is the flicker effect.

During the Baltic East OWF lifetime, light emissions will be limited to the necessary level resulting from applicable regulations and operational safety standards.

2.6.6 Sewage emissions – type, quantity and management

Sewage emissions during the Project are related to the implementation phase (process sewage, wastewater from ships and vessels) and to water consumption for crew welfare on land and at sea.

OWF sewage generation and emissions take place both on land and at sea. In the implementation phase (in the port supporting the Project execution), sewage may be generated during the cleaning of machinery and onshore construction site facilities and storage yards.

The estimated volume of sewage during the implementation phase will be approx. 11 000 m^3.

In the operation phase, waste and sewage will be generated by people on board the vessels and during the servicing of turbine towers, substations and inter array cables. The estimated volume of sewage during the operation phase will be approx. 385 m^3/year.

During the decommissioning phase, sewage emissions are estimated to be comparable to the implementation phase.

In each phase of the Baltic East OWF implementation, mandatory legal requirements and good practices will be applied regarding waste and sewage treatment.

2.6.7 Waste – types, quantity and management

The types and quantities of waste expected to be generated during the subsequent phases of the Baltic East OWF project, classified in accordance with the Regulation of the Minister of the Climate of 2 January 2020 on Waste Catalogue (Journal of Laws of 2020, item 10) are presented in Table 10. The waste quantities are presented per unit, i.e. they refer to a single wind turbine or one offshore substation or 1 km of cable.

At this stage of the Project development, it is impossible to determine precisely the types or the quantities of waste to be generated; therefore, the table below includes all theoretically possible types of waste and the estimates of their maximum expected annual quantities based on the information regarding the technology assumed to be used.

While preparing the values summarised in the table below, it was assumed that the higher value, resulting from the comparison of the two variants, was adopted. Therefore, when comparing the Project alternatives considered, it was assumed that the quantities of waste and sewage will be greater for the RAV than for the APV.

Table 10 Summary of estimated quantities of waste generated during the construction, operation and decommissioning phases of the Baltic East OWF per year [Source: internal materials]

WASTE CODE (*HAZARDOUS WASTE)	WASTE TYPE	ESTIMATED QUANTITY [MG/YEAR]		
		Construction phase	Operation phase	Decommissioning phase
08 01 11*	Waste paint and varnish containing organic solvents or other hazardous substances	0.05	0.50	N/A
08 01 12	Waste paint and varnish other than those mentioned in 08 01 11	0.05	0.50	N/A
12 01 13	Welding waste	0.10	0.10	N/A
13 01 09*	Mineral-based chlorinated hydraulic oils	0.05	0.03	0.05
13 01 10*	Mineral based non-chlorinated hydraulic oils	0.05	0.03	0.05
13 01 11*	Synthetic hydraulic oils	0.05	0.03	0.05
13 01 12*	Readily biodegradable hydraulic oils	N/A	0.03	0.05
13 01 13*	Other hydraulic oils	N/A	0.03	0.05
13 02 04*	Mineral-based chlorinated engine, gear and lubricating oils	0.05	0.03	N/A
13 02 05*	Mineral-based non-chlorinated engine, gear and lubricating oils	0.05	0.03	0.01
13 02 06*	Synthetic engine, gear and lubricating oils	0.05	0.03	0.01
13 02 07*	Readily biodegradable engine, gear and lubricating oils	0.05	0.03	0.01
13 02 08*	Other engine, gear and lubricating oils	0.05	0.03	0.01
13 03 01*	Insulating or heat transmission oils containing PCBs	0.20	1.00	82.5
13 04 03*	Bilge oils from other navigation	0.10	0.10	0.1
13 05 02*	Sludges from oil/water separators	0.50	0.50	N/A
13 05 06*	Oil from oil/water separators	0.50	0.50	N/A
13 05 07*	Oily water from oil/water separators	0.50	0.50	N/A
13 07 01*	Fuel oil and diesel	0.05	0.10	0.05
13 07 02*	Petrol	0.05	0.05	0.05
13 08 80	Oily solid waste from ships	0.10	0.10	0.1
14 06 01*	Chlorofluorocarbons, HCFC, HFC	0.05	0.05	0.1
14 06 02*	Other halogenated solvents and solvent mixtures	0.05	0.05	0.1
14 06 03*	Other solvents and solvent mixtures	0.05	0.05	0.1
15 01 01	Paper and cardboard packaging	2.00	0.10	0.1
15 01 02	Plastic packaging	2.00	0.10	0.1
15 01 03	Wooden packaging	2.00	0.10	0.1
15 01 04	Metallic packaging	2.00	0.10	0.1
15 01 05	Composite packaging	2.00	0.10	0.1
15 01 06	Mixed packaging	2.00	0.10	0.1
15 01 07	Glass packaging	0.10	0.10	0.1
15 01 09	Textile packaging	0.10	0.10	0.1
15 02 02*	Absorbents, filter materials (including oil filters not otherwise specified), wiping cloths (e.g. rags, wipes), protective clothing contaminated by hazardous substances (e.g. PCBs)	1.00	0.30	1

WASTE CODE (*HAZARDOUS WASTE)	WASTE TYPE	ESTIMATED QUANTITY [MG/YEAR]		
		Construction phase	Operation phase	Decommissioning phase
15 02 03*	Absorbents, filter materials, wiping cloths (e.g. rags, wipes) and protective clothing other than those mentioned in 15 02 02	1.00	0.30	1
16 06 01*	Lead batteries	0.10	0.10	0.1
16 06 02*	Ni-Cd batteries	0.10	0.10	0.1
16 06 03*	Mercury-containing batteries	0.01	0.01	0.01
16 06 04	Alkaline batteries (except 16 06 03)	0.01	0.01	0.01
16 06 05	Other batteries and accumulators	0.01	0.01	0.01
16 81 01*	Wastes exhibiting hazardous properties	1.00	0.30	1
16 81 02	Wastes other than those mentioned in 16 81 01	1.00	0.30	1
17 01 01	Waste concrete and concrete rubble from demolitions and renovations	50.00	5.00	7000
17 01 03	Tiles and ceramics	10.00	1.00	50
17 01 07	Mixed waste from concrete, brick rubble, ceramic materials and elements of equipment other than those listed in 17 01 06	N/A	N/A	50
17 01 82	Waste not otherwise specified	50.00	5.00	50
17 02 01	Wood	2.00	0.20	0.1
17 02 02	Glass	0.10	0.10	2
17 02 03	Plastic	5.00	0.50	1000
17 04 01	Copper, bronze, brass	0.05	0.05	1
17 04 02	Aluminium	0.05	0.05	1
17 04 04	Zinc	0.05	0.05	1
17 04 05	Iron and steel	1.00	1.00	4000
17 04 07	Mixed metals	0.05	0.05	1
17 04 11	Cables other than those mentioned in 17 04 10	5.00	5.00	71
17 09 03*	Other construction and demolition wastes (including mixed wastes) containing hazardous substances	20.00	2.00	50
17 09 04	Mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03	20.00	2.00	50
19 08 05	Sludges from treatment of urban waste water	1.00	3.00	1
20 01 01	Paper and cardboard	1.00	2.00	1
20 01 02	Glass	1.00	2.00	1
20 01 08	Biodegradable kitchen and canteen waste	1.00	2.00	1
20 01 10	Clothes	1.00	2.00	1
20 01 21*	Fluorescent tubes and other mercury-containing waste	0.05	0.10	0.05
20 01 23*	Discarded equipment containing chlorofluorocarbons	0.05	0.10	0.05
20 01 29*	Detergents containing hazardous substances	0.05	0.10	0.05
20 01 30	Detergents other than those mentioned in 20 01 29	0.05	0.10	0.05
20 01 33*	Batteries and accumulators included in 16 06 01, 16 06 02 or 16 06 03 and unsorted batteries and accumulators containing these batteries	0.05	0.10	0.05

WASTE CODE (*HAZARDOUS WASTE)	WASTE TYPE	ESTIMATED QUANTITY [MG/YEAR]		
		Construction phase	Operation phase	Decommissioning phase
20 01 34	Batteries and accumulators other than those mentioned in 20 01 33	0.05	0.10	0.05
20 01 35*	Discarded electrical and electronic equipment other than those mentioned in 20 01 21 and 20 01 23 containing hazardous components (1)	0.05	0.10	0.05
20 01 36	Discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35	0.05	0.10	0.05
20 03 01	Mixed municipal waste	20.00	30.00	20

Implementation phase

In this phase, waste is expected to be generated due to the normal operation of the different vessels involved in the construction of the Project and during the joining of structural elements (e.g. by welding or grouting), in the piling process, i.e. pile driving or drilling (e.g. drilling mud), as well as during the installation of anti-corrosion protection systems and possible abrasion of protective coatings (e.g. during piling).

The anodic-cathodic method will be used for corrosion protection of the OWF structural elements, in accordance with applicable standards.

Operation phase

The main factors causing the generation of waste and wastewater during the Baltic East OWF operation phase will be repairs and vessel operations.

Decommissioning phase

In technical terms, the decommissioning phase is a reversal of the OWF construction phase. In the reverse order of the construction phase, individual OWF components will be removed and transported to disposal sites.

At all Project stages, ballast water will be handled in accordance with the International Convention for the Control and Management of Ships' Ballast Water and Sediments, adopted on 13 February 2004.

2.7 Risk of major accidents or natural and construction disasters

2.7.1 Types of accidents resulting in environmental contamination

The project related to the implementation, operation and decommissioning of the Baltic East OWF is an undertaking involving several decades of complex activities carried out on land and at sea.

The implementation and operation of the Project being the subject of this EIA Report will not involve the presence of hazardous substances in quantities determining the classification of the Baltic East OWF as a plant with an increased or high risk of a serious industrial accident pursuant to the Regulation of the Minister of Development of 29 January 2016 on the types and quantities of hazardous substances present in the industrial plants, which determine the plant classification as a plant with an increased or high risk of a serious industrial accident (Journal of Laws of 2016, item 138).

The production of all elements for the Baltic East OWF construction and operation will take place on land. Preparatory operations, construction, installation, service, repair and subsequent dismantling work will be carried out at sea. All these activities depend on vessels intended for transportation, service and construction.

Ports and ships are of key importance during the implementation of the Project. Large-scale components of wind turbines, large-diameter piles or jacket structures and towers as well as power substations are manufactured in ports or in their immediate vicinity. The technologies and production processes related to their production do not pose a risk of major emergencies. Possible emergencies will not cause significant emissions of pollutants threatening the environment. Also during the decommissioning or disposal of waste materials from dismantled elements of wind turbines, which take place in port or industrial areas, no events causing environmental hazard are expected.

The main threats that may occur during the Baltic East OWF implementation, operation and decommissioning are the spills of petroleum products, mainly diesel, hydraulic, transformer and lubricating oils. To a lesser extent, the marine environment may incidentally be endangered with materials containing hazardous substances, if they are used. During the operation phase, the main cause of marine pollution can be oil spills. Both within the open sea waters (e.g. the OWF) and near the coast, they can constitute a problem with long-lasting effects on fauna, flora, fisheries and beaches affected by the contamination. In order to counteract this threat, OWF installations will be equipped with protective measures against spillage of hazardous substances, as described in Subsections 2.7.5 and 2.7.6.

The extent of oil pollution can be classified as follows:

- **Tier 1 (small spill, up to 20 m^3)** – small spills of petroleum products that do not require the intervention of external forces and resources and are possible to be removed with own resources. These spills are of local character, their removal does not pose particular technical difficulties and they do not pose a significant threat to the marine environment;

- **Tier 2 (medium-sized spill, up to 50 m^3)** – spills of petroleum products, the scale of which requires a coordinated counteraction within the maritime area under the authority of the director of a maritime office who decides on the scale of the counteraction required;
- **Tier 3 (catastrophic spill, above 50 m^3)** – spills of petroleum products that are extremely dangerous to the environment, the neutralisation of which involves forces and resources subordinate to more than one director of the maritime office.

2.7.2 Accident description with an assessment of potential impacts

2.7.2.1 Spills of petroleum products (during normal operation of vessels)

Various petroleum products (lubricating and diesel oils, petrol) may spill during normal vessel operation. It should be assumed that these will be small (Tier 1) spills.

The areas particularly vulnerable to potential pollution are the conservation areas including those belonging to the Natura 2000 network of nature protection areas [Reszko 2020]. Therefore, from an environmental point of view, the most sensitive area in the case of possible spills will be Natura 2000 site *Przybrzeżne wody Bałtyku*. Considering the prevailing westerly wind direction and the occurrence of coastal currents, the coastal strip with tourist resorts (Jarosławiec, Rowy) and the harbours in Ustka and Łeba to the west, as well as the town and harbour in Władysławowo, is at risk.

It should be emphasised that the key issue is not so much the size of the spill as the place where it has occurred. There are known cases of high bird mortality due to small oil spills into the sea. Extensive oil slicks drifting away from the coasts, in sea areas with very low numbers of birds, do not cause as high population losses as smaller spills in areas of high seabird concentrations [Meissner 2005]. In the proposed Baltic East OWF area, bird densities were much lower than in the other areas of great significance for seabirds. It should be underlined, however, that in the case of Tier 1 spills and with the proper management of ship traffic, the situation in which an uncontrolled dispersal of petroleum products reaches important natural areas is unlikely.

The determination of the actual extent of a spill will be technically possible only during the event, on the basis of the current meteorological data and the data on the type and potential quantity of the contaminant. Therefore, at the EIA Report stage, it is impossible to make a more detailed assessment of the impact on marine organisms that are the most exposed to the effects of oil spills.

The number of potential spills is proportional to the number of vessels used to carry out the Project implementation, operation or decommissioning

Spills of petroleum products (during an emergency situation)

During the implementation, operation and decommissioning of the Baltic East OWF, spills of petroleum products may occur, the consequence of which will be water and sediment contamination. A spill may occur as a result of a breakdown or collision of vessels, their collision with OWF structures, their sinking or grounding, as well as during seepage and operational leaks from vessels, leakage from oil systems of a wind turbine, leakage from transformers at substations or oil spills related to inspections and repairs of the OWF elements. In the worst case scenario, during the implementation or decommissioning stage, Tier 2 spills (spills of medium size) will occur. It has been calculated that the probability of serious accidents is very small, ranging from 10^{-5} (practically impossible – 1 in 100 000 years) to 10^{-2} (rare – 1 in 100 years) [Reszko 2020a].

Assuming the worst case scenario and the release of 200 m^3 of diesel fuel into the marine environment, as well as taking into account its type, the behaviour in seawater as well as the time of oil dispersion and drift, it is estimated that the range of pollution will not exceed 5 to 20 km from the Baltic East OWF [Reszko 2020b].

Pursuant to the Act of 18 August 2011 on maritime safety, detailed principles of counteracting and combating hazards and pollution shall be agreed with the maritime administration prior to submitting the application for the Baltic East OWF building permit.

The release of chemical substances and waste

During the implementation of a wind farm, waste directly related to the construction process will be generated on vessels, at onshore site facilities (located in the port handling the implementation of the Project) and at the Project site. These can include, among others, damaged parts of the OWF elements, cement, grout, mortar, adhesives used to connect elements of the wind turbines and other chemical substances used during the construction. They can be accidentally released into the sea.

Loose cement is packed in bags of about 1 m^3. It has been assumed that during transshipment about 5 m^3 of the product can sink. Grouts, mortars and other binders often contain hazardous substances. For example, (two-component) epoxy binders contain various proportions of: epoxy resin, alkyl-glycidyl ethers and polyaminoamides. Due to their high density (approximately 1.3 $g \cdot cm^{-1}$), after release into water, these substances sink and deposit on the seabed. They are considered a serious threat because they cannot be easily removed from the seabed and are toxic to marine organisms.

The possibility of releasing waste or chemicals into the water is proportional to the activity associated with the use of chemicals.

2.7.3 Other types of releases

2.7.3.1 The release of municipal waste or domestic sewage

During the implementation of a wind farm, aboard vessels and within onshore site facilities (in the port supporting the implementation of the Project) waste will be generated, mostly municipal and other waste, not directly related to the construction process, as well as domestic sewage. Waste and wastewater may be accidentally released into the sea while being transferred from a ship by another vessel and in the case of a breakdown, causing a local increase in nutrient concentrations as well as deterioration of water and sediment quality.

It is estimated that the possible occurrence of the above releases will not affect the structure and functioning of marine organisms in the vicinity, nor will it cause their mortality.

2.7.3.2 Contamination of the water depth and seabed sediments with antifouling agents.

In order to protect ship hulls against fouling, biocides are used, the composition of which may include for example: copper, mercury and organotin compounds (e.g. TBT). These substances can transfer into water and eventually be retained in the sediments. It should be assumed that emissions of these compounds will be insignificant. Among the substances listed, organotin compounds are the most harmful (toxic) to aquatic organisms.

Currently, the use of tributyltin (TBT) (the most harmful substance) in antifouling paints is prohibited. However, the presence of these compounds cannot be excluded in the protective coatings of older vessels. This impact can be mitigated by introducing the control of the type of protective coatings on vessels employed in operations within the Baltic East OWF Area.

It is estimated that the possible occurrence of the above-mentioned events will not affect the structure and functioning of marine organisms in the Project area, nor will it increase their mortality.

2.7.3.3 Release of contaminants from anthropogenic objects on the seabed

It is impossible to exclude completely the possibility of the release of contaminants from man-made objects lying on the seabed. During geophysical surveys conducted between March 2022 and May 2024, the Baltic East OWF Area was systematically checked for the presence of objects of anthropogenic origin, including packaging and containers which can contain hazardous chemicals. Such objects may originate, for example, from insufficiently secured and hence lost cargoes of vessels passing through the Baltic East OWF Area. Based on the analysis of sonar and bathymetric data, 68 objects identified on the seabed were selected for visual inspection. Nine objects were not found during the inspection [Figure 12].

The objects identified were assigned to the following groups:

- pUXO (potential unexploded ordnance) (2);
- wrecks (3);
- linear objects (18);
- other objects of anthropogenic origin (17);
- geological objects (17);

- other types of objects (11), including (9) objects not found during the ROV inspection.

A map of the distribution of objects on the seabed is provided below.

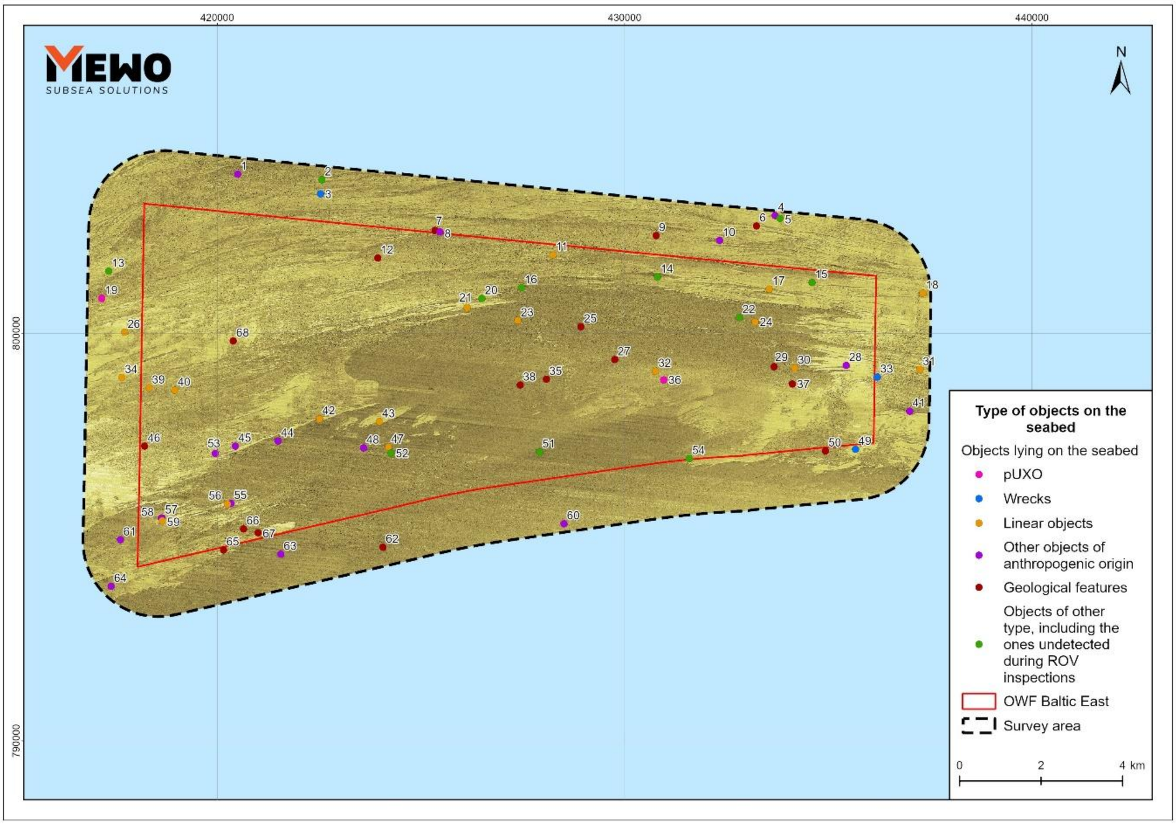

Figure 12 Map of the distribution of objects on the seabed in the Baltic East OWF Area

Of all the objects on the seabed, six were singled out as being of particular importance in terms of the Project implementation (likely to be an obstruction during the course of the works, requiring bypassing or possibly removal) [Table 11]. A detailed summary of the objects identified is provided in **Appendix 1** of the EIA Report.

Table 11 List of objects identified on the seabed, considered important in the process of the Project implementation

ID	EASTING	NORTHING	OBJECT TYPE	DESCRIPTION
3	422535.40	803414.79	Wreck	Wreck of an 18th century sailing ship
19	417167.83	800856.14	pUXO	Torpedo
33	436203.59	798921.97	Wreck	Remains of a wooden wreck
49	435669.80	797155.44	Wreck	Remains of a shipwreck
36	430957.80	798856.00	pUXO	Elongated object with entangled ropes
63	428513.77	795327.74	Objects of anthropogenic origin	Remains of a wooden structure

It cannot be ruled out that during the preparatory work for the construction process, including in particular the survey of seabed cleanliness in terms of the occurrence of unexploded ordnance and chemical weapons, new anthropogenic objects (for example small barrels or unexploded ordnance) may be discovered. In order to determine the way of dealing with such finds, the Applicant shall prepare a plan for handling dangerous objects, both from the point of view of operational work at sea (for example, rules for conducting works in the vicinity of potentially hazardous objects) and from the point of view of possible removal or avoidance of such objects. The basic assumption of the plan for dealing with dangerous objects is to avoid threats to human life and health and to avoid the spread of contaminants from such objects.

2.7.4 Environmental threats

2.7.4.1 Implementation phase

Based on the data obtained from other OWF projects and similar offshore undertakings as well as on the authors' knowledge and experience, the following potential environmental threats, which may become a source of negative impact of OWFs on the environment, have been identified for the implementation phase:

- spill of petroleum products as a result of collision of ships, construction accident or catastrophe (during normal operation or an emergency situation);
- accidental release of waste or sewage;
- accidental release of building materials, equipment, OWF components or chemical agents;
- contamination of water and seabed sediments with antifouling agents;
- noise reduction system failure.

As a direct result of emergency situations and incidents, the abiotic environment, particularly seawater and to a lesser extent seabed sediments, may become contaminated. Indirectly, these events can also affect living organisms inhabiting or otherwise using the seabed, water column and the surface of the sea. The contamination of water or seabed sediments with waste or sewage is a direct negative impact, temporary or short-term, reversible and of local range. The scale of the impact is negligible.

Ship collisions and the resulting release of hazardous substances (especially petroleum products) into the environment is a factor that can cause increased mortality and diseases of marine organisms. The likelihood of such events can be considered small. Additionally, the implementation of a proper response plan in case of collisions and spills aims to limit the impact of such events on the seawater, seabed sediments and marine organisms.

The main threat to the environment, including Natura 2000 sites, during the implementation phase is the release of hazardous substances (especially petroleum products) into the environment as a result of ship collisions. This factor may cause increased mortality and diseases of marine organisms, including those which are the subject of conservation in protected areas. The likelihood of such events can be considered small. The implementation of a collision and leakage management plan for the duration of the Project is aimed at minimising the impact of such events on marine organisms, in accordance with the applicable laws. It can be assumed that this factor will not significantly affect the seawater, seabed sediments and protected areas.

Failure of the equipment used in the noise reduction system could reduce its effectiveness or disable it, which could result in noise emissions from piling at critical levels [Appendix 3 to the EIA Report]. This factor may cause mortality, injury and behavioural changes to marine organisms (primarily fish and marine mammals), including those which are the subject of conservation in protected areas. The likelihood of such events can be considered small. The implementation of safe operating procedures throughout the duration of the Project is intended to immediately suspend work until a given failure is rectified and the NRS is restored.

2.7.4.2 Operation phase

During the operation of the Baltic East OWF, threats to the environment may occur – particularly the contamination of the water and seabed sediments by:

- petroleum products;
- antifouling agents;
- accidentally released waste and sewage;
- accidentally released chemical agents and waste from the OWF operation.

Waste and sewage can be generated by people on the vessels as well as during the operation, during the servicing of turbine towers, offshore substations, transmission cables, and other structural components.

Ship collisions and the resulting release of hazardous substances (especially petroleum products) into the environment is a factor that can cause increased mortality and diseases of marine organisms. The likelihood of such events can be considered small. The implementation of a proper response plan in case of collisions and spills aims to limit the impact of such events on the water, seabed sediments and marine organisms.

The impacts caused by the occurrence of emergency situations during the operation phase are identical as those that may occur during the Baltic East OWF implementation phase. Only the aspect regarding the accidental release of chemicals and waste is slightly different. During the Baltic East OWF operation, the maintenance of its facilities will be carried out. The possibility of small quantities of waste or operating fluids being accidentally released into the sea cannot be excluded. It is estimated that the possible occurrence of the above unexpected random incidents will not affect the structure and functioning of marine organisms in the Project area, nor will it cause their mortality.

During the Baltic East OWF operation, harmful chemical substances may leak into the environment as a result of collisions and breakdowns of vessels involved in the Project service, i.e. mainly fuels, motor oils or hydraulic fluids. Their impact on marine organisms can be an important pathogenic factor and may result in increased mortality. However, the likelihood of such events can be considered small. The implementation of a proper response plan in case of collisions and spills aims to limit the impact of such events. The threat from this event can be considered negligible.

The main threat to the Natura 2000 sites during the operation phase is the release of hazardous substances (especially petroleum products) into the environment as a result of vessel collisions. This factor may cause increased mortality and diseases of marine organisms, including those which are the subject of protection. The likelihood of such events can be considered small. The implementation of a proper response plan in case of collisions and spills aims to limit the impact of such events on marine organisms. It can be assumed that this factor will not affect the protected areas significantly.

2.7.4.3 Decommissioning phase

During the decommissioning of the Baltic East OWF, there may be impacts resulting from the occurrence of emergency situations and other environmental hazards, in particular the contamination of the water and seabed sediments with:

- accidentally released dismantled elements of turbine towers, substations and cables,
- accidentally released waste and sewage;
- petroleum products;
- antifouling agents.

The risk of sewage release from the ship into the water exists at the time of the collection of sewage from a ship by another vessel and in the event of a breakdown. It may cause local increase of nutrient concentration and the deterioration of the water quality. The pollutants are expected to disperse quickly, and thus will not contribute to a permanent environmental deterioration in the Project area.

The impacts related to environmental threats in the decommissioning phase are identical to the above-described impacts occurring in the Baltic East OWF implementation phase.

During the Baltic East OWF decommissioning, harmful chemical substances – mainly fuels, motor oils or hydraulic fluids – may leak into the environment as a result of collisions and breakdowns of vessels involved in service operations. Their impact on marine organisms can be an important pathogenic factor and may result in increased mortality. However, the likelihood of such events can be considered small. The implementation of a proper response plan in case of collisions and spills aims to limit the impact of such events. The threat from this event can be considered negligible.

2.7.5 Breakdown prevention

The prevention of breakdowns constitutes a comprehensive range of activities related to the protection of human life and health, the natural environment and property, as well as the reputation of all participants in the processes related to the OWF implementation, operation and decommissioning. These activities include, among others:

- developing plans for the safe implementation, operation and decommissioning of the OWF in accordance with the applicable legal regulations;
- developing rescue plans and training plans for crews and personnel, including the principles of updating and verification by conducting regular exercises, in particular determining the procedures for the use of own vessels and external vessels, including helicopters;
- developing a plan for counteracting hazards and pollution arising during the construction, operation and decommissioning of the OWF;
- selecting suppliers as well as certified parts and components of the OWF;
- designating protection zones;
- accurate marking of the OWF area, its facilities and vessels moving within the area;
- planning offshore operations;
- applying the standards and guidelines of the International Maritime Organization (IMO), recognised classification societies and maritime administration recommendations;
- developing plans of safe navigation within the OWF area and safe passages to ports;
- providing adequate navigational support in the form of maps and navigational warnings;
- providing direct or indirect navigational supervision using a surveillance vessel or remote radar surveillance and Automatic Identification System (AIS);
- continuous monitoring of vessel traffic within the OWF, direct or remote throughout the entire period of the OWF implementation, operation and decommissioning;
- establishing a coordination centre supervising the implementation, operation and decommissioning of the OWF;
- maintaining regular communication lines between the OWF coordination centre and the coordinator of works at sea and other coordination centres (Maritime Rescue Coordination Centre in Gdynia and maritime administration).

2.7.6 Design, technological and organisational security expected to be applied by the Applicant

Design, technological and organisational security mainly relies on carrying out navigational risk assessments and developing prevention plans against:

- threats to human life – evacuation plans, rescue plans;

- fire hazards;
- threats of environmental pollution – a plan to counteract the threats and contamination by oil. The principle of the obligation to have a relevant plan in place will apply not only to the facility, but also to all large and medium-sized vessels involved in the construction, operation and decommissioning of the OWF;
- risk of structural collapse – all structures are designed in a manner accounting for possible extreme conditions for at least double the operation period.

Pursuant to the Act of 18 August 2011 on maritime safety (consolidated text: Journal of Laws of 2024, item 1068), prior to submitting the application for the offshore wind farm building permit, the Applicant is required to prepare:

- navigational expert report containing the assessment of the impact of the offshore wind farm and the complex of facilities on the safety and efficiency of ship navigation in Polish sea areas, approved by the director of the maritime office competent for the location of the offshore wind farm;
- technical expert report containing the assessment of the impact of the offshore wind farm and the complex of facilities on the Polish sea areas A1 and A2 of the Global Maritime Distress and Safety Communications System (GMDSS) and the Operational Communications System of the Maritime Search and Rescue Service, approved by the director of the maritime office competent for the location of the offshore wind farm;
- technical expert report containing the assessment of the impact of the offshore wind farm and the complex of facilities on the National Maritime Security System, approved by the director of the maritime office competent for the location of the offshore wind farm;
- emergency plan specifying the types of threats to the health and life of the personnel involved in the construction, operation and decommissioning of the offshore wind farm and the complex of facilities, as well as methods and operational procedures in the event of these threats, and the forces and resources provided by the manufacturer to implement this emergency plan, approved by the director of the maritime office competent for the location of the offshore wind farm;
- hazard and pollution control plan for the offshore wind farm and the complex of facilities, approved by the director of the maritime office competent for the location of the offshore wind farm;
- technical expert report containing the assessment of the impact of the offshore wind farm and the complex of power export facilities on the national defence systems, including the system of radiolocation imaging, technical monitoring, maritime radio communication, and

the system of control of air traffic services of the Armed Forces of the Republic of Poland, approved by the Minister of National Defence and the minister in charge of internal affairs, respectively,

- technical expert report containing the assessment of the impact of the offshore wind farm and the complex of power export facilities on radiolocation imaging systems, technical monitoring and maritime radio communication of the Border Guard, approved by the Minister of National Defence and the minister in charge of internal affairs, respectively.

2.7.7 Potential causes of breakdowns including extreme situations and the risk of natural and construction disasters

Given their intended purpose, OWF structures are designed and erected with a view to withstanding extremely difficult atmospheric conditions. All components, despite being subject to extremely high stresses, are suited to many years of operation. All equipment is continuously monitored and any sign of deviation from the situation classified as safe operation triggers automatic remote maintenance interventions or changes in operating parameters, also including shutdown. The rotor is stopped automatically at wind speed exceeding the safe operation threshold for the wind turbine. The service plan is intended to ensure flawless operation.

The greatest potential risks occur during the implementation phase; however, the risk of disaster is minimal due to the fact that the planning of offshore operations always takes into account weather conditions and the possibility of their change. Every offshore operation has its limitations in terms of visibility, wind speed, sea status (height of waves) or ambient temperatures. The occurrence of negative effects of climate change in the form of too strong wind or too high waves can only result in the extension of the implementation cycle and an increased demand for energy – fuel consumption.

2.7.8 Risk of major accidents and natural or construction disasters, taking into account the substances and technologies applied, including the risk related to climate change

The risk of a major accident resulting in the emission of hazardous substances is minimal [Reszko 2020b]. The probability of such events as ship collisions belongs to the category of very rare events (1 per 100 years) [Reszko 2020a], while events such as vessel contact with the OWF construction remains in the category of very rare events (1 per 200 years). Taking into account the effects in the form of 200 m^3 of diesel oil emission, the risk level is within an acceptable range. Emission of 200 m^3 of diesel oil will cause insignificant damage to the environment because it will disperse within 12 hours [Reszko 2020b].

2.8 Relations between the parameters of the Project and its impacts

A matrix of relations between the proposed Baltic East OWF Project parameters and impacts in the implementation, operation and decommissioning phases is provided in Table 12.

Table 12 Matrix of relations between the Project parameters and impacts [Source: internal materials]

PROJECT PARAMETER	IMPACT (TYPE OF EMISSION OR DISTURBANCE/CHANGE)																			
	UNDERWATER STRUCTURES	ABOVE-WATER STRUCTURES	UNDERWATER NOISE	ABOVE-WATER NOISE	BARRIER EFFECT	CULTURAL HERITAGE	LANDSCAPE	PEOPLE	DISPLACEMENT OF WILDLIFE	SEABED DISTURBANCES	SUSPENDED SOLIDS AND	EMF	HEAT	LIGHT	WASTE	WATER POLLUTION	AIR POLLUTION	INCREASE IN VESSEL TRAFFIC	HAZARDS / BREAKDOWNS	ARTIFICIAL REEF EFFECT
Width of scour protection	X					X			X	X	X				X	X		X		X
Diameter of large-diameter pile	X		X			X			X	X					X			X		X
Piling parameters	X		X	X				X	X						X	X	X	X	X	
Total wind turbine height		X		X	X		X	X	X					X			X	X	X	
Rotor diameter [m]		X		X	X		X		X					X	X	X	X	X	X	
Length and type of cables	X								X	X		X	X		X	X		X	X	
Depth and method of cable laying/burial	X					X			X	X	X	X	X		X	X		X	X	X
Number and size of substations	X	X		X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
Organisation of technological processes (number of vessels, time)		X		X	X		X	X	X	X	X			X	X	X	X	X	X	

3 ENVIRONMENTAL CONDITIONS

The environmental conditions in the Baltic East OWF area are characterized on the basis of performed surveys, results of other surveys, including the State Environmental Monitoring and analysis of the literature.

Table [Table 13] presents the characteristics of marine environment surveys which were carried out for the purpose of preparing the EIA Report in the Baltic East OWF area. Detailed survey methods for individual elements are presented in the Survey Report attached as Appendix No. 1 to this Report.

Table 13 Characteristics of surveys of abiotic and biotic elements of the marine environment [Source: data of Orlen Neptun VIII Sp. z o.o.]

TYPE OF SURVEYS	DATE OF SURVEYS	SCOPE OF SURVEYS	DETAILED DESCRIPTION
Abiotic elements			
Geophysical surveys	03.2022–04.2022; 05.2024	Measurements (in profiles every 90 m): • Bathymetric surveys (Multi-Beam Echosounder); • Sonar surveys (Sidescan Sonar); • Seismoacoustic surveys (Subbottom Profiler). Visual inspection carried out by means of a ROV. Analysis of material collected during bathymetric and sonar measurements and visual inspections of selected facilities. Taking 199 samples of surface sediments using the Van Veen sampler. Taking 51 core samples using a vibration probe.	Appendix No. 1. Part: GEOPHYSICAL INTERPRETATION REPORT
Archaeological surveys	03.2024	Visual inspection performed by means of a ROV for facilities/anomalies selected on the basis of geophysical surveys Querying information, expert analysis and report preparation.	Appendix No. 6. Part: ARCHAEOLOGICAL ANALYSIS OF GEOPHYSICAL ANOMALIES AND UNDERWATER RECORDINGS
Meteorological surveys	06.2022–03.2024	Measurements using a measuring buoy to measure meteorological conditions. Registration of: • Wind speed and direction; • Atmospheric pressure; • Air temperature and humidity.	Appendix No. 1. Part: HYDRODYNAMIC, HYDROPHYSICAL AND METEOROLOGICAL CONDITIONS
Hydrological surveys	06.2022–03.2024	Measurements using two sets for measurements of hydrological parameters (one under the meteorological buoy and one in the shallowest place of the Baltic East OWF area). Registration of: • Wave height, period and direction; • speed and direction of sea currents (in the surface, central and demersal layers);	(merged with the cell above)

TYPE OF SURVEYS	DATE OF SURVEYS	SCOPE OF SURVEYS	DETAILED DESCRIPTION
		• water temperature, turbidity and conductivity (at a depth of: 1, 4, 8, 16 m and above the seabed). Measurement of water temperature and conductivity (during water sampling) using CTD probes. Physical and chemical analyses of indicators in accordance with reference methods (or equivalent) specified in Appendix No. 7 to the Regulation of the Minister of Maritime Economy and Inland Navigation of July 13, 2021 *on forms and method of monitoring of surface water bodies and underground water bodies* (Journal of Laws of 2021, item 1576).	
Geochemical surveys	08.2022-01.2023	Taking 199 samples of surface sediments (in the summer campaign) and 202 samples of surface sediments (in the winter campaign). Laboratory analyses based on PN-EN-ISO standards or, in the absence thereof, in accordance with survey procedures prepared by an accredited laboratory or applicable survey methods.	Appendix No. 1. Part: PHYSICAL AND CHEMICAL PROPERTIES OF WATER AND BOTTOM SEDIMENTS
Hydrochemical surveys	08.2022 -06.2023	Taking water samples at 43 stations in an even net with density of 1 sample per 5 km^2 from the superficial and demersal layers, including at 7 stations taking water samples in standard vertical profiles.	
Acoustic surveys	07.2022–10.2023	Background noise measurements using 2 hydrophones.	Appendix No. 1. Part: BACKGROUND NOISE
Biotic elements			
Phytobenthos	06.2022	Analysis of bathymetric and sonar data. Visual inspection performed using a ROV on 4 transects, on the rocky seabed. Analysis of film material.	Appendix No. 1. Part: BENTHOS
Macrozoobenthos	06.2022–06.2023	Taking 108 quantitative samples on the soft seabed and 6 quantitative samples on the hard seabed. Laboratory analysis in terms of: • taxonomic composition; • abundance; • Biomass.	
Ichthyofauna	07.2022–06.2023	Acoustic measurement using a testing echo sounder. Sampling (ichthyofauna) using midwater trawls and sets of survey nets. Sampling (ichthyoplankton) using a Bongo net. Ichthyological analysis in terms of: • Length and mass of specimens; • Sex and maturity of the gonads; • Degree of stomachs filling; • Age. Ichthyoplankton analysis in terms of: • taxonomic composition;	Appendix No. 1. Part: ICHTHYOFAUNA

TYPE OF SURVEYS	DATE OF SURVEYS	SCOPE OF SURVEYS	DETAILED DESCRIPTION
		• abundance; • Larvae and fry lengths.	
Marine mammals	07.2022–10.2023	Passive acoustic recording of porpoises using 11 continuous underwater acoustic porpoise detectors (C-POD). Aerial observations on 7 transects.	Appendix No. 1. Part: MARINE MAMMALS
Migratory birds	08.2022–05.2023	Visual observations, acoustic recordings and recordings using vertical and horizontal radars at 1 station, 40 days of observations in total.	Appendix No. 1. Part: AVIFAUNA – MIGRATORY BIRDS
Seabirds	06.2022–05.2023	Counting of birds sitting on water and flying, along: • 5 transects in the OWF area; • 5 transects in the South Middle Bank area;	Appendix No. 1. Part: AVIFAUNA – SEABIRDS
Bats	08.2022–05.2023	Acoustic recording with the use of recorders at 1 station and along 5 transects with a total length of 55 km.	Appendix No. 1. Part: CHIROPTEROFAUNA

3.1 Location, topography of the sea basin bottom

The Baltic East OWF area is located 22.5 km north of the seashore at the height of Sasino and Białogóra. The seabed of the surveyed area is located at a depth from 25.8 to 45.9 MBSL, and the depth of the surveyed area increases northwards. The shallowest parts of the seabed are located in the southern part of the area [Figure 13]. The seabed surface varies.

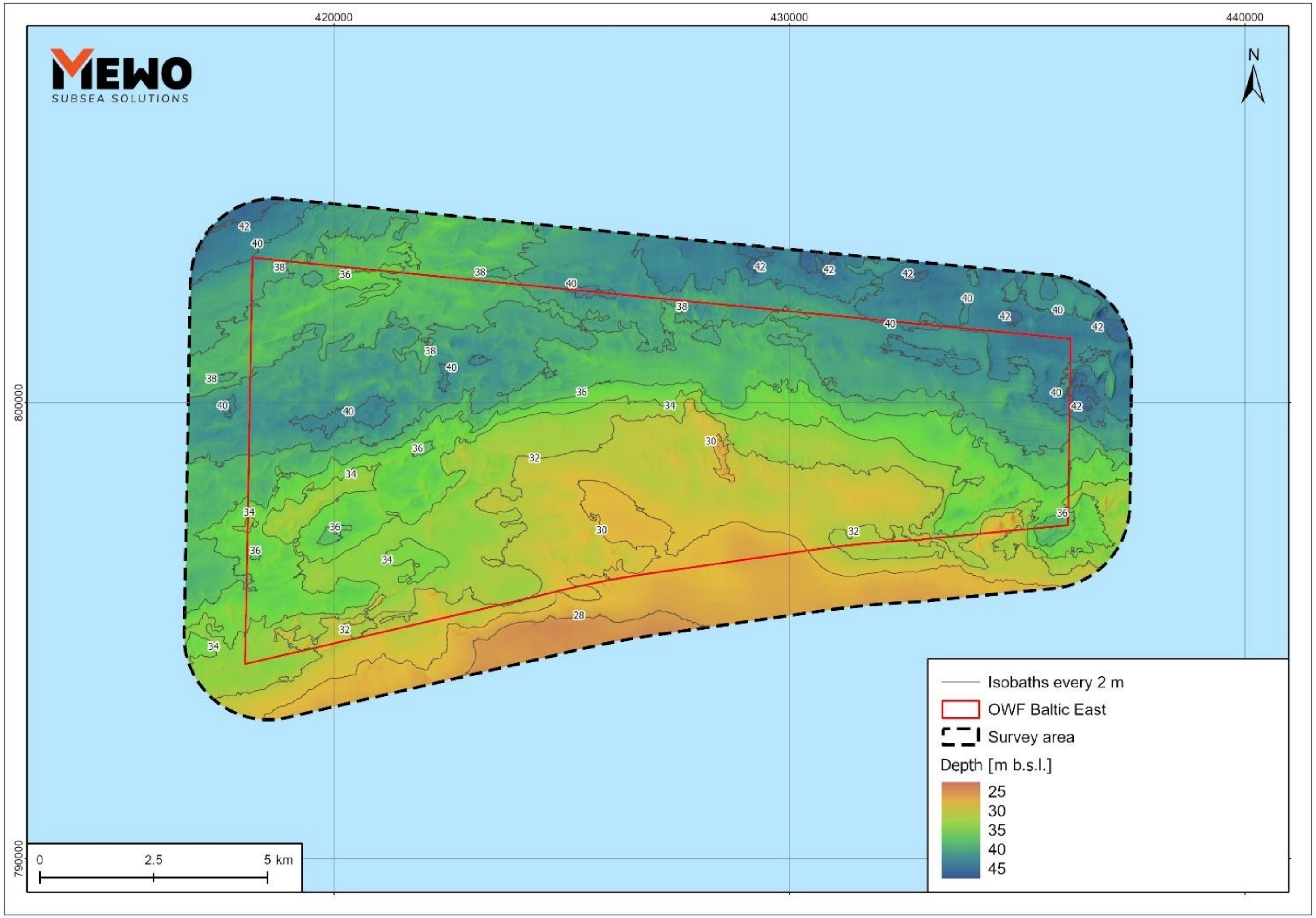

Figure 13 Baltic East OWF bathymetric map [source: internal materials]

The characteristics of changes in the depth and relief of the surveyed area seabed were developed in the form of a map of seabed surface types, which was prepared using the bathymetric map, map of slopes, sonar mosaic and surface sediments, and seabed sediment structure data obtained by interpretation of seismoacoustic data. Within the analysed area, two types of seabed surface were distinguished, covering the accumulation platform and the abrasion and accumulation platform [Figure 14].

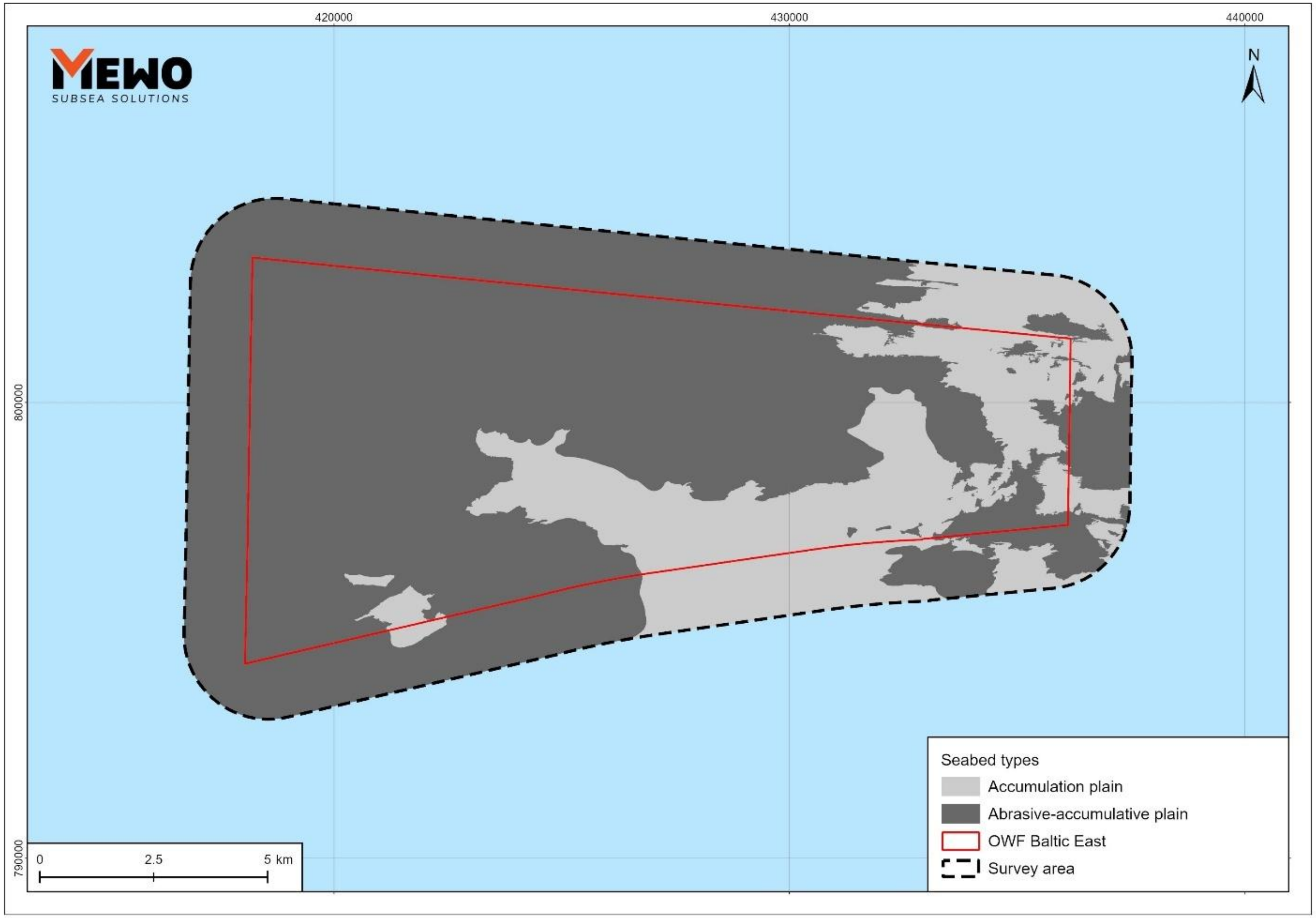

Figure 14 Map of seabed surface types for the Baltic East OWF surveyed area [source: internal materials]

Accumulation platform

The accumulation platform is an area with a leveled, locally corrugated seabed surface composed mainly of sands, locally sands and gravels. The slopes of the seabed are small – 1 to 2 degrees on average. The seabed surface of the accumulation platform area is located at a depth from approx. 26 MBSL (southern part) up to approx. 39 MBSL (northern part). The area of occurrence of the accumulation type is shown in the figure above [Figure 14].

Abrasion and accumulation platform

The area of the abrasion and accumulation platform nature covers the majority of the Baltic East OWF surveyed area. The depth within the abrasion and accumulation platform area ranges from approx. 26 MBSL in the southern part to approx. 46 MBSL in the northern part of the area. It is an area with diversified seabed relief with clear, well preserved elements of glacial and fluvioglacial relief in the form of moraine hills and elevations of fracture accumulation forms. Elevations of glacial and fluvioglacial formations are up to 5 m high above the surrounding seabed surface. The surface of the seabed of the abrasion and accumulation platform is mainly made of glacial and fluvioglacial sediments with a thin, discontinuous cover of sands and gravels with a thickness of up to 50 cm, with local accumulations of gravels and boulders of the abrasion pavement type. The slopes of the seabed of this part of the area are small and amount to 1 to 2 degrees on average, only within the slopes of glacial formations they amount to more than 10 degrees.

Detailed data on the shape of the seabed of the analysed area, obtained on the basis of the conducted surveys, are included in Appendix No. 1 to the EIA Report.

3.2 Geological structure, bottom sediments, raw materials and deposits

3.2.1 Geological structure, geotechnical conditions

The crystalline basement, within the boundaries of the surveyed area, is located at a depth from 2500 to 2900 MBSL (Ryka, Dadlez 1995; Dadlez et al. 1995). The northern part of the Baltic East OWF surveyed area is located within the Łeba Block and the southern part within the Żarnowiec Block. The Sambia fault runs through the analysed area (Dadlez 1995a). Above the crystalline basement there is a series of Cambrian, Ordovician, Silurian and Permian sediments. These formations are covered with Triassic sediments (excluding the north-western part of the area), and in the southern part of the area – also with Cretaceous sediments (Dadlez 1995b; Dadlez et al. 1995; Kramarska et al. 1999). Above the Permian and Mesozoic sediments, Paleogene and Neogene sediments were identified (Kramarska et al. 1999). At Paleogene and Neogene sediments, there are Quaternary sediments.

The thickness of Quaternary formations for the analysed area is estimated at 5 to 30 m. The smallest thickness of less than 5 m is expected in the north-western part of the surveyed area. The thickness of Quaternary sediments increases eastwards and south-eastwards, where it may be more than 30 m (Kramarska et al. 1995, Uścinowicz 1995, Gudelis and Yemielianow 1982).

In the Project area, 5 main seismic units were distinguished. These units were interpreted geologically in relation to the general knowledge about the survey method and surveyed area (Dadlez 1995a,b; Gudelis, Jemielianow 1982; Kramarska 1995a,b; Kramarska et al. 1999; Kramarska et al. 1995; Dadlez et al. 1995; Pikies and Jurowska 1992, 1995; Uścinowicz 1995; Uścinowicz and Zachowicz 1991a,b; https://igs.pgi.gov.pl, https://geolog.pgi.gov.pl). The interpretation of the tops of individual seismic units, and thus the main sediment series of geological structure of the surveyed area, was carried out manually by the interpreter and is the author's result of the analysis of collected data and literature data. Such an approach results from the specificity of Pleistocene and Holocene sediments forming the seabed of the southern Baltic Sea. These are usually sediments of high diversity (e.g. glacial sediments) and a significant number of internal horizons appearing in sediments of similar genesis (marginal and lacustrine sediments, fluvioglacial sediments, marine sediments).

The separated units were described as:

- IA unit – fine-, medium- and coarse-grained sands (marine, fluvial, fluvioglacial); sediments of this unit occur on the seabed surface forming a discontinuous layer with a thickness of up to more than 5.6 m;
- IB unit – fine-grained sands (marine, fluvial, fluvioglacial); sediments of this unit were identified locally in the southern part of the area; create discontinuous accumulations filling the depressions in the top of IC unit sediments, due to the image of reflexes of sediments of this unit similar to the sediments of the IA unit, a volatile course of the top surface and the lack of clear confirmation of a different nature of these sediments in core samples, this separation should be treated as a package underlaying the sediments of the IA unit, similar in nature to these sediments, therefore the thickness of these two series was presented together as the thickness of the sediments of the IA unit and the IB unit;
- IC unit – clays, silts, sands (marginal and lacustrine); forms a layer with a thickness of up to more than 6 m, covering almost the entire analysed area; due to the exploration range (up to approx. 6 m), it is not possible to indicate the full thickness;
- ID1 unit – Diamicton (glacial and fluvioglacial sediments with a large share of loams); they form an accumulation in the north-western part of the area, with a thickness of up to more

than 6 m (depressions in the top of lower deposited units); due to the exploration range (up to approx. 6 m), it is not possible to indicate the full thickness;

- ID2 unit – Diamicton (glacial and fluvioglacial sediments with a large share of loams, as well as with a large share of various grain sediments); form an accumulation in the north-western part of the area, with a thickness of up to more than 6 m; due to the exploration range (up to approx. 6 m), it is not possible to indicate the full thickness of this unit sediments. Within this unit, a system of depression/valley type with an averaged north-south route was identified. These depressions are filled with ID1 unit sediments.

Based on the conducted analyses of bathymetric, sonar and seismoacoustic data, the structure of seabed sediments of the analysed area to the depth of at least 5.8 m below seabed level was identified.

In the central, southern and eastern part of the surveyed area, the seabed is made of IA unit fine-, medium- and coarse-grained sands, in the central part of the area covered with IB unit sands. The sand thickness (IA and IB units) ranges from 0.5 to over 5.7 m (range of interpretation of seismoacoustic data). In the majority of the surveyed area, under the thin cover of modern marine sands of the IA unit (in the central part of the area also the sediments of the IB unit) or directly on the seabed surface, cohesive sediments of the IC unit (mainly silts, clays and sands) are deposited. They form a layer with a thickness of up to more than 5 m (range of interpretation of seismoacoustic data). In the north-western part of the area, fluvioglacial and glacial sediments of the ID1 unit deposited on ID2 unit sediments forming a bed with a thickness of up to more than 5 m were identified (range of interpretation of seismoacoustic data). In the top of the ID2 unit sediments, a system of four fossil valleys with a general north-south route was identified. The valleys are filled with Quaternary sediments, mainly of the ID1 unit, and in the southern sections of the valleys also marginal and lacustrine sediments of the IC unit.

3.2.2 Bottom sediments and their quality

Based on the conducted analyses of bathymetric and sonar data, a map of seabed surface sediments was prepared using data from analyses of seismoacoustic measurements and results of sediment samples analyses [Figure 15].

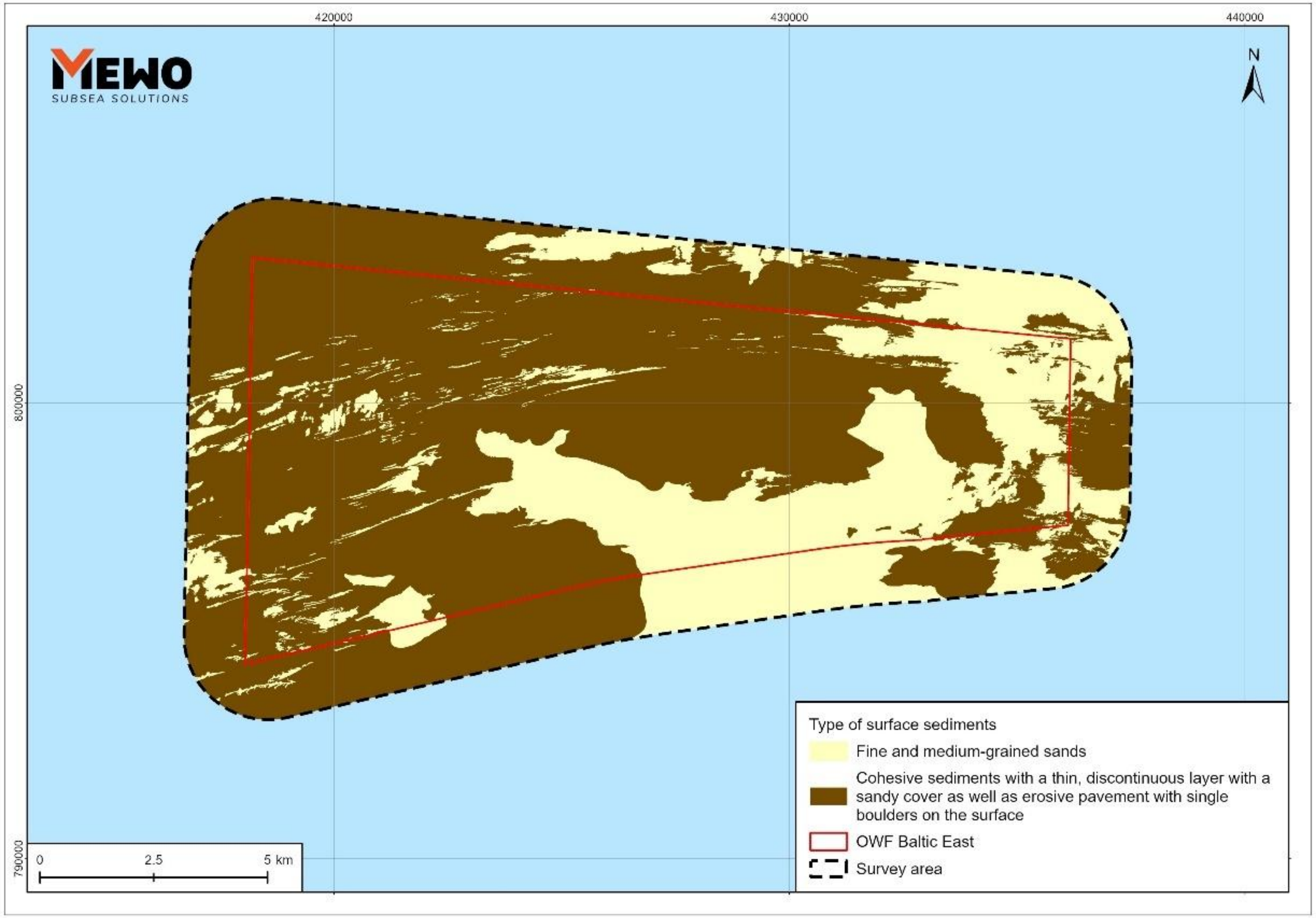

Figure 15 Map of surface sediments of the Baltic East OWF surveyed area [source: internal materials]

The majority of the surface of the seabed of the surveyed area is made of cohesive sediments with a thin discontinuous sandy cover and with erosive pavement and single boulders on the surface – dark brown color in the figure above. The remaining part of the surveyed area (yellow in the figure above) is made of fine- and medium-grained sands, forming a layer with a thickness of 0.5 to over 5.7 m. Almost 64 thousand boulders were identified in the analysed area, at least one of which exceeded 0.3 m. They are mainly located within the seabed made of cohesive sediments with a thin sandy cover and erosion pavement on the surface.

The analysed surface bottom sediments from the Baltic East OWF area belong to inorganic sediments with an organic matter content expressed by the loss on ignition (LOI) below 10% and average moisture content of 20.4%.

The bottom sediments collected during the environmental surveys were analysed, i.a., for the content of biogenic substances, metals and POPs (i.e. PAH, PCB, TBT, mineral oils).

None of the tested sediment samples showed exceeded permissible concentration values of metals (As, Pb, Cu, Zn, Ni, Cd, Cr, Hg), PAHs and PCBs specified in the Regulation of the Minister of the Environment of May 11, 2015 *on recovery of waste outside plants and equipment* (Journal of Laws, item 796), which allows the sediment to be classified as pure in the context of practical applications and, although they do not refer to sediments moved within waters, may constitute the basis for assessment of pollution of bottom sediments with chemical compounds.

Primary processes influencing the content of **biogenic substances** in the sea are geophysical and geochemical processes that control not only the inflow of these elements to seawater, but are also accountable for dispersion and removal of these compounds.

Nitrogen compounds present in bottom sediments are cyclically transformed as a result of biogeochemical processes. Oxidation of ammonia and its compounds by nitrifying bacteria leads to the formation of nitrogen oxides and then nitrates. However, excessive nitrification is not desirable as nitrates are much easier to leach from the sediment than ammonium ions.

In the sediments of the Baltic Sea, nitrogen occurs mainly in organic form and its regional variability is analogous to the variability of carbon (Carman 2003). Inorganic forms of nitrogen normally account for no more than 10% of total nitrogen in sediments (Carman and Rahm 1997). An increase in the share of inorganic nitrogen forms is possible in the zone of erosion and transport of fine-dispersive sediments (Uścinowicz 2011).

The nitrogen circulation in the environment is a very complex process and its intensity depends on many factors (e.g. oxidation, temperature, season, primary production, etc.), as well as on the amount of inflow of biogenic substances from point sources, dispersed sources and deposition from the atmosphere (Boynton et al., 1995; Fisher et al., 1988), and it is impossible to calculate accurately the nitrogen load which will penetrate from the sediments into the water column during the construction works. The results of performed surveys were used in general estimation of the load of this element that may penetrate into the water column during the performed works. The average value of nitrogen concentration in the tested sediments was below the LOQ of the applied method (i.e. 200 mg kg^{-1} DW). The presence of total nitrogen was found only in one sample taken in winter (max. concentration of 206 mg kg^{-1} DW) and in one sample taken in summer (max. concentration of 214 mg kg^{-1} DW).

The obtained results are compliant with the reference data of nitrogen content in the sediments of the southern Baltic Sea, which ranges from 98 to 2604 mg N kg^{-1} DW in sandy sediments, from 1106 to 3094 mg N kg^{1} DW in sandy and silty sediments, from 1904 to 9506 mg N kg^{-1} DW in clays and from 1694 to 4606 mg N kg^{-1} DW in loams (Pęcherzewski 1972).

Phosphorus in bottom sediments is conventionally divided into labile (mobile, reactive) and refractive phosphorus. Refractive forms are combinations of phosphorus with calcium, clay, loamy minerals and are resistant to organic degradation of this element. Refractive phosphorus is deposited in sediments and is removed from the circulation in the water column. Labile phosphorus is phosphorus contained in fresh organic matter, phosphates in interstitial waters, phosphorus-Fe3 + combinations and phosphates loosely bound to various sediment components by adsorption. These forms are easily returned to circulation in the water column, mainly as a result of mineralization of organic matter and dissolution of phosphorus combinations with Fe3+ as a result of a decrease in the redox potential value (Alloway and Ayres 1999; Uścinowicz 2011). Phosphorus may be a factor limiting the productivity of marine ecosystems (Weiner 2005). In the aquatic environment, when primary production limits the amount of phosphorus, the intake of 1 mg of phosphorus results in an increase of 100 mg of algal dry weight per biological cycle (Dojlido 1995).

The content of biogenic substances in the surveyed area did not exceed the values typical for sediments of the southern Baltic Sea. The amount of phosphorus that can pass into water (so-called digestible phosphorus) is estimated at 10–20% of the total phosphorus pool contained in sediments (Wiśniewski et al. 2006). The average concentration of phosphorus in the surveyed sediments was 398 mg kg^{-1} DW in winter and 418 mg kg^{-1} DW in summer.

Concentration of POPs (PAHs, PCBs) and harmful substances, such as metals or mineral oils, in the surveyed area were low and did not exceed the values typical for sandy sediments of the southern Baltic Sea.

PAHs and PCBs present in sediments can undergo many transformations and have a significant impact on the environment. The extent of the impact depends on transformations of these compounds. These can be abiotic processes such as sorption, leaching, oxidation, photodegradation and reactions with other compounds, and biological processes such as microbial transformation. They may inhibit or stimulate the development of micro-organisms, have a phytotoxic effect on or stimulate plant growth and be toxic to fauna (Galer et al., 1997). The accumulation of PAHs and PCBs in sediments is promoted, among others, by a high share of silty and loamy fractions with a sediment particle size of <0.063 mm, characterized by a high specific surface area and high ability to adsorb hydrophobic pollutants and organic compounds of phosphorus, sulfur and nitrogen.

Pyrogenic PAHs (generated during combustion of coal, oil, gas, wood, garbage or other organic material) as well as PCBs show extremely high durability in bottom sediments, which is caused by the occlusion of these chemicals in very fine sediment particles (Bolałek et al., 2010). Therefore, desorption of the substances in question from sediments to water occurs to a limited extent. This is generally a maximum of 0.5% for PCB congeners up to 5% for PAH analytes (Gdaniec-Pietryka 2008; Gdaniec-Pietryka et al. 2013). Assuming that such amounts will be transferred to water from sediments, it can be concluded that the risk of repeated pollution of water related to remobilization of PAHs and PCBs in the surveyed area is low.

PAH and PCB concentration in the surveyed sediments (dry weight) and their availability are presented in the below table [Table 14].

Table 14 Concentration of PAHs and PCBs in the surveyed bottom sediments in the Baltic East OWF surveyed area [source: internal materials]

Indicator	Average concentration in the surveyed sediments [mg kg^{-1} DW]	Available form [%]
Congeners representing PCBs	0.0002	0.5
Analytes representing PAHs	0.063	5

The concentration of metals in the surveyed sediments from the Baltic East OWF surveyed area were low. Additionally, their availability (i.e. the ability to pass to water) should be taken into account, which depends on the physical and chemical form in which they occur (Siepak, 1998). Metals permanently embedded in the crystalline network of minerals are immobilized and will not pass to water under natural conditions. On the other hand, the mobile (labile) part of metals (Siepak, 1998; Dembska, 2003; SMDI_BSII_2015) is susceptible to passing from sediment to water.

The labile form of metals may constitute (depending on the type of sediment for individual metals) from less than 30 to 80% Savvides et al., 1995; Parkman et al. 1996; Siepak 1998; Usero et al. 1998; Dembska 2003; Davutluoglu et al. 2010). The results of the labile metal form analysis in the surveyed sediments showed that approx. 60% lead, approx. 39% copper and approx. 48% zinc may pass to water in unfavorable conditions. In the case of nickel and chromium which are more permanently bound to sediment, this may occur in approximately 30% and 16%, respectively.

Average metal concentration in the surveyed sediments (dry weight) and labile form concentration are presented in the table [Table 15].

Table 15 Average concentration of metals in the surveyed sediments in the Baltic East OWF surveyed area [source: internal materials]

Metal	Average concentration of total content in the surveyed sediments [mg kg^{-1} DW]	Average concentration of available (labile) form [mg kg^{-1} DW]
Arsenic (As)	1.84	<1.25
Lead (Pb)	3.11	1.84
Copper (Cu)	1.31	0.51
Zinc (Zn)	7.09	3.42
Nickel (Ni)	1.63	0.79
Chromium (Cr)	3.92	0.63
Mercury (Hg)	0.02	<0.01

The values of cadmium (LOQ <0.05 mg kg^{-1} DW) and TBT (LOQ <0.01 mg kg^{-1} DW) concentration in the surveyed sediment were negligent, generally below the lower LOQ. For this reason, the risk of water pollution related to remobilization of these chemical compounds from the bottom sediment during the Baltic East OWF implementation phase was considered negligible and was not subject to further analyses.

The surveyed sediments were also characterized by low activity of radioactive ^{137}Cs isotope, typical of sandy sediments.

The identified spatial diversity of the analysed physical and chemical properties of bottom sediments does not create any limitations for the location of facilities, i.e.: foundations and supporting structures and internal power system.

3.2.3 Raw materials and deposits

Within the boundaries of the Baltic East OWF surveyed area and in its immediate vicinity, no mineral deposit and mining area (igs.pgi.gov.pl; geolog.pgi.gov.pl) were found [Figure 16].

In accordance with the geoenvironmental map of Polish maritime areas (Kramarska et al. 2019), the eastern and north-eastern part of the Baltic East OWF surveyed area is indicated as a perspective for the occurrence of aggregate raw materials. A prospective area of sands, sands and gravels was designated there (area II – "Baltic coastal seabed zone"). Within the Baltic East OWF surveyed area, no sands suitable for coastal silting were designated.

In accordance with the provisions of the PZPPOM for the POM.46.E sea basin, where the Baltic East OWF area is located, "renewable energy generation" was indicated as the basic function. The permissible function covers "prospecting and exploration of mineral deposits and extraction of minerals from deposits", which is described in the further part of the sea basin sheet as follows: "*in* *the entire sea basin, the performance of functions (for prospecting and exploration of mineral deposits and extraction of minerals from deposits) is limited to methods not affecting linear elements of technical infrastructure; not threatening the ecological function of spawning grounds and survival of early development stages of fish (eggs and larvae) of commercial species; in the entire sea basin, the extraction of minerals from deposits is limited to projects agreed with the competent offshore wind farm investor*." Due to the indication of the superior function for the POM.46.E sea basin – renewable energy generation, the prospecting and exploration of mineral deposits and extraction of minerals from deposits should be treated as secondary.

Detailed data on the geological structure, bottom sediments and raw materials of the analysed area, obtained on the basis of the conducted surveys, are included in Appendix No. 1 to the EIA Report.

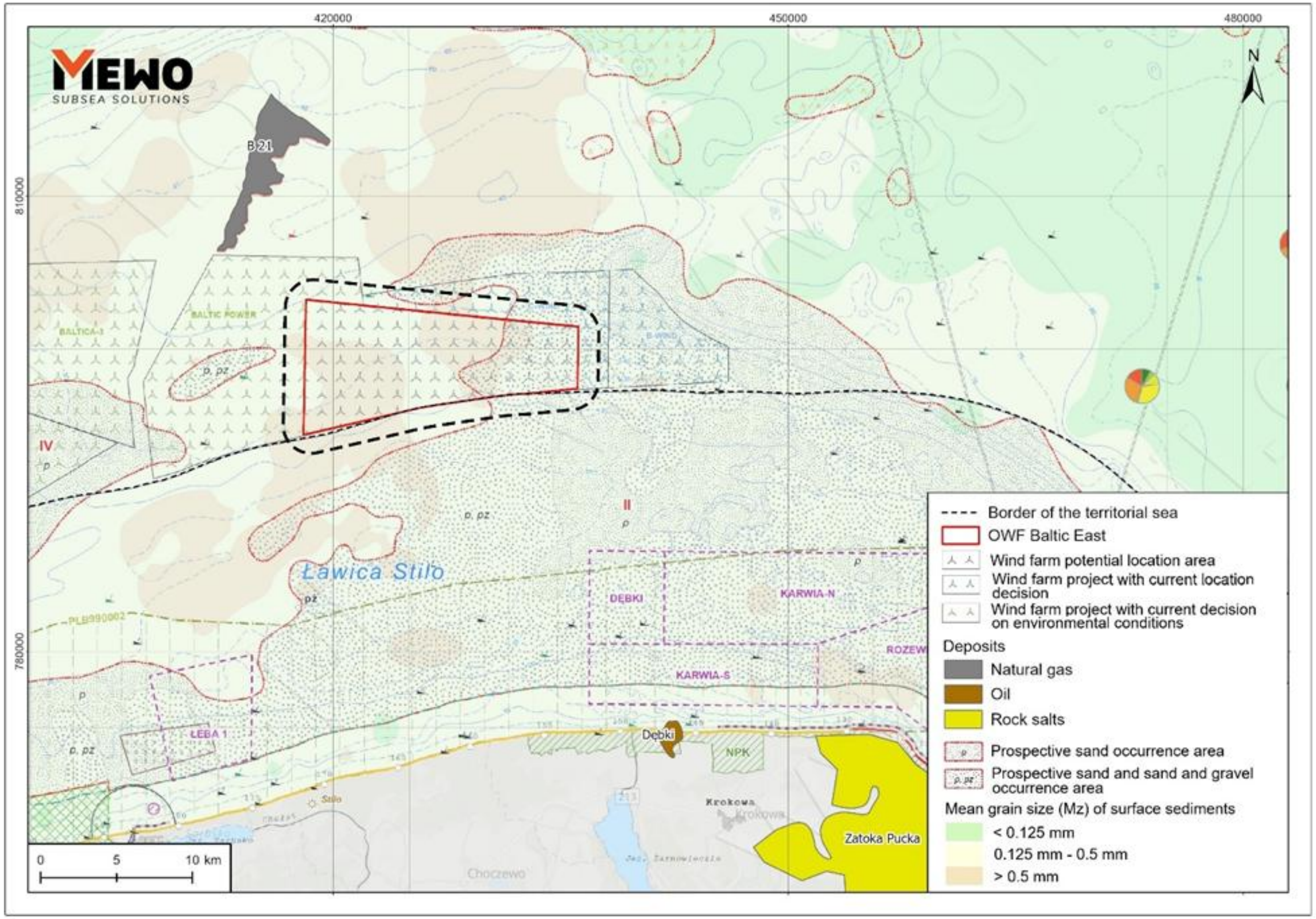

Figure 16 Baltic East OWF map against raw material deposits [source: internal materials based on the geoenvironmental map (Kramarska et al., 2019)]

3.3 Sea waters and their quality

The results of surveys of individual chemical parameters of water in the Baltic East OWF surveyed area, such as reaction, oxygenation, five-day biochemical oxygen demand (BOD_5), total organic carbon (TOC), biogenic substances, PCBs, PAHs, mineral oil, cyanides, metals, phenols, cesium, strontium, did not differ significantly from the values typical for waters of the southern Baltic Sea. Detailed results of surveys are presented in Appendix No. 1 to the EIA Report.

These waters were characterized by alkaline reaction (average pH from 7.71 to 8.57), alkalinity of approx. 1.71 mval dm^{-3} and relatively good oxygenation, with seasonal variability characteristic of the waters of the southern Baltic Sea. The assessment of the water quality index in the Baltic East OWF surveyed area on the basis of oxygen content in the demersal layer in the summer period (June to September) indicates a good condition (no oxygen deficit). Average dissolved oxygen content in this period was above the limit value of 6.0 mg dm^{-3}.

During the entire measurement period (August 2022 – June 2023), the average biochemical oxygen demand (BOD_5) in water samples taken from the Baltic East OWF surveyed area in individual measurement periods was below 2.00 mg dm^{-3}, only in March 2023 it amounted to 3.25 mg· dm^{-3} in the surface layer and 2.92 mg dm^{-3}· in the demersal layer. The suspended matter content in the individual measurement periods was also typical for the southern Baltic Sea waters. The lowest average concentration of suspended matter in the surveyed area occurred in October and the highest concentration in April and June, which may have been caused by increased primary production.

The content of biogenic substances – total nitrogen, mineral nitrogen (nitrates, nitrites and ammonia in total) phosphates and total phosphorus – in the surveyed waters showed seasonal variability typical for the southern Baltic Sea waters. The lowest concentration of the surveyed substances occurred in the period of developed vegetation, i.e. in August 2022 and April and June 2023, while in winter and spring months (January – March) their significant increase was observed in accordance with the seasonal trend of biogenic substance recovery. The average concentration of total phosphorus in the water column in August 2022 and June 2023 was 0.022 and 0.021 mg dm^{-3}, respectively. The average concentration of phosphates found in the samples collected in January and March 2023 was 0.013 mg dm^{-3} (average value from the water column). The average concentration of total nitrogen in water samples taken from the Baltic East OWF surveyed area in August 2022 and June 2023 was similar and amounted to 0.12 and 0.13 mg ·dm^{-3}, respectively. The average concentration of DIN *(dissolved inorganic nitrogen)* from the water column in water samples from the Baltic East OWF area collected in January and March 2023 was 0.024 mg dm^{-3}.

The waters of the analysed sea basin were characterized by low concentration of particularly harmful substances. PCBs, mineral oils (mineral oil index), free and bound cyanides, metals (Pb, Cd, $Cr_{og.}$, Cr(VI), As, Ni, Hg, Al) and phenols were present at trace levels.

The surveyed waters were also characterized by low activity values of ^{137}Cs and ^{90}Sr typical for the waters of the southern Baltic Sea, which confirms a slow downward trend of concentration of ^{90}Sr and ^{137}Cs in the Baltic Sea area (Zalewska, 2012; Zalewska and Kraśniewski, 2022).

In the Baltic East OWF surveyed area, concentration of PAHs were recorded slightly higher than in the literature (Witt, 2002), which may result from differences at the stage of preparation of samples for analysis (PAHs were determined in waters without separation of suspended matter, with which they show strong affinity).

The identified spatial diversity of the analysed physical and chemical properties of sea waters does not create any limitations for the location of facilities, i.e.: foundations and support structures and internal power system.

3.3.1 Status of sea waters and bottom sediments

Physical and chemical elements of water, such as concentration value of: dissolved oxygen at the seabed in summer, TOC, nitrate nitrogen, mineral nitrogen and total nitrogen analysed in the surveyed Baltic East OWF area are in the 1st water quality class (very good condition) (in accordance with the limit values of the Regulation of the Minister of Infrastructure of June 25, 2021 *on the classification of ecological status, ecological potential and chemical status and the method of classification of the status of surface water bodies, as well as environmental quality standards for priority substances* (Journal of Laws, item 1475)). However, the obtained results of water surveys regarding concentration of total phosphorus and phosphate phosphorus and pH classify the surveyed waters to the 2nd quality class.

The assessment of water quality in the Baltic East OWF area, carried out in accordance with the aforementioned Regulation in force as of the date of preparation of this study as regards specific synthetic and non-synthetic pollutants and a group of chemical indicators characterizing the occurrence of substances particularly harmful to water environment and priority substances in the field of water policy, i.e. metals (Pb 14 µg dm^{-3}, Cd 0.45 µg dm^{-3}, Cr (VI) 0.02 mg dm^{-3}, as 0.05 mg dm^{-3}, Ni 34 µg dm^{-3}, Hg 0.07 µg dm^{-3}), mineral oil index (0.2 mg dm^{-3}) and PAH (naphthalene 130 µg dm^{-3}, anthracene 0.1 µg dm^{-3}, fluoranthene 0.12 µg dm^{-3}, benzo(a)pyrene 0.027 µg dm^{-3}, benzo(b)fluoranthene and benzo(k)fluoranthene 0.017 µg dm^{-3}, benzo(g,h,i)perylene 0.00082 µg dm^{-3}), performed in water samples taken in April 2023 showed that the limit values were not exceeded in water samples taken from the Baltic East OWF area. The exception covered the values of benzo(g,h,i) perylene concentration, exceeded in the demersal water sample from one survey station, with the value of 0.00105 µg dm^{-3} and the mineral oil index at the level of 0.25 mg dm^{-3} determined in one sample of the demersal water layer. It should be emphasized that this is an incidental exceedance, falling within the measurement uncertainty of the applied survey methods for both indicators. However, the average value of concentration of benzo(g,h,I)perylene and mineral oil in water from the surveyed area is <0.00017 µg dm^{-3} and 0.02 mg dm^{-3}, respectively, and does not exceed the limit values. The limit values are given in the units of measurement in which they are indicated in the Regulation to which they refer.

Since January 1, 2022, §24 and Appendix No. 26 to the above-mentioned Regulation have not been applicable, in which indicators such as total chromium, free and bound cyanides and volatile phenols had limit values set for the 2nd class of surface water quality, it was used for reference purposes and in order to enable comparisons with the results of surveys performed for other OWFs. Previously applicable limit values were: total chromium 0.05 mg dm^{-3}, phenols 0.01 mg dm^{-3}, free cyanides 0.05 mg dm^{-3} and bound cyanides 0.05 mg dm^{-3}, respectively. The currently applicable Appendix No. 11 to the same Regulation does not specify these indicators and thus does not specify the current limit values for them.

Due to the obtained results of concentration of total chromium, phenols and cyanides in waters from the Baltic East OWF area in relation to the limit values of water quality indicators for surface water bodies (SWB) specified in Appendix No. 26 to the aforementioned Regulation, it was found that none of the analysed indicators exceeded the admissible values.

Moreover, in all the analysed water samples from the surveyed Baltic East OWF area, the concentration values of the sum of 7 PCBs were below LOQ of the applied analytical methods (i.e. 0.001 µg dm^{-3}). The average concentration of ^{137}Cs in sea water taken from the Baltic East OWF area was 15.6 $Bq \cdot m^{-3}$. For ^{90}Sr, the average activity in water was 4.9 $Bq \cdot m^{-3}$. The obtained results confirmed a gradual decrease in radionuclide activity since the commencement of continuous monitoring in 2010/2011.

In turn, the Marine Strategy Framework Directive (MSFD – 2008/56/EC) of 17 June 2008 establishes a framework for community action in the field of marine environmental policy and requires Member States to develop strategies to achieve good environmental status in maritime areas under their jurisdiction. The Directive was transposed into the Polish law by the Act of January 4, 2013 *on the amendment to the Water Law and certain other acts* (Journal of Laws of 2013, item 165). In 2017, the MSFD was amended by Commission Directive (EU) 2017/845 of 17 May 2017, hereinafter referred to as “Directive 2017/845”, by adopting a new version of Annex III to Directive 2008/56/EC as regards the indicative lists of elements to be taken into account for the preparation of marine strategies. The amendment to the Commission Directive was transposed into the Polish law by the Act of September 11, 2019 *on the amendment to the Water Law and certain other acts* (Journal of Laws, item 2170, as amended).

Currently, the Regulation of the Minister of Infrastructure of February 25, 2021 *on the adoption of an update of the set of properties typical for good environmental status of sea waters (*Journal of Laws, item 568) is applicable.

Table [Table 16] refers the concentration values of the discussed indicators obtained in the annual survey cycle from August 2022 to June 2023 to the threshold values of the Appendix to the Regulation of the Minister of Infrastructure of February 25, 2021 *on the adoption of an update of the set of properties typical for good environmental status of sea waters (*Journal of Laws, item 568). The basic indicator describing eutrophication and being at the same time a driver of this process is the content of nutritious salts in sea water (Criterion D5C1 – concentration of nutrients). The indicators used for the assessment comprise total phosphorus (TP) and total nitrogen (TN) presented as average annual concentration and dissolved inorganic nitrogen (DIN) and dissolved inorganic phosphorus (DIP) presented as average winter concentration from months XII–II, as then the values of nutritious salt concentration are the highest.

Table 16 Average concentration values (µ M dm-3) in the surface layer of dissolved inorganic phosphorus (DIP) and dissolved inorganic nitrogen (DIN) in winter months (January) and average annual concentration values of phosphorus (TP) and nitrogen (TN) in relation to threshold values. Poor (inappropriate) status is marked red – subGES, good status is marked green – GES [source: internal materials]

SEA BASIN	**INDICATOR**			
	dissolved inorganic nitrogen DIN (AVERAGE WINTER CONCENTRATION XII–II)	**dissolved inorganic phosphorus DIP (AVERAGE WINTER CONCENTRATION XII–II)**	**total nitrogen TN (AVERAGE ANNUAL CONCENTRATION)**	**total phosphorus TP (AVERAGE ANNUAL CONCENTRATION)**
Eastern Gotland Basin threshold values	**(<0.036 mg·dm^{-3}) <2.60 µM·dm^{-3}**	**(<0.009 mg·dm^{-3}) <0.29 µM·dm^{-3}**	**(<0.231 mg·dm^{-3}) <16.5 µM·dm^{-3}**	**(<0.021 mg·dm^{-3}) <0.68 µM·dm^{-3}**
Average concentration values from the Baltic East OWF surveyed area	(0.025 mg·dm^{-3}) 1.78 µM·dm^{-3}	(0.013 mg·dm^{-3}) 0.42 µM·dm^{-3}	(0.118 mg·dm^{-3}) 8.43 µM·dm^{-3}	(0.022 mg·dm^{-3}) 0.71 µM·dm^{-3}
Survey period	January 2023	January 2023	August 2022–June 2023	August 2022–June 2023

The results of assessment of the feature 8 indicators concerning the concentration of pollutants in marine environment elements according to the MSFD, carried out on the results of monitoring surveys from August 2022 to June 2023 at survey points in the Baltic East OWF area for the water matrix and on the Baltic East OWF construction site for bottom sediments, are presented below. The average concentration of metals and caesium in environmental matrices collected during marine surveys in the Baltic East OWF area in relation to the threshold values is presented in table [Table 17].

Table 17 Average values of concentration of metals, ^{137}Cs and concentration of persistent organic pollutants in environmental matrices (water, bottom sediment) collected during offshore surveys in the Baltic East OWF area in relation to the threshold values. Poor (inappropriate) status is marked red – subGES, good status is marked green – GES [source: internal materials]

Substance	Survey period	Matrix	Threshold value	Average value from the surveyed area
Baltic East OWF sea water and bottom sediment surveyed area				
Cadmium (Cd) (mg kg^{-1} DW)	August/September 2022 January 2023	Sediments	<2.3	<0.05
Lead (Pb) (mg kg^{-1} DW)	August/September 2022 January 2023	Sediments	<2.3	3.11
Mercury (Hg) (mg kg^{-1} DW)	August/September 2022 January 2023	Sediments	<0.07	0.02
^{137} Cesium (Bq m^{-3})	April 2023	Water	<15	15.09
Fluoranthene (µg kg^{-1} DW)	August/September 2022 January 2023	Sediments	<2000	10.0
Benzo(g,h,I)perylene (µg kg^{-1} DW)	August/September 2022 January 2023	Sediments	<85	2.00
Indeno(1.23-cd)pyrene (µg kg^{-1} DW)	August/September 2022 January 2023	Sediments	<240	2.00

Based on the conducted surveys and analyses of the results, it can be concluded that the environmental status of sea waters in terms of eutrophication of the Baltic East OWF surveyed area is poor (subGES). This was due to the elevated concentration of phosphates in winter and total phosphorus expressed as an annual average concentration. The limit values of concentration of mineral nitrogen in winter and total nitrogen (GES) were not exceeded. The determined concentration of metals (cadmium and mercury) in bottom sediments did not result in exceeded limit values, which classifies the status of the surveyed sediments as good (GES). On the other hand, the value of lead concentration in bottom sediments exceeds the limit value, which classifies them as inappropriate (subGES). Also the environmental status in terms of radioactive contamination with ^{137}Cs in water was found to be inappropriate (subGES). Concentration of persistent organic pollutants (fluoranthene, benzo(ghi)perylene and indeno(123cd)pyrene) did not exceed the limit values, which classifies the status of the surveyed sediments as good (GES) in terms of these parameters. The obtained results do not differ from the data from the monitoring of sea waters of the Baltic Sea (Zalewska, Kraśniewski (ed.) 2022).

3.4 Climatic conditions and air quality status

3.4.1 Climate and risk of climate change

Climatic conditions of the southern Baltic Sea are defined as humid moderate, influenced by the Atlantic climate with prevailing oceanic winds. The vicinity of the Atlantic Ocean, due to the influx of large air masses, significantly determines the climate of the Baltic Sea region. As a result of these conditions, the winters are relatively mild and warmer compared to the northern part of Europe, while the summers are cooler compared to the southern part of Europe.

The climate specific to the Polish coast and adjacent areas of the sea can be classified as a coastal strip climate type, with relatively small amplitudes of air temperature, high humidity, mild winters, cooler summers and strong winds. The prevailing winds here are from the west and southwest. In areas of the open sea, including the Baltic East OWF, climatic conditions are characterized by the fact that air temperature amplitudes are smaller and average wind speed are higher compared to adjacent onshore areas.

The following parameters have been recorded for many years in the Polish open sea areas and in the coastal zone: near-water layer of the atmosphere (pressure, temperature and humidity), wind conditions (direction and force), sunshine duration, precipitation volume and types, ice duration, water parameters (temperature and salinity) and hydrodynamic conditions (sea level, flows and wave motion). These are in particular continuous measurements carried out for operational purposes for several decades at IMGW-PIB metering stations and posts, and in recent years also on buoys anchored in the sea. Moreover, IMGW-PIB performs monitoring measurements in the southern Baltic Sea area several times a year, recording hydrophysical and physical and chemical parameters of the sea in a designated network of points. Continuous hydrological and meteorological records are also performed by other research an development units. At the Coastal Research Station in Lubiatowo of the Institute of Hydro-Engineering of Polish Academy of Sciences (IBW PAN) wind, air temperature and humidity, as well as mean sea level are measured, whereas the Institute of Oceanology of the Polish Academy of Sciences (IO PAN), at the monitoring station located at the jetty in Sopot, records air temperature, pressure and humidity and sunshine duration, as well as water temperature and salinity. As part of the SatBałtyk project, implemented in 2010–2015, satellite data were analysed, which allowed the determination of sea and atmosphere characteristics and the results were shown in the form of maps presenting, i.a., temperature distribution, ice caps, instantaneous water flow velocity, water mixing and turbidity of water. At the Institute of Meteorology of the Gdynia Maritime University (IM UMG), as part of various research projects and following orders of investors, parameters of the near-water layer of the atmosphere as well as hydrophysical and dynamic values in the entire cross-section of the water column were recorded in different places of the Polish Exclusive Economic Zone of the Baltic Sea.

The presented surveys related to similar recordings performed by the Baltic State services allow the determination of the existing trends and expected directions of changes in the basic climate parameters of the southern Baltic Sea. Moreover, information from climate simulation calculations of numerical models of the global atmospheric circulation model available, among others, from surveys carried out as part of BALTEX assessment of Climate Change for the Baltic Sea Basin is used for this purpose.

Based on the available observational data and analyses of climate models, the most important conclusions concerning the forecasts of changes of individual elements of atmosphere and water in the Baltic Sea area in the coming decades can be presented:

- the air temperature rise is faster than the average global rise, and this trend will continue;
- the water surface temperature rise is greater than in deeper layers of the water column, which may result in greater thermal stratification and stabilization of the thermocline during the year;
- forecast changes in salinity are not clearly defined and will depend, on one hand, on changes in air circulation conditions and the volume of water exchange with the North Sea, and, on the other hand, on the volume of fluvial water inflow; in general, a decrease in salinity is forecast;
- precipitation is forecast to increase throughout the Baltic Sea basin during the winter season, while only in the northern part during the summer; the frequency of extreme precipitation will increase;
- in terms of forecast of sea level changes, the effects of global growth will not be significantly felt. This is due to the fact that the Baltic Sea, being a relatively small and shallow shelf sea, is connected through relatively narrow Danish Straits with the North Sea, through which ocean waters are only incidentally exchanged (so-called inflows). Moreover, most of its area (in the northern part) is located within the Scandinavian plate, which is characterized by visible lifting processes (so-called isostatic processes), which results in a decrease in the height of the mean sea level. However, in the southern part, the impact of these processes is practically negligible, and the height of the water level is mainly shaped by the atmospheric circulation conditions;
- forecasts of wind climate changes are subject to significant uncertainty, however, it is assumed that with an increase in the average surface water temperature, the average wind

speed over the sea areas will increase and the conditions of stability of the near-water layer of the atmosphere will decrease;

- changes in the wave climate are mainly related to changes of wind conditions, which will cause an increase in the frequency and intensity of storms, whereby an increase in the number of extreme phenomena is forecast;
- model calculations indicate that there will be an increase in the surface area of areas with low oxygen content in water and anaerobic areas at the seabed.

Climate change forecasts for the territory of Poland, covering also the coastal zone and maritime areas under the jurisdiction of the Polish State, as well as scenarios of adaptation actions aimed at mitigating and counteracting the effects of changes, have been the subject of intensive works carried out by the Ministry of Climate and Environment and the Institute of Environmental Protection of the National Research Institute, which implements the project entitled "Database of knowledge on climate change and adaptation to its effects and channels of its dissemination in the context of increasing the resilience of the economy, environment and society to climate change and counteracting and minimising the effects of extraordinary hazards", funded by the EU, referred to as the KLIMADA 2.0 project. Taking into account the conclusions and recommendations relating to the coast and adjacent areas of the Baltic Sea, it was concluded that the observed and expected climate changes will have a negative impact on the conditions in the coastal zone. A negative impact of periodic sea level increases is expected, mainly resulting from an increase in the frequency of occurrence and intensity of strong storms. In the case of the Baltic Sea, this refers to a possible increase in the number, intensity and duration of these events, with an increase in the irregularity of occurrence of these events, i.e. after long periods of relative calm, there may be a series of fast consecutive storms with a significant force.

The factor accelerating the shore erosion processes is winter warming, which is expected to reduce the ice cap that constitutes a protection of beaches against the storm surge and, at the same time, coastal erosion. The scenarios of sea level changes show that in the period 2011–2030 the average yearly sea level along the whole shoreline will be higher by 5 cm in comparison to the reference period level, i.e. 1971–1990. Very significant consequences of climate changes will be higher frequency of storm flooding and more frequent inundation of lowlands, as well as degradation of cliffs and sea shore, which will create a strong pressure on the infrastructure existing on these areas.

Due to the increase in the average water temperature and the increased inflow of biogenic pollutants (nitrogen compounds and phosphorus) to the sea, the negative phenomenon will be the progressive eutrophication, especially on the water surface (algal blooms).

The measures taken to adapt the coastal zone to climate change concern areas along the coastline of the Baltic Sea. However, so far no detailed instructions and recommendations have been provided with regard to the open sea areas, including systems and structures located or present there, presenting the scope of actions aimed at counteracting the effects of the forecast changes in climate conditions.

3.4.2 Meteorological conditions

Meteorological conditions of the sea basin covering the Baltic East OWF area were determined on the basis of measurements of parameters of the near-water atmosphere layer carried out between June 13, 2022 and October 12, 2023. They are characterized by wind speed and direction, temperature, pressure and air humidity recorded by the automatic atmosphere measurement station (at the height of approx. 4 MASL). The basic statistical parameters obtained for the said period are included in the table [Table 18].

Table 18 Statistical analysis of meteorological parameters measured at the MB metering station for the period between June 13, 2022 (12:00 AM) and October 12, 2023 (11:45 PM) [source: data of Baltic Neptun VIII sp. z o.o.]

PARAMETER	UNIT	VALUE		
		AVERAGE	MINIMUM	MAXIMUM
Relative humidity	[%]	85.98	39.96	100.00
Atmospheric pressure	[hPa]	1015.20	983.38	1042.62
Air temperature	[°C]	11.92	-2.96	25.20
Wind speed	[$m \cdot s^{-1}$]	6.89	0.01	20.25
Prevailing wind directions	-	W, WSW, SW		

3.4.3 Air quality

In Poland, the tasks related to the performance of environmental status surveys and assessments, including air quality monitoring, are performed by the Inspectorate of Environmental Protection as part of the State Environmental Monitoring, the program of which is prepared by the Chief Inspector of Environmental Protection (GIOŚ) and approved by the Minister competent for the environment. As part of this program, tasks related to meeting the requirements included in EU regulations and Polish law, as well as international conventions signed and ratified by Poland are performed. The Strategic State Environmental Monitoring Program for 2020-2025 is currently being implemented.

Due to the fact that air quality monitoring is carried out only in onshore areas, the values obtained from measurements for the Pomorskie Voivodeship, and in particular for the coastal zone were assumed as the reference level for the sea basin covering the area of the planned OWF. For most parameters measured by the Inspectorate of Environmental Protection for 2022, concentration criteria were obtained corresponding to purity class A, except for benzo(a)pyrene suspended in PM10 dust (Annual assessment of air quality in the Pomorskie Voivodeship, Voivodeship Report for 2022).

In the sea areas which include the areas of the planned Baltic East OWF, no measurements were carried out to assess the air quality in terms of greenhouse gas content, dust concentration and other harmful volatile substances. The nearest place where the monitoring of the said air pollutants was carried out was the onshore station in Łeba. Due to the lack of significant, persistent sources of pollution emission above the open sea areas, the air purity parameters should not be worse here than those measured on the shore.

Based on the measurement data made available by the Chief Inspectorate of Environmental Protection (GIOŚ) for Łeba metering station during the last five years (2019–2023), the following substance concentration values are presented in table [Table 19]:

- sulfur dioxide (SO_2) – maximum 24-hour concentration (admissible value: 125 µg m^{-3});
- nitrogen dioxide (NO_2) – 24-hour average concentration (admissible value: 40 µg m^{-3});
- ozone (O_3) – number of days with exceeded 8-hour average (assumed number of no more than 25 days with concentration of 120 g m^{-3}).

Table 19 Content of selected gaseous substances in the air measured at Łeba station in 2019–2023 [Source: data of the Chief Inspectorate of Environmental Protection]

YEAR	SO_2 24 H	NO_2 24 H	O_3
	µg·m^{-3}	µg·m^{-3}	No. of days >120 µg m^{-3}
2019	5.0	23.0	14
2020	3.2	18.4	4
2021	5.8	24.0	13
2022	5.8	22.7	6
2023	2.4	12.8	1

According to the assessment included in the report of the Regional Department of Environmental Monitoring in Gdańsk (Annual assessment of air quality in the Pomorskie Voivodeship, Voivodeship Report for 2022), the applicable criteria concerning the target level for the protection of human health and plant protection are met in the Pomorskie Voivodeship.

Such a level of recorded values causes that the coastal zone area in the Łeba area has the air purity class A. However, the open sea areas planned for the construction of the Baltic East OWF are located at a significant distance from onshore sources of emission of SO_2 and NO_2. These substances are only emitted by vessels, and this emission depends on the traffic intensity and the type of vessels. The Baltic East OWF area is free of any physical obstacles hindering the spread of these substances. Therefore, the average concentrations of these compounds in the air should be significantly lower. For example, based on data on vessel traffic in 2018–2019, using the IWRAP [IALA Waterway Risk Assessment Program, the official model of the International Association of Lighthouse Authorities (IALA) – the international organization responsible for navigational safety], it was calculated that in the area bounded by coordinates: 55°30' N; 16°00' E and 54° 00' N; 19°00' E, vessels consume over 100,000 mg of fuel per year, emitting over 300,000 mg of CO_2, over 5,000 mg of SO_2, over 9,500 mg of NO_x and over 700 mg of dust.

Taking into account the parameters of the currently used marine fuels resulting from the applicable regulations, the actual emissions from fuel combustion may be significantly lower than those calculated using the IWRAP.

In the case of ground ozone concentration (present in the near-surface layer of the atmosphere), which in the coastal area is higher than in inland areas, it can be assumed that these values in the open sea will not differ significantly from those recorded in the coastal zone. Ground ozone is a secondary pollutant and is formed as a result of photochemical reactions of nitrogen oxides and volatile organic compounds in the atmosphere, with the intensity of these reactions increasing as the air temperature and the amount of sunlight increase. Therefore, the highest concentration of ozone near the Earth surface occur in spring and summer. Due to the fact that the ozone precursor comprises, i.a., nitrogen oxides from transport, due to emissions lower at sea than onshore, it can be assumed that the expected ground ozone concentration will be negligible and the persistence of a certain level in the atmosphere is largely due to the presented natural reasons (mainly weather-related, generated as a result of photochemical reactions of nitrogen oxides and volatile organic compounds in the atmosphere accelerated by high air temperature – on sunny, hot days, the highest concentration of ozone occur most often during the afternoon hours). Also due to the fact that ozone is easily transmitted over long distances, its concentration above sea areas depends largely on the current conditions of atmosphere circulation over the Baltic Sea area, especially its concentration in air masses coming from the southern and south-western Europe.

3.5 Background noise, including noise associated with vessel traffic

3.5.1 Characteristics of the acoustic soundscape of the Baltic Sea

The background noise of the sea is a set of underwater sounds consisting of sounds of natural and anthropogenic origin over time. The most important natural sound-generating factor is wind speed influencing the formation of waves that rise sound levels under water. It usually increases in winter, which results in higher underwater sound levels in the Baltic Sea. Animals also affect underwater acoustic soundscapes (Johnson et al. 1947), however, according to some researchers, the share of animals in long-term monitored noise in the Baltic Sea is mostly negligible (Mustonen et al. 2019). Anthropogenic sounds shaping underwater noise in the Baltic originate mainly from different types of navigation. The acoustic soundscape is also to a lesser extent shaped by activities relating to offshore operations, such as the use of sonars, seismic methods, explosions resulting from military activities, underwater construction works and operation of plants, such as e.g. offshore wind farms.

Differences between the occurrence of natural and anthropogenic sources emitting sounds, together with local sound propagation conditions, may result in large variability of underwater sound levels, as demonstrated in the Baltic Sea Information on the Acoustic Soundscape (BIAS) research program. The most significant difference between the two survey locations in the Baltic Sea during the BIAS monitoring was almost 50 dB in the band with a central frequency of 63 Hz of one third octave and 40 dB in the band with a central frequency of 125 Hz of one third octave. Both locations differed significantly in vessel traffic intensity and natural features (Mustonen et al. 2019). It is characteristic to note much higher SPLs in locations with high vessel traffic intensity. During the large-scale BIAS monitoring, the highest average SPLs in the band of one third octave with a central frequency of 125 Hz were recorded in the Baltic Sea, in Danish Straits (approx. 110 dB re 1 µPa), and the lowest in the Åland Sea (approx. 75 dB re 1 µPa) (Mustonen et al. 2019).

The Baltic Sea is characterized by sound propagation conditions unique to other seas, which affects the acoustic soundscape of the sea basin. This is mainly caused by a relatively small depth of 55 m on average. The low depth results in an increased interaction of propagating sound waves with the seabed and sea surface, which leads to a reduction in sound propagation, especially at lower frequencies – the so-called cut-off phenomenon (Urick 1983; Mustonen et al. 2019). The low depth also makes the Baltic Sea more susceptible to temperature changes caused by seasonal fluctuations in atmospheric temperature, which also affects the conditions of sound energy propagation.

Therefore, the Baltic Sea is a sea with a very diverse acoustic soundscape, with a strong impact of maritime navigation, as well as natural factors, additionally emphasized by the low depth.

3.5.2 Background noise in the Baltic East OWF location

Determination of background noise levels is crucial for forecasting possible changes in the acoustic soundscape related to the implementation, operation or decommissioning of the Project and having a potential impact on marine organisms.

Monitoring methodology

In order to characterize the sound conditions occurring in the Baltic East OWF area, passive acoustic monitoring was carried out between July 1, 2022 and October 23, 2023. The surveys were performed in accordance with the BIAS recommendations, according to which the monitoring of background sounds should cover most of the year, in order to indicate the prevailing values of sound pressure levels (SPL) in a given area (Mustonen et al. 2019).

Background noise measurements in the Baltic East OWF area were carried out at two stations (AW 01, AW 02) [Figure 17]. Autonomous SM4M Wildlife Acoustics sound recorders were used for monitoring. Data were collected continuously, using the operation cycle with 5 minutes recording and 25 minutes in standby mode. The equipment was serviced during eight cruises when the obtained data were collected.

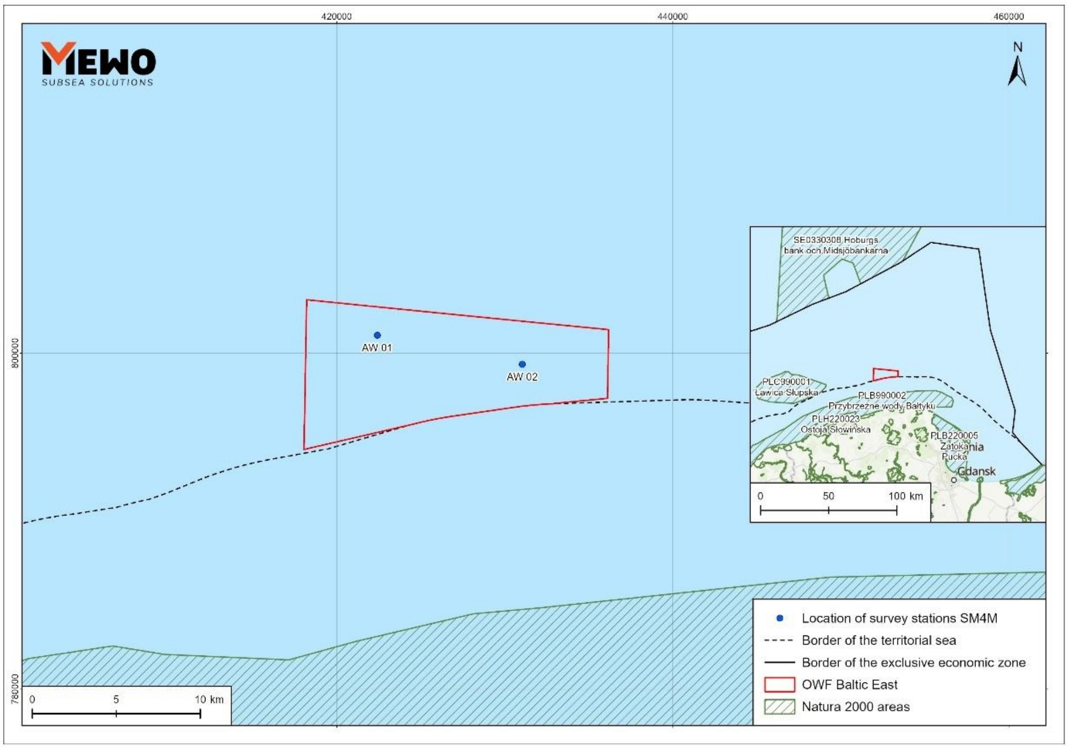

Figure 17 Location of background noise monitoring stations in the Baltic East OWF area (AW 01 and AW 02)

The background noise analysis was carried out in frequency bands with a width of one third octave, with central frequencies from 20 Hz to 20 kHz. This is in line with the recommendations of the EU Technical Group on Underwater Noise (TG Noise) (Dekeling et al. 2014a-C) and HELCOM Expert Group on Underwater Noise (EG Noise) (HELCOM 2021). This frequency range covers most anthropogenic noise recorded in the underwater acoustic soundscape. Frequencies 63 Hz and 125 Hz are good indicators of continuous sound generated by vessels, and higher frequencies are analysed due to their high importance for the orientation and communication of marine mammals (HELCOM 2021). Navigation in the Baltic Sea takes place on 19% of its surface area, which, following the Mediterranean Sea, makes the sea basin the second European sea with the largest shipping traffic (European Commission 2022).

Results of the conducted monitoring

The results of acoustic noise monitoring in the area of the planned Baltic East OWF showed dominant sound pressure levels with values of approx. 100 dB re 1 µPa, in a wide frequency band of 20 Hz – 20 kHz. The sound levels recorded at the AW 02 station were higher by approx. 3 dB than those recorded at the AW 01 station [Figure 18, Figure 19]. This probably results from a shorter distance of the AW 02 station from the shipping route and local differences in sound propagation affected by bathymetry and geoacoustic properties of the seabed [Figure 18].

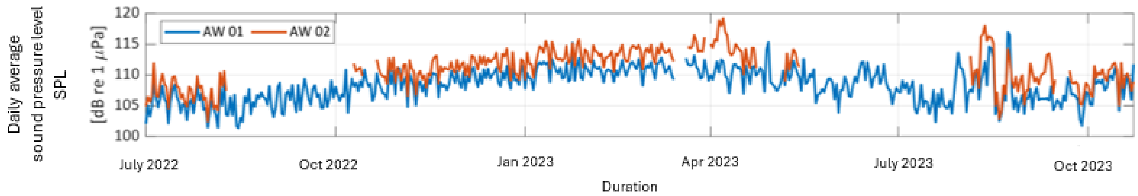

Figure 18 Daily averaged sound pressure levels SPL for metering stations in the Baltic East OWF area during the entire monitoring period

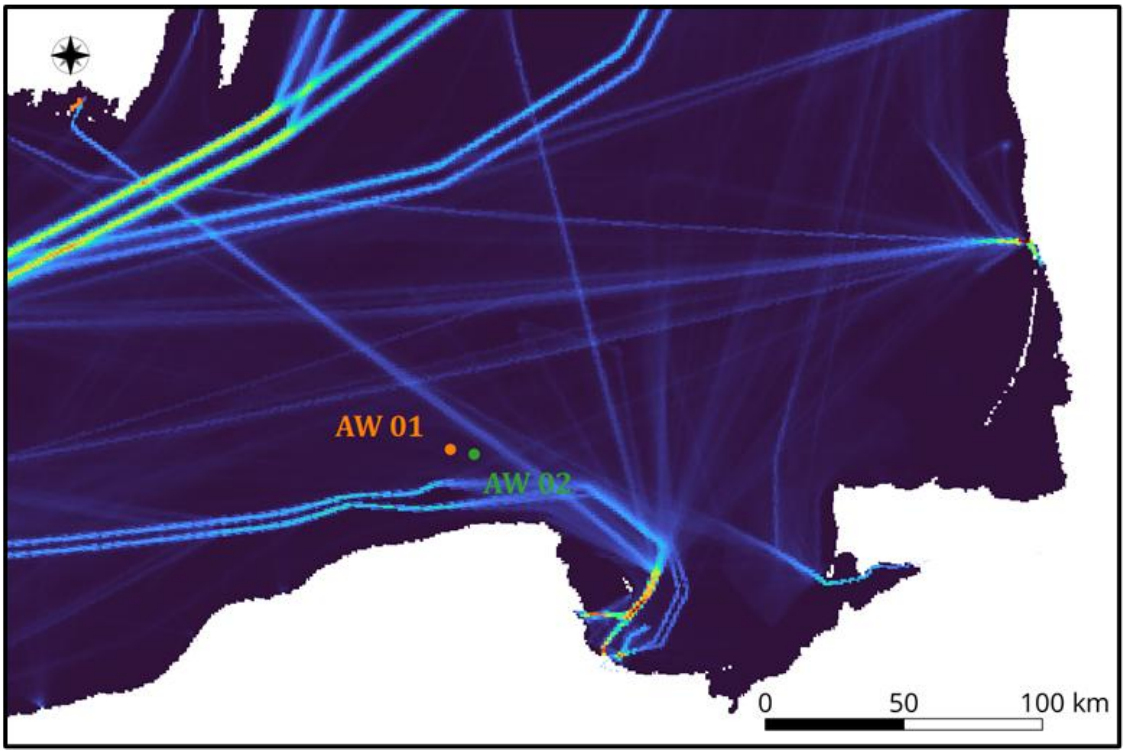

Figure 19 AW 01 and AW 02 monitoring stations with annual average sea traffic intensity in the southern Baltic Sea (color gradient from blue through yellow to red, indicating an increase in vessel traffic intensity; HELCOM, 2022)

For both metering stations, anthropogenic noise plays a significant role in shaping the background noise, which is visible in the frequently observed high sound levels in the low frequency bands 63 Hz and 125 Hz [Figure 20, Figure 21, Table 20]. During the analysis, sounds emitted by the sonar were also identified, which do not significantly affect the long-term image of the background noise.

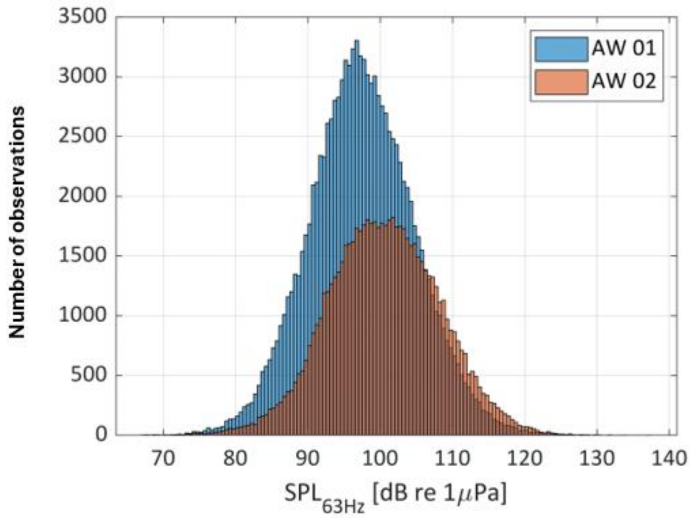

Figure 20 Sound pressure level (SPL) histogram with a center frequency of 63 Hz for the survey stations in the Baltic East OWF Area

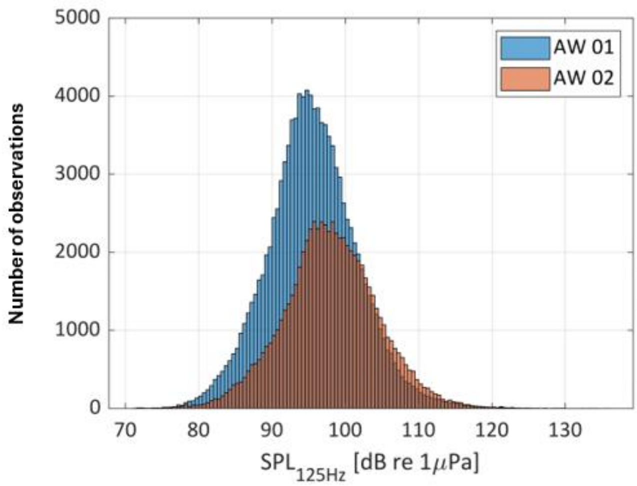

Figure 21 Sound pressure level (SPL) histogram with a center frequency of 125 Hz for the survey stations in the Baltic East OWF Area

Table 20 Statistics of measured SPLs [dB re 1μPa] for bands with a central frequency of 63 Hz and 125 Hz and for the broadband band of 20 Hz – 20 kHz (levels L_{95}, L_{50}, L_{05} mean levels that were exceeded by 95%, 50% and 5% of the monitoring time) for metering stations in the Baltic East OWF area during the entire monitoring period

FREQUENCY	SURVEY STATION	AVERAGE SPL [DB RE 1 µPA]	L_{95}	L_{50}	L_{05}
63 Hz	AW 01	97.5	85.4	97.4	109.7
	AW 02	100.5	88.2	100.5	113.0
125 Hz	AW 01	95.5	85.6	95.3	105.7
	AW 02	98.0	87.3	97.9	108.6
20 Hz-20 kHz	AW 01	108.3	99.0	108.0	118.0
	AW 02	111.2	101.2	111.0	121.5

At both stations, significant changes in sound levels were recorded over time, with short-term fluctuations exceeding 20 dB and slow seasonal changes, changing average noise levels by up to 5.6 dB in the frequency band 20 Hz – 20 kHz [Figure 22, Table 21]. Seasonal variability was even approx.

10 dB for both stations, whereas the highest SPLs were recorded in the period from late winter to early spring. This is in line with the results of seasonal changes in noise levels recorded during other surveys in the southern Baltic Sea, which amounted to 12 dB or 10–15 dB, with higher levels in winter (Wagstaff and Newcomb 1987; Klusek and Lisimenka 2016). Seasonal variability was more evident at AW 02 metering station. It is likely that the main cause of seasonal differences comprises the effect of the thermocline on the sound velocity profile and thus the effectiveness of underwater noise propagation. In summer, the upper layers of water heat up, causing sound waves to refract downwards and reach the seabed, resulting in faster loss of sound energy (Brekhovskikh and Lysanov 2003; Mustonen et al. 2019). Therefore, in winter there are better conditions for sound propagation in the sea.

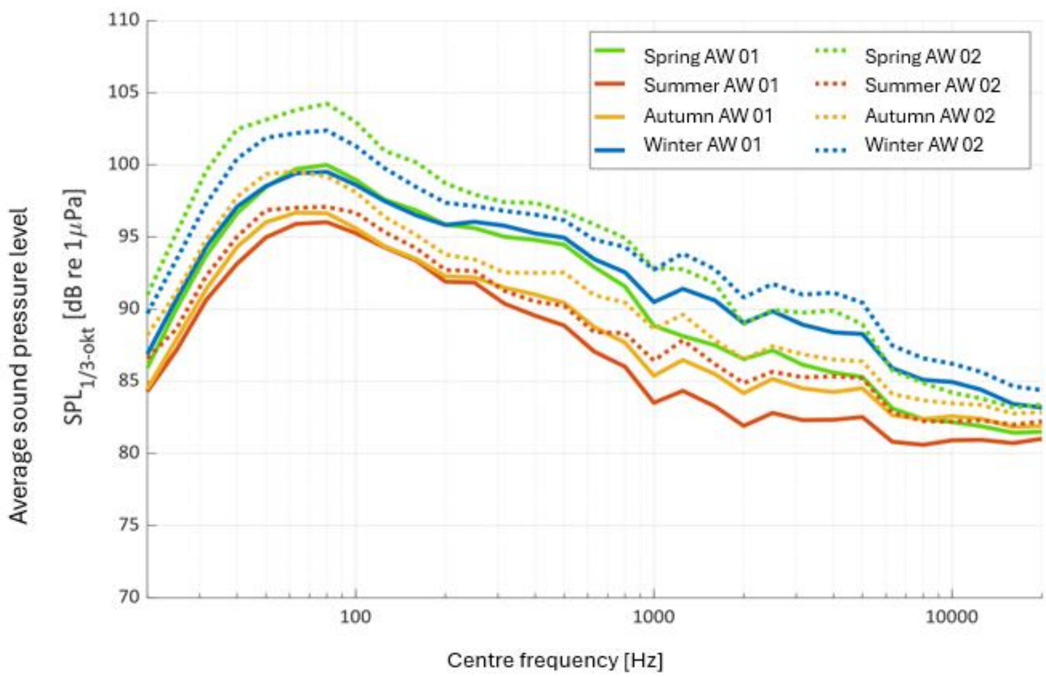

Figure 22 Average sound pressure levels $SPL_{1/3\text{-}Oct}$ for all seasons of the year recorded at the metering stations in the Baltic East OWF area during the entire monitoring period SPL_{63}[dB re 1 µPa]

Table 21 Statistics of measured SPLs [dB re 1 µPa] for individual seasons of the year and 20 Hz broadband band – 20 kHz recorded for metering stations in the Baltic East OWF area for the entire monitoring period (Levels L_{95}, L_{50}, L_{05} mean levels that were exceeded by 95%, 50% and 5% of the monitoring time)

SEASON	SURVEY STATION	AVERAGE SPL [DB RE 1 µPA]	L_{95}	L_{50}	L_{05}
Spring	AW 01	110.1	102.8	109.5	119.5
	AW 02	114.1	106.3	113.7	123.3
Summer	AW 01	106.8	96.9	106.6	116.8
	AW 02	108.5	97.4	108.3	119.1
Autumn	AW 01	107.4	98.8	106.9	117.3
	AW 02	110.0	101.4	109.4	120.4
Winter	AW 01	110.3	104.3	109.6	118.6
	AW 02	112.7	105.7	111.9	122.3

The results of the background noise monitoring carried out in the Baltic East OWF area are consistent with the results of other measurement campaigns from the southern Baltic Sea area and indicate a significant anthropogenic impact of maritime navigation in shaping the sound pressure levels SPL (Mustonen et al. 2019). Noise levels in the surveyed location are also characterized by high seasonal variability, to which both natural and anthropogenic factors contribute. The background noise levels in the area of the planned Baltic East OWF fit into the diverse acoustic soundscape of the Baltic Sea.

3.6 Electromagnetic field

Electromagnetic fields occurring in the environment can be divided into natural fields and fields of anthropogenic origin (referred to as artificial fields). The geomagnetic field of the Earth, whose intensity ranges from 16 to 56 A m^{-1}, is best recognizable from natural fields. An electric charge accumulates on the Earth's surface, which is a source of natural electric field. The intensity of the natural electric field of the Earth is approx. 120 V m^{-1} under moderate weather conditions. In the marine environment, the values of the electric field and geomagnetic field are similar. There are no artificial sources of electromagnetic field in the Baltic East OWF area. The existing DC transmission system between Poland and Sweden (SwePol Link) is located at a distance of several kilometers to the west from the planned location of the Baltic East OWF. The projects planned to be implemented related to the generation of electromagnetic fields include: DC transmission system between Poland and Lithuania (Harmony Link) located at a distance of several kilometers to the east (over 16 km) and the following facilities related to offshore wind energy: substations, cables between wind turbines within the OWF, grid connection infrastructure and communication systems, as well as the currently implemented nuclear power plant in Lubiatowo-Kopalino (including in the sea area).

Changes in natural electric fields have no direct impact on living organisms. Natural magnetic fields vary according to geographical location. They have a significant impact on some living organisms. Electromagnetic fields generated as a result of electric current flow may change natural migratory behavior of sea mammals and fishes, and may also be a source of thermal energy introduced into the marine environment. So far, no indicators have been developed that could be used to assess the condition of the marine environment for descriptive indicator W11, including indicator 11.4.1 entitled "Intensity and spatial range of electromagnetic and electric fields" (according to the MSFD). These factors are currently not monitored in the PSA [Chief Inspectorate of Environmental Protection 2018, 2024].

3.7 Cultural values, monuments and archaeological sites and objects

There are no elements of underwater cultural heritage in the Baltic East OWF area.

In the surveyed area around the Baltic East OWF during the geophysical surveys performed from March 2022 to May 2024 a total of 3 wrecks were found, including 1 (marked as ID: WK-0055) named "Żaglowiec" which has been already identified on the basis of the SIPAM data and 2 (marked as ID: SSS-033 and SSS-049) not yet identified [Figure 23].

The following is a summary of the distances of identified wrecks in the surveyed area (1 NM) from the boundary of the Baltic East OWF area [Table 22].

Table 22 List of identified wrecks in the surveyed area (1 NM) with the distance from the boundary of the Baltic East OWF area [Source: Baltic East OWF]

WRECK ID	DISTANCE FROM THE BOUNDARY OF THE BALTIC EAST OWF AREA
WK-0055	666 m
SSS-033	67 m
SSS-049	113 m

The newly found wrecks, in accordance with the applicable regulations, have been reported as potential elements of underwater cultural heritage to the Pomeranian Voivodeship Heritage Conservation Officer in Gdańsk, the Maritime Office in Gdynia, and the Hydrographic Office of the Polish Navy.

Until the submission of this EIA Report, conservation services have not decided whether the reported wrecks will be subject to special protection. The applicant assumes that if these wrecks are subject to special protection in their location and in direct protection zones, no works related to the construction and operation of the Baltic East OWF will be carried out, first in accordance with the conditions specified in the Permit for erection and use of artificial islands, structures and devices for the Baltic East OWF and then according to the terms specified by the Pomeranian Voivodeship Heritage Conservation Officer in Gdańsk.

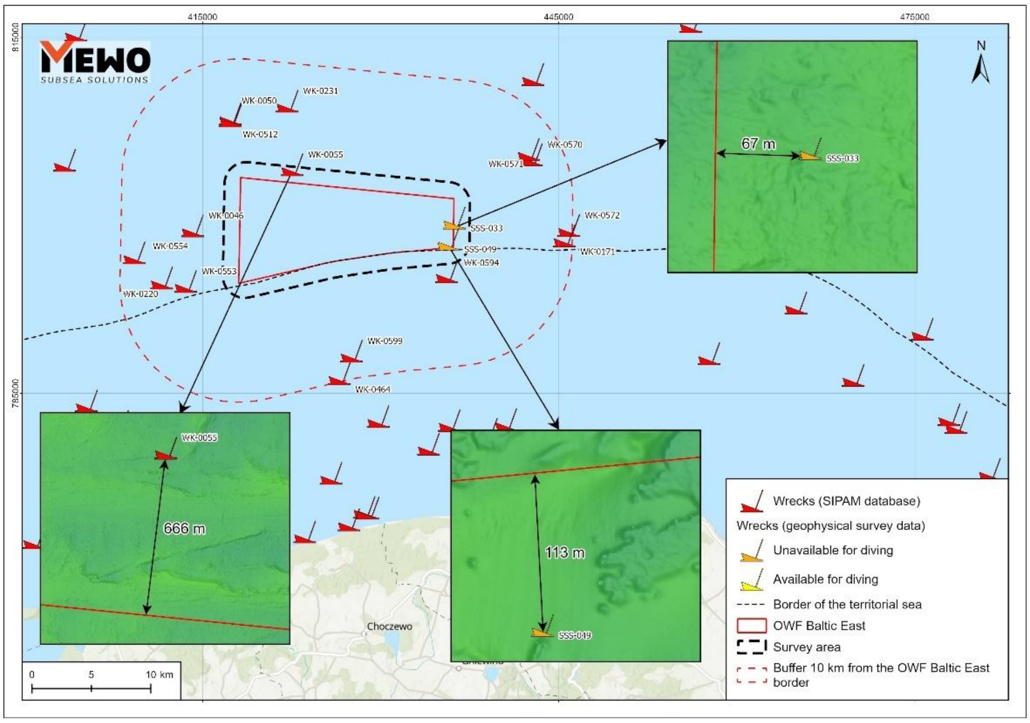

Figure 23 Cultural heritage facilities in the Baltic East OWF area

In the Permit for erection and use of artificial islands, structures and devices for the Baltic East OWF, the Investor was obliged to carry out an archaeological survey and submit its results to the Director of Maritime Office. It was also obliged to perform works in the vicinity of the identified cultural heritage facilities as part of the implementation of the project under archaeological supervision. Moreover, the Investor is obliged to ensure in situ protection for monuments including their surroundings, i.e. the seabed at a distance of at least 25 m from the external line of the monument until the protection zone is established. Works listed in the Permit for erection and use of artificial islands, structures and devices for the Baltic East OWF, which could disturb the seabed, lead to the destruction of the monument or damage it, have been prohibited.

3.8 Use and management of the sea basin and tangible property

The Baltic East OWF area is located within the sea basin POM.46.E, designated by the Regulation of the Council of Ministers of April 14, 2021 *on the adoption of the spatial development plan for internal sea waters, the territorial sea and the exclusive economic zone at a scale of 1:200 000* (Journal of Laws, item 935, as amended) [Figure 24]. For the sea basin, renewable energy generation was indicated as the basic function, at the same time allowing for the performance of other activities in the future, such as: aquaculture, scientific research, cultural heritage, technical infrastructure, prospecting and exploration of mineral deposits and extraction of minerals from deposits, fishing, artificial islands and structures, transport and tourism, sport and recreation. All functions allowed in the sea basin may be performed provided that the basic function is considered as primary function.

The Baltic East OWF area is characterized by a low degree of use by humans, limited to relatively rare fishing activities and occasional navigation.

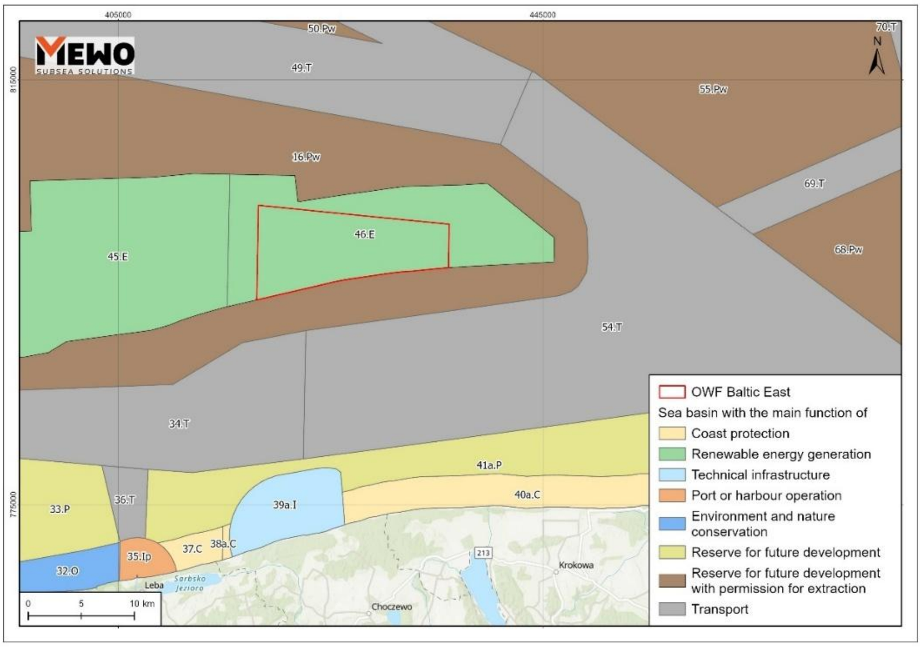

Figure 24 The Baltic East OWF area against the SIPAM PSA [Source: internal materials]

3.8.1 Sea transport (navigation)

3.8.1.1 Vessel traffic on navigation routes

The preliminary analysis covered the traffic of all vessels in the Polish maritime areas (PSA). Figures [Figure 25, Figure 26] show the overall navigation situation in the PSA. The data refer to two periods – 2019 and 2023 – and allow for the assessment of changes in the main navigation routes related to the new traffic arrangement on the Słupsk Bank TSS, applicable from July 1, 2021. The information originate from the AIS-PL data obtained from the Maritime Office in Gdynia.

The maps present the location of offshore wind farms planned for 2026−2030 located in the vicinity of the Project and cable corridors of those projects for which the cable landfall is planned in a similar location.

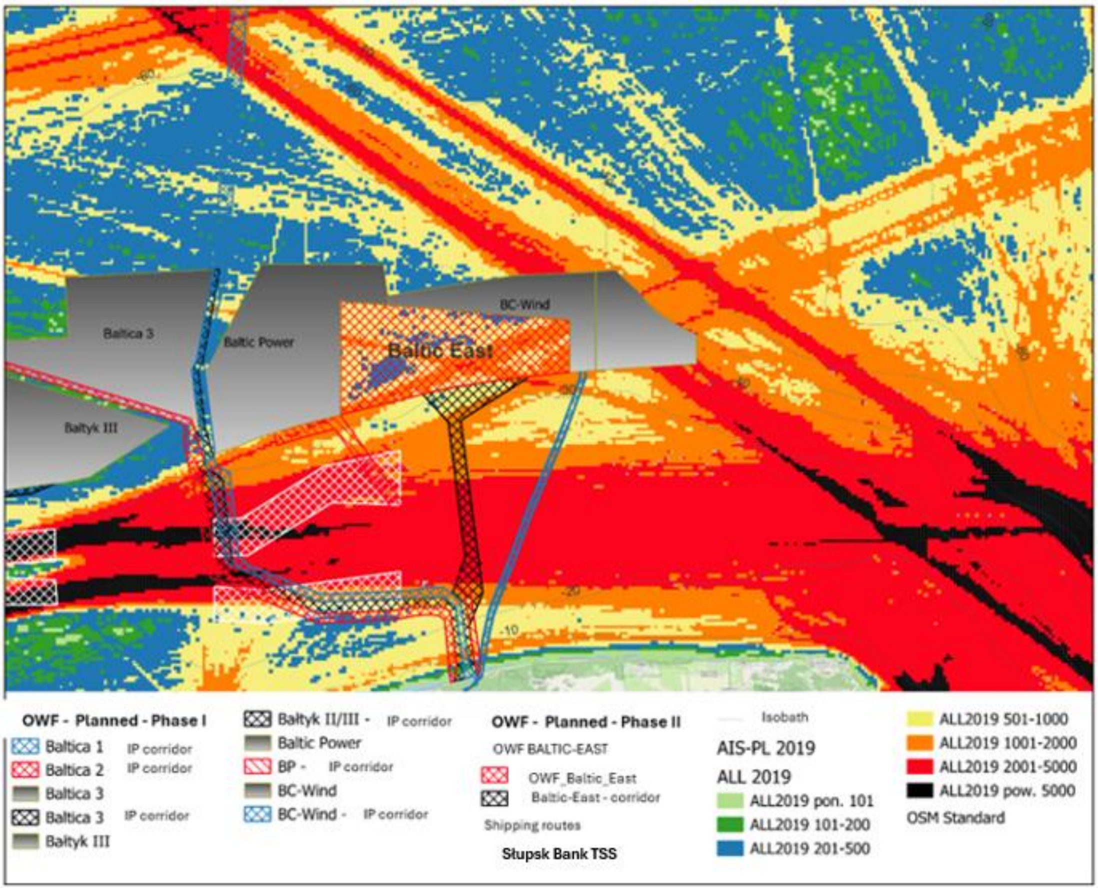

Figure 25 Vessel traffic in the PSA in 2019 [Source: AIS-PL]

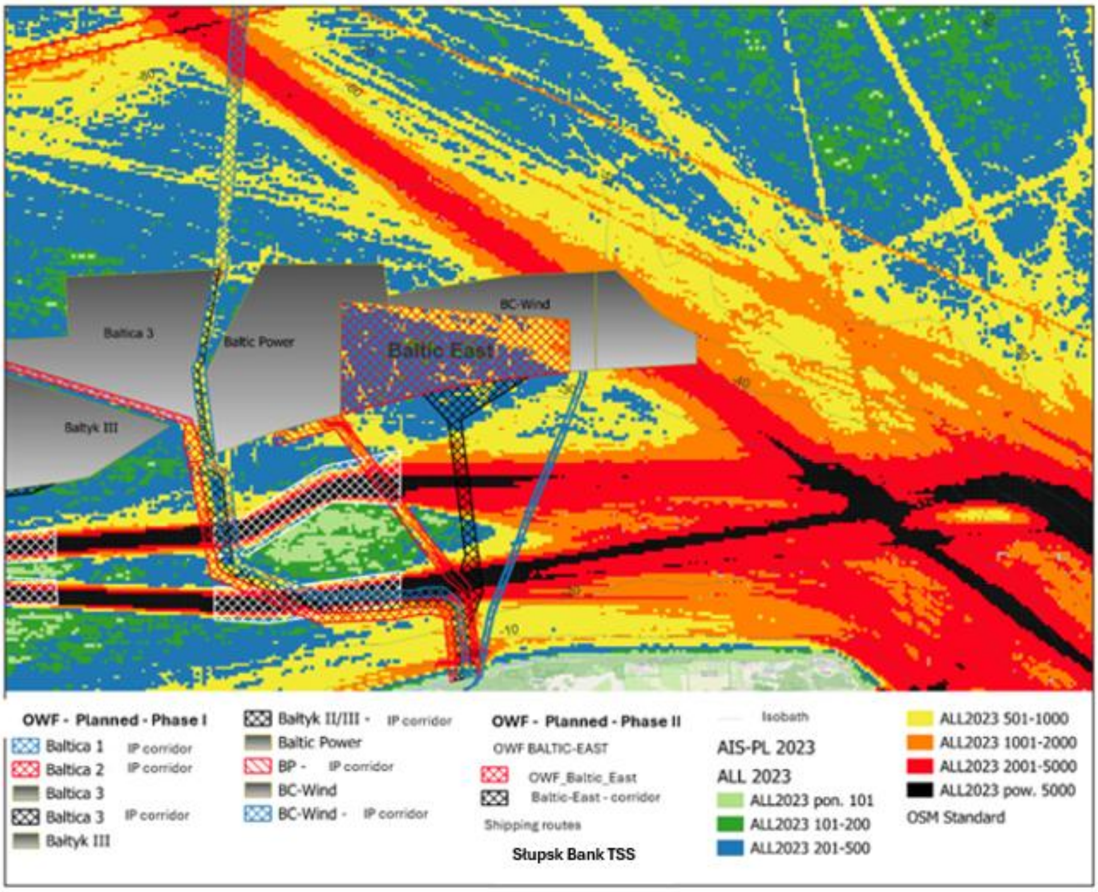

Figure 26 Vessel traffic in the PSA in 2023 [Source: AIS-PL]

3.8.1.2 Vessel traffic in the Baltic East OWF area

The analysis covered a sea basin in a 5 NM buffer area for the Baltic East OWF. The illustration of the detailed navigation situation in the surveyed area was prepared on the basis of the AIS-PL data for the period of 2019–2023 obtained from the Maritime Office in Gdynia.

The AIS-PL data in the maps below are presented divided by vessel category in the following arrangement shown in the table below [Table 23].

Table 23 Division of vessels by their category (type) [Source: internal materials]

ITEM	VESSEL CATEGORY	CATEGORY DESIGNATION
1	Merchant vessels – vessels of the following types Bulk Carrier, Bulk/Liquid Carrier, Cement Carrier, Container Ship, General Cargo Ship, Heavy Load Carrier, Refrigerated Cargo Ship, Ro-Ro Cargo Ship, Self Discharging Bulk Carrier, Vehicles Carrier	CARGO
2	Fast vessels (ferries) – vessels registered as high speed craft[1] (HSC)	FAST FERRY
3	Fishing vessels (total) – vessels of the following types Fishery Support Vessel, Fishing Vessel	FISH
4	Fishing vessels moving at speeds below 4 knots* – as above.	FISH-V4
5	Other vessels — other vessels, special vessels e.g. warships or unspecified vessels	OTHER
6	Passenger vessels (ferries) – vessels of the following types Passenger (Cruise) Ship, Passenger Ro-Ro Cargo Ship, passenger ferries	PAX
7	Pleasure crafts — vessels of the following types Yacht, Leisure Vessel, Sail Training Ship	PLEASURE
8	Support vessels – vessels of the following types Dredger, Hopper Dredger, Motor Hopper, Offshore Supply Ship, Offshore Support Vessel, Offshore Tug/Supply Ship, Pipe Layer, Pusher Tug, Research Vessel, Standby Safety Vessel, Tug, Utility Vessel	SUPPORT
9	Tankers – vessels of the following types Bitumen Tanker, Bunkering Tanker, Chemical Tanker, Chemical/Oil Products Tanker, CO2 Tanker, Crude Oil Tanker, LNG Tanker, LPG Tanker, Molasses Tanker, Oil Products Tanker	TANK

* Vessel traffic at speeds below 4 knots means supposed fishing. This assumption may mean the probability of fishing and refers to the traffic of fishing vessels in the open sea.

The following is the vessel traffic in the surveyed area for selected categories of vessels. This is related to the traffic intensity analysis and the nature of navigation concerning the behavior of individual groups of vessels. The maps [Figure 27, Figure 28, Figure 29 and Figure 30] allow for comparing the intensity of vessel traffic in the CARGO, PAX and TANK categories and the group of vessels considered to be very large, i.e. with a length exceeding 350 m as those which regularly cruise and those for which the biggest changes have occurred.

Changes in the illustration of CARGO vessel traffic result mainly from the direction of vessel traffic resulting from the direct vicinity with the Słupsk Bank TSS vessel traffic separation zone. A slight increase in traffic intensity is less important in this case. The visible significant presence of vessels in 2023 along the planned corridor of the connection infrastructure in its southern part and then

[1] According to the SOLAS Convention, vessels are capable of moving at a speed in m/s expressed by the formula $3.7 \times \nabla^{0.1667}$, where $\nabla =$ displacement volume in cubic meters corresponding to the design waterline, excluding vessels whose fuselage is supported above the water surface in non-displacement mode by aerodynamic forces generated by soil impact.

towards the south-western corner of the Baltic East OWF results from their incorrect classification as CARGO vessels. In fact, the traffic recorded in this area is related to the performance of survey works for currently implemented projects concerning offshore wind energy.

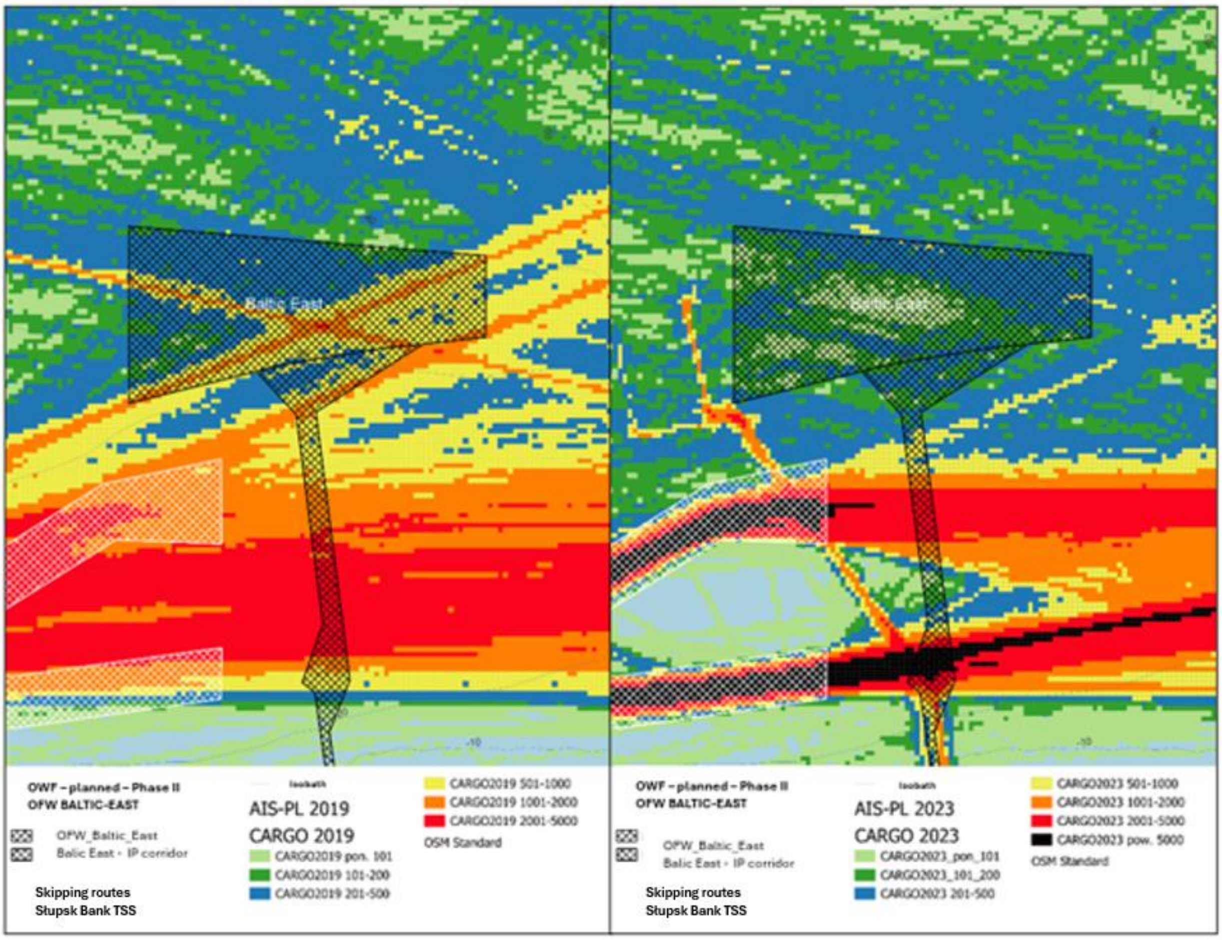

Figure 27 Comparison of CARGO vessel traffic in the surveyed area in 2019 and 2023 [Source: internal materials]

The incorrect marking of the vessel type (category) in the AIS transmitter is quite common, therefore, at subsequent stages of the Project, verification of the recorded AIS data will be necessary to carry out a detailed analysis of traffic intensity.

In general, it can be demonstrated that CARGO vessel traffic in the area and direct vicinity of the Baltic East OWF after introducing changes in the Słupsk Bank TSS is insignificant.

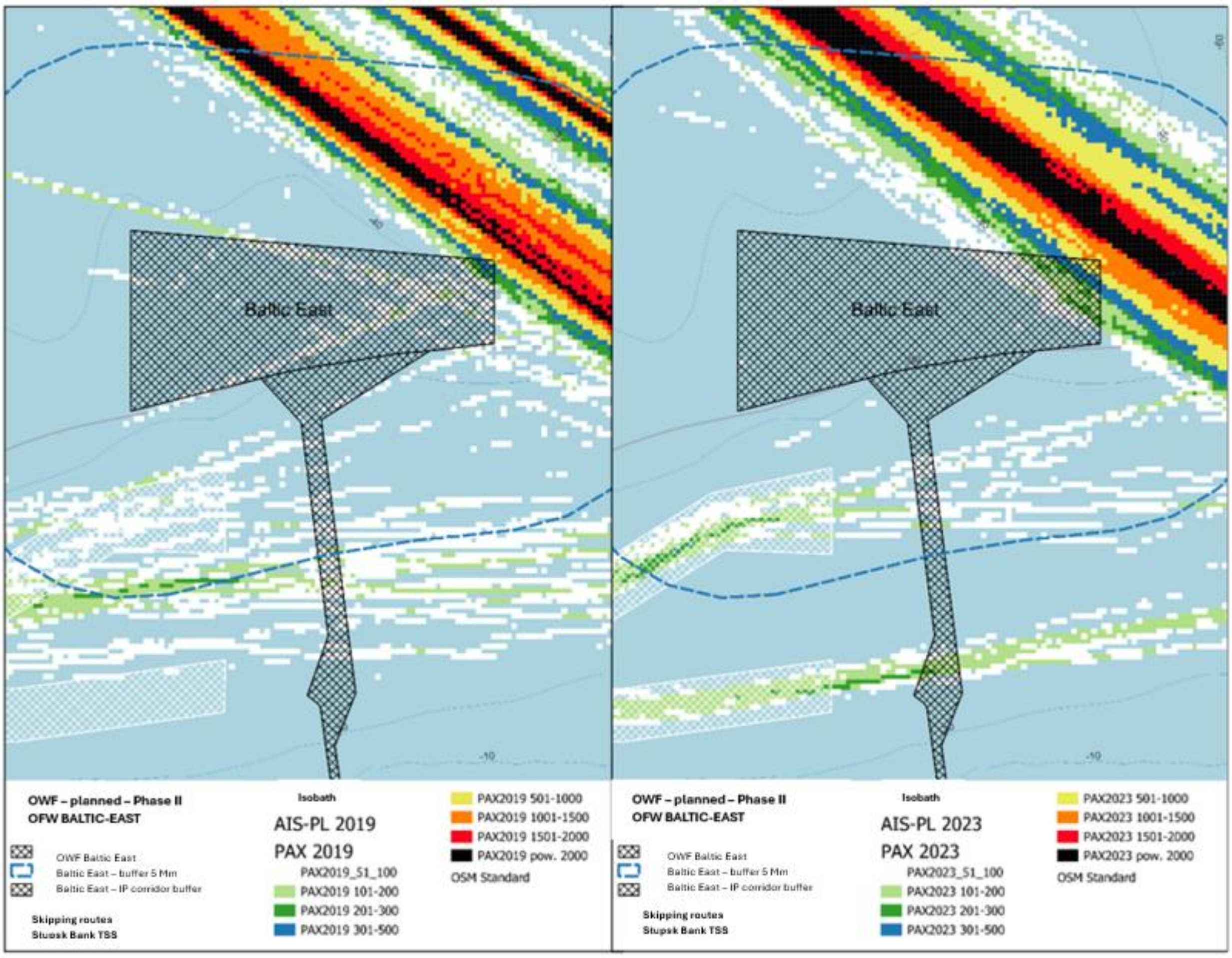

Figure 28 Comparison of passenger vessel traffic (PAX) in the surveyed area in 2019 and 2023 [Source: Internal materials]

tutajThe comparison of passenger vessel traffic in the surveyed area shows a similar level of intensity in the north-eastern part and presents ferry navigation on the Gdynia – Karlskrona route. Minor traffic changes in the southern part are mainly related to traffic direction in the eastern part of the Słupsk Bank TSS.

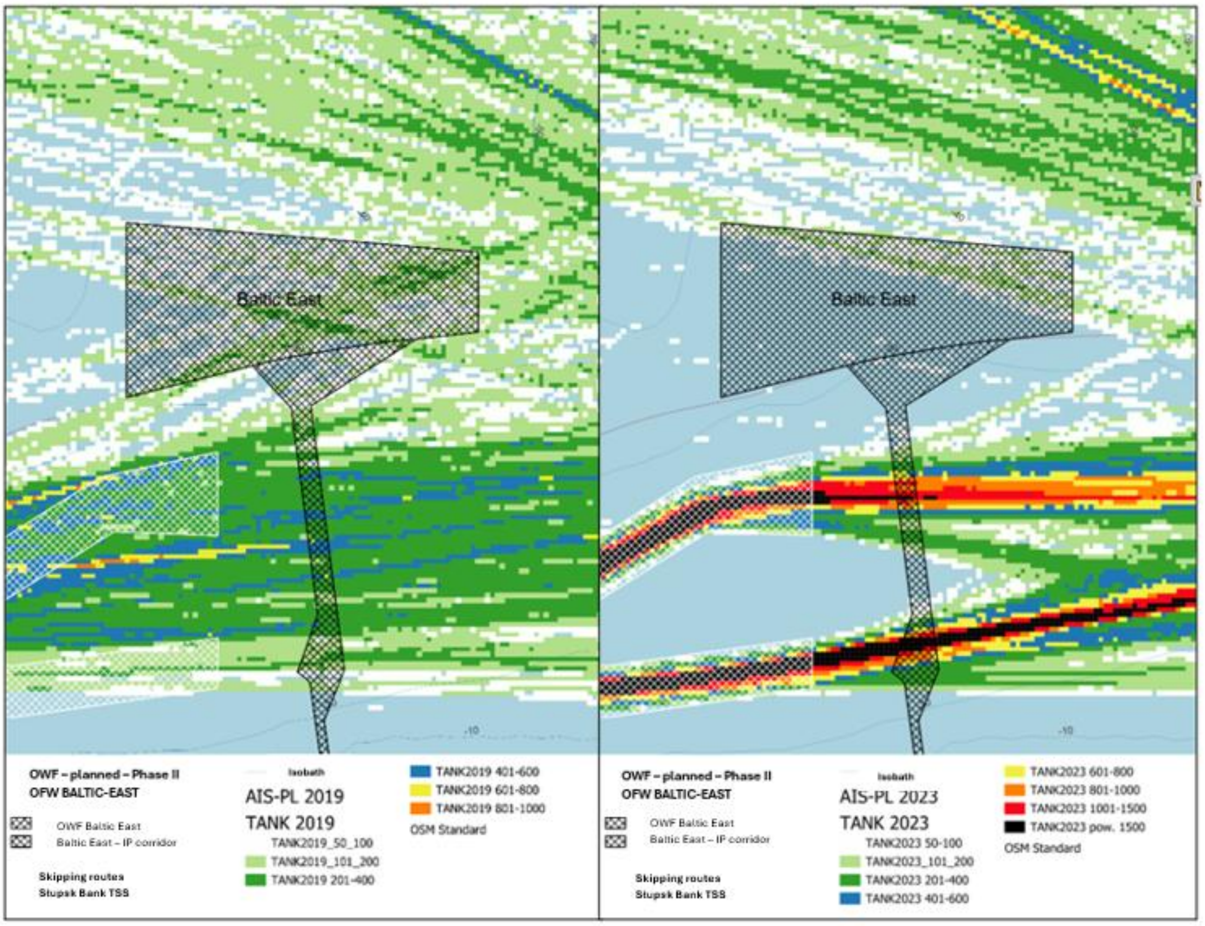

Figure 29 Comparison of tanker traffic (TANK) in the surveyed area in 2019 and 2023 [Source: Internal materials]

The comparison of tanker traffic in the surveyed area shows a significant increase in intensity. This is related to diversification of deliveries of crude oil, petroleum products and increased LNG transport. Tanker traffic takes place mainly south of the Baltic East OWF area and partially through the Project area in its northern part.

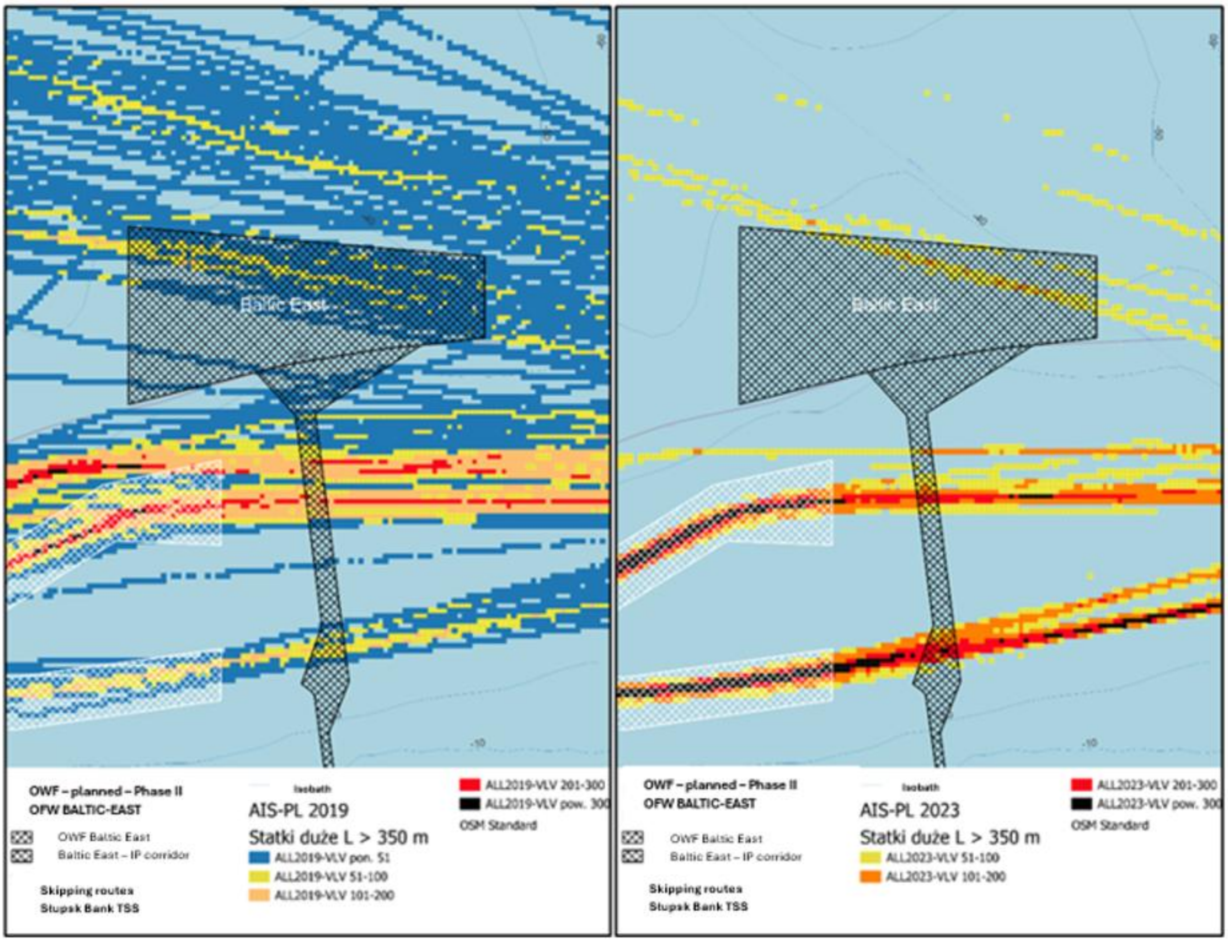

Figure 30 Comparison of very large vessel traffic (L > 350 m) in the surveyed area [Source: Internal materials]

The comparison of the traffic of very large vessels in the surveyed area shows a slight increase in intensity and that there is insignificant tendency for traffic increase in specific directions. This is related to the Słupsk Bank TSS (this applies mainly to the western direction), but also due to the fact that very large vessels with a large draft had to avoid shallow area located in the zone separating the traffic of the eastern part of the TSS.

Very large vessels are equipped with the largest and heaviest anchors. This is important for the Project due to the need to protect cables against damage in case of emergency anchoring.

The traffic of very large vessels takes place mainly south of the Baltic East OWF area and partially through the Project area in its northern part.

Two separate categories of vessels are fishing vessels and pleasure crafts. The maps below [Figure 31, Figure 32, Figure 33] show comparatively the traffic of all fishing vessels, the traffic of fishing vessels moving at speeds below 4 knots and the traffic of pleasure crafts for two periods: 2019 and 2023.

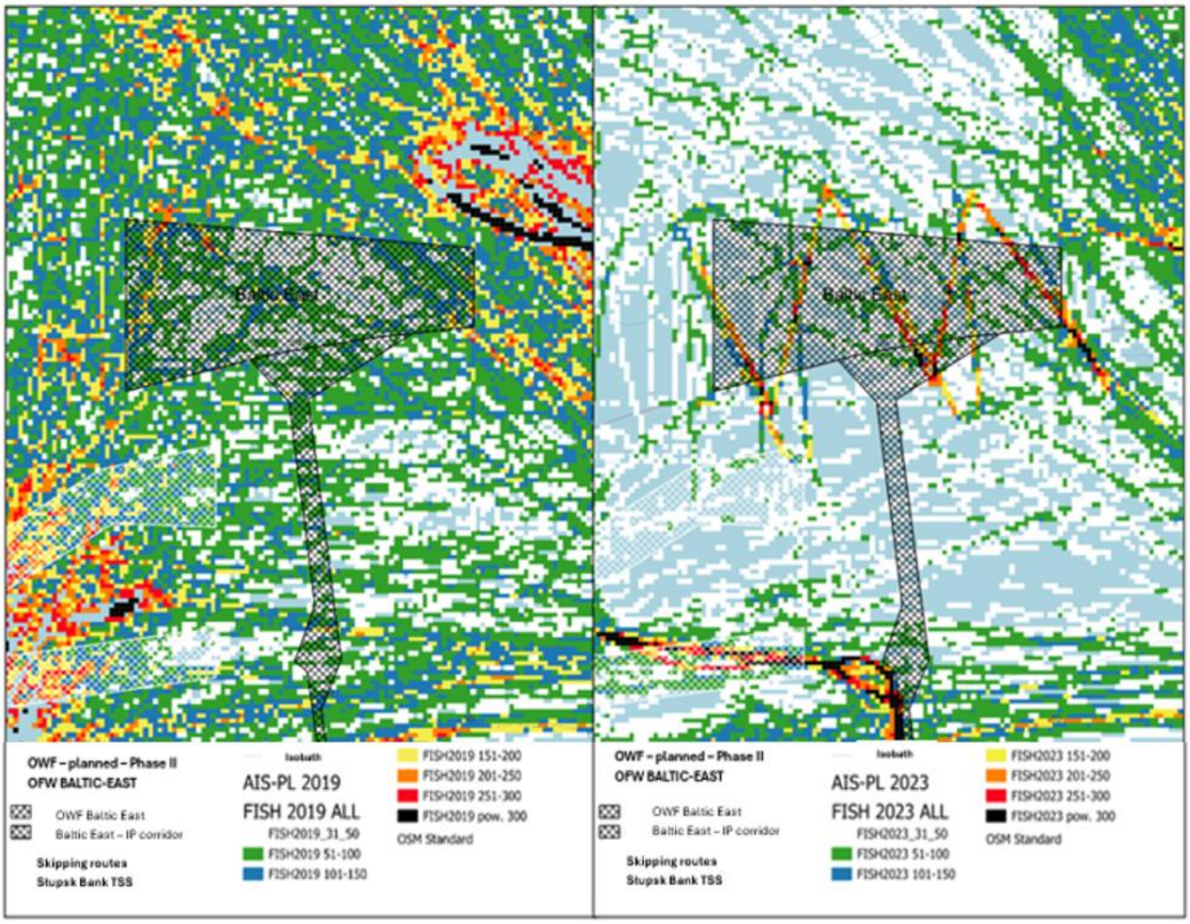

Figure 31 Comparison of fishing vessel traffic (FISH) in the surveyed area in 2019 and 2023 [Source: Internal materials]

The comparison of periods shows a significant decrease in the intensity of fishing vessel traffic. The significant vessel traffic in the southern part of the corridor for the grid connection infrastructure and in the Baltic East OWF area in 2023 results from the fact that, although fishing vessels were present there, they did not perform activities related to travel to fishing grounds or fishing. The presence of these vessels was most probably related to the performance of auxiliary works for the purpose of implementation of projects related to offshore wind energy.

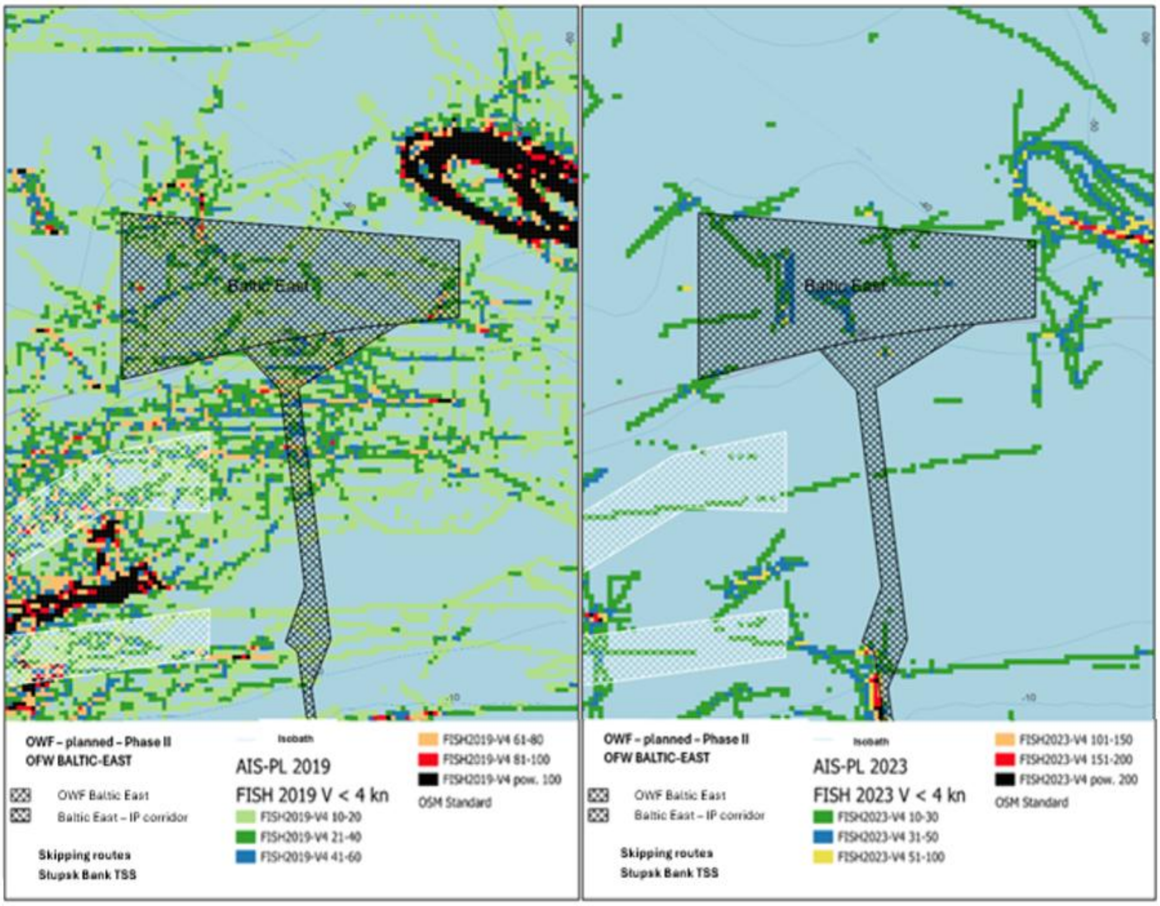

Figure 32 Comparison of traffic of fishing vessels (FISH) traveling at a speed below 4 knots in the surveyed area in 2019 and 2023 [Source: Internal materials]

The comparison of vessel traffic in both periods shows a significant decrease in the presence of fishing vessels moving at a speed below 4 knots. The significant vessel traffic in the southern part of the corridor for the grid connection infrastructure in 2023 results from the fact that, although fishing vessels were present there, they did not perform activities related to travel to fishing grounds or fishing. The presence of these vessels was most probably related to the performance of auxiliary works for the purpose of implementation of projects related to offshore wind energy.

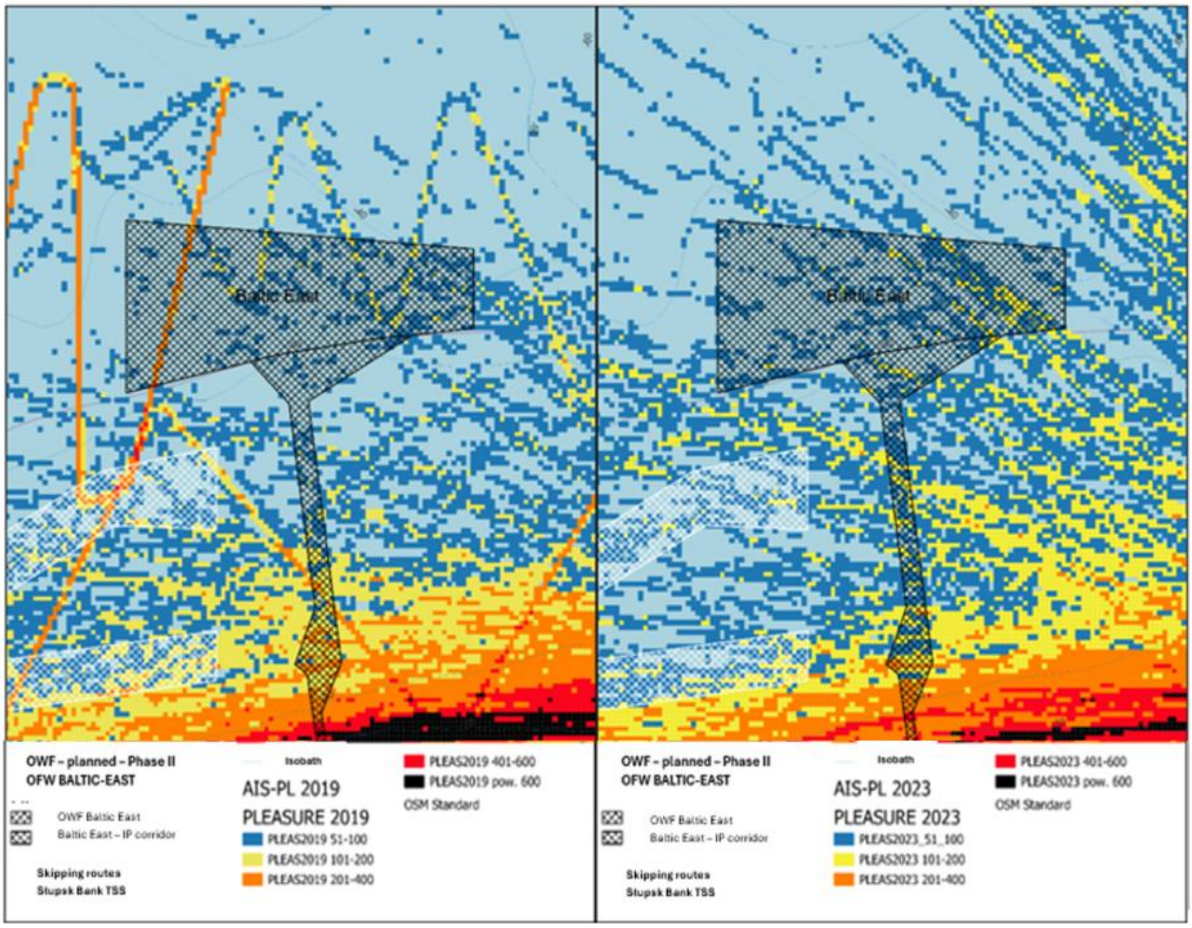

Figure 33 Comparison of pleasure craft traffic (PLEASURE) in the surveyed area in 2019 and 2023 [Source: Internal materials]

The comparison of vessel traffic data in 2019 and 2023 shows a decrease in the intensity of navigation of pleasure crafts. However, this phenomenon should not be considered as a trend. The reduction in the number of vessels may also result from other reasons, for example, performance of works in the coastal zone related to the implementation of offshore wind energy projects. In general, the traffic of pleasure crafts is assessed as it occurs in the coastal zone and the implementation of any project in this zone will have an impact on pleasure navigation.

This study omits the assessment of traffic of other vessels (OTHER). The reason for this is that these vessels do not primarily travel between ports. Their traffic is most often related to the type of performed tasks and is cyclical in nature. Moreover, a detailed assessment was not carried out as it requires prior verification of the classification of categories (types) of vessels.

Due to the difficulty in determining the traffic patterns of auxiliary vessels (SUPPORT), the assessment was omitted. The work of these vessels is usually closely related to the performance of specific tasks in sea basins and their traffic ceases upon completion of these tasks.

3.8.2 Fisheries (volume and value of fish catches, amount of fishing effort)

In the Baltic East OWF area activities related to fishery are carried out by Polish fishing vessels. These activities were analysed on the basis of data from fishing vessel catch reports, taking into account the place of fishing (fishing square or geographical position [Figure 34], fish species, month of fishing, fishing gear and vessel size (vessels up to 12 m and over 12 m). The 12 m criterion was adopted to distinguish vessels that may be classified as coastal fishing vessels (*small scale fisheries* <12 m) based on the provisions determining the 12 m boundary of Regulation (EU) No. 508/2014 of the European Parliament and of the Council of 15 May 2014 *on the European Maritime and Fisheries Fund and repealing Council Regulations (EC) No. 2328/2003, (EC) No. 861/2006, (EC) No. 1198/2006 and (EC) No. 791/2007 and Regulation (EU) No. 1255/2011 of the European Parliament and of the Council* (OJ Official Journal of 2014, No. 149, p. 1, as amended). The analysis was prepared on the basis of fishing data for the years 2019–2023 available in the npzdr.pl database (National Fisheries Data Collection Program), which is based on information from the Fisheries Monitoring Center. The value of catches was calculated on the basis of average annual prices of first sales of individual fish species and the weight of caught fish. Since the most detailed reported data on the place of fishing is available for fishing squares (approximately 400 km^2 each), which do not overlap with the Baltic East OWF area, the following issues have been considered to determine the impact of the Project on fisheries specified in chapter 5 of this EIA Report in the area of the OWF itself with greatest possible accuracy:

1) For fishing vessels over 12 m, equipped with a VMS (Vessel Monitoring System) – the volume of catches on a given day, assigned to a given square (outside the OWF area) or farm area on the basis of the proportion of the number of vessel position reports reported in a square or in the farm area itself to the total number of VMS reports on a given day;
2) in the case of fishing vessels below 12 m, for which no VMS data is available, information on catches in the area of the fishing square was used,
3) the volume of catches in the farm area was estimated taking into account the relative share of the area to be occupied by the farm in the total area of the fishing square [Table 24].

This is a simplification that ignores the possible variation in the volume of catches within a particular square (e.g. due to the depth or type of seabed), but the only one possible for a more precise reference to the size of caught fish to the fishing place.

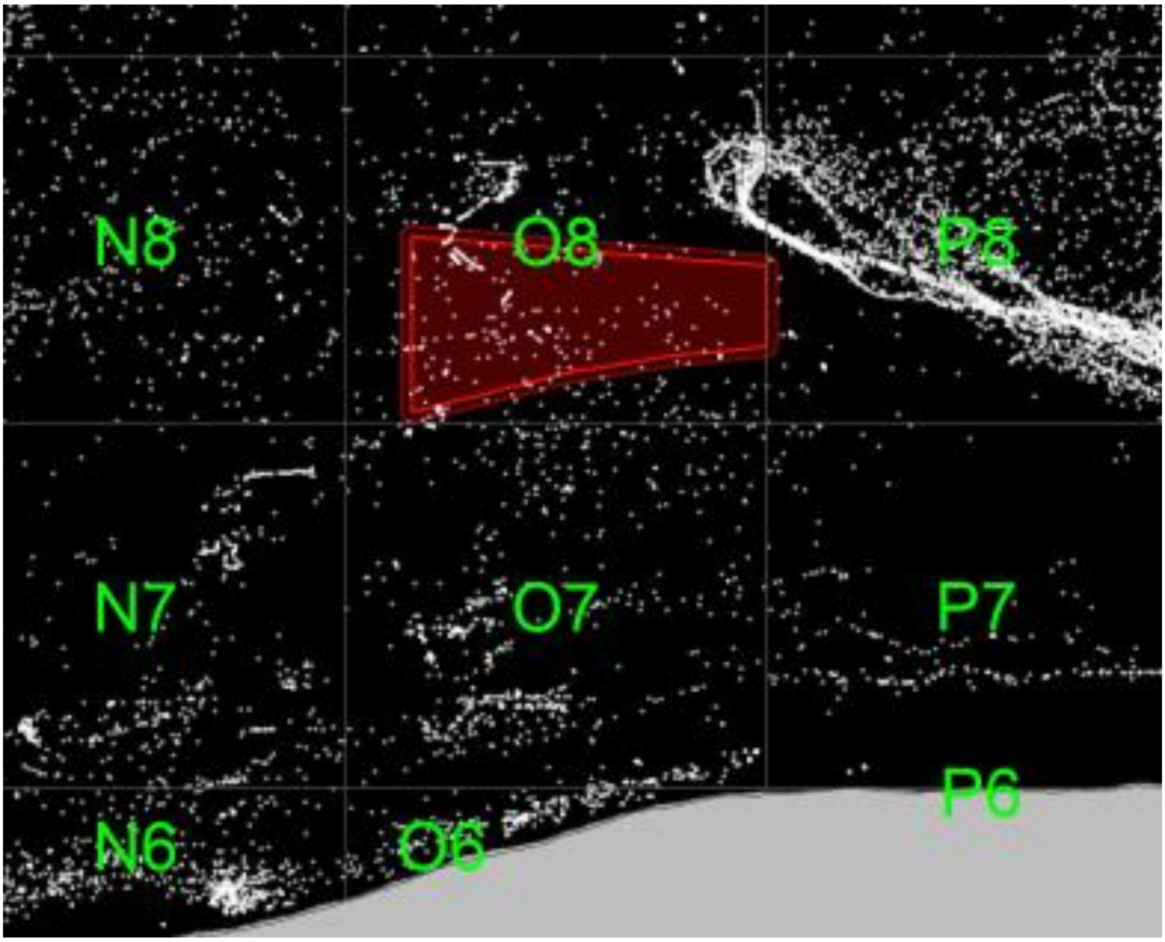

Figure 34 Location of the Baltic East OWF area against fishing squares and fishing points (white)

Table 24 Area occupied by the Baltic East OWF surveyed area in individual fishing squares used in the calculations of volume of catches of vessels up to 12 m

FISHING SQUARE	FISHING SQUARE SURFACE AREA OCCUPIED BY THE OWF AREA (PLUS 500 M) [%]
O8	34.1
P8	0.6

The volume and value of fish catches in fishing squares occupied by the OWF area varied in the respective years. As can be seen in figure below [Figure 35], the volume of catches in the analysed years has changed, with a decreasing trend.

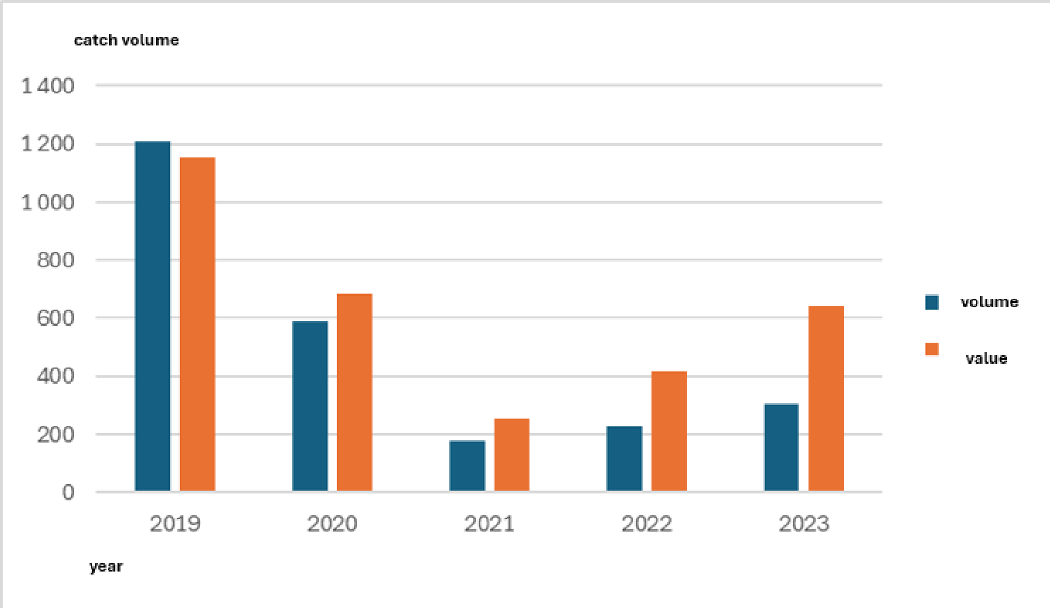

Figure 35 Volume [t] and value [thousand PLN] of catches in fishing squares O8 and P8 in total [Source: internal materials based on npzdr.pl data]

The main fish species caught in the area of two analysed squares in 2019–2023 were herring and sprat [Figure 36], which in total accounted for as much as 99% of the total volume and value of fish caught [Figure 36]. The observed decrease in catches of both species in 2023 compared to 2019 – by 53% for herring (the decrease in value due to the increase in prices was significantly lower) and 95% for sprat, could be a consequence of, on the one hand, a decrease in fishing quotas for Baltic herring in this period – by 54% and sprat by 16% in 2023, and, on the other hand, the recorded volume of catches in the analysed area is so low that the observed catch fluctuations could also be the result of random changes in activity of a small number of fishing vessels.

Table 25 Volume and value of catches in fishing squares: O8 and P8 in 2019–2023, by major fish species [Source: internal calculations based on the npzdr.pl data]

VALUES	SPECIES	2019	2020	2021	2022	2023
Tons	Herring	585.3	274.2	149.1	204.7	276.3
	Sprat	619.4	304.6	25.6	23.6	29.2
	Other	5.2	11.3	3.2	0.5	0.1
PLN	Herring	673.1	349.1	205.2	390.4	600.7
	Sprat	451.2	256.4	24.5	26.2	44.1
	Other	27.4	76.3	25.9	0.7	0.2
Total: tons		1,209.9	590.1	177.8	228.7	305.6
Total: thousand PLN		1,.151.7	681.8	255.6	417.3	645.0

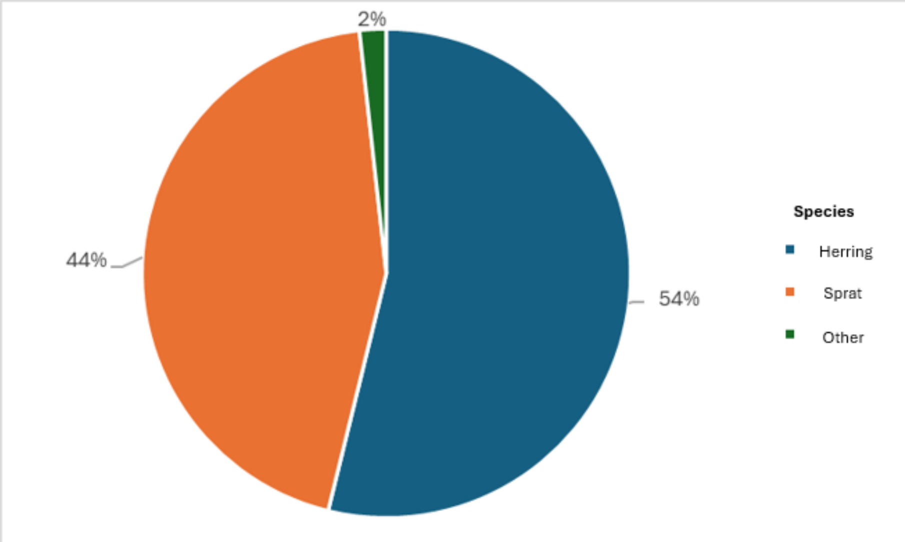

Figure 36 Species structure of fish catches in the area of fishing squares: O8 and P8 in 2019–2023 [Source: internal materials based on the npzdr.pl data]

3.8.2.1 Volume and value of fish catches

The average annual volume of fish catches in the area of two analysed squares in 2019–2023 ranged from approx. 180 tons to 1.2 thousand tons and amounted to 502 tons on average, which accounted for only 0.42% of the volume of Polish Baltic Sea catches in this period [Table 26]. The average value of catches ranged from PLN 0.25 to 1.15 million in the area of two analysed squares, i.e. on average approx. PLN 630 thousand, which accounted for 0.36% of the average value of completed unloadings from Polish catches in the Baltic Sea in 2019–2023.

Volumes of annual catches estimated only for the area to be occupied by the OWF (together with the 500 m buffer zone) ranged from 10 kg to approx. 13 tons for 2019–2023, which gives an average of only 3.2 tons with the value of approx. PLN 10 000. The average share of fish caught in 2019–2023 in the OWF area in relation to the value of Polish total catches in the Baltic Sea was 0.01%.

Table 26 Volume [tons] and value [thousand PLN] of fish catches in fishing squares O8, P8 and the Baltic East OWF area against the general Polish catches in the Baltic Sea in 2019–2023 [Source: internal calculations based on the npzdr.pl data]

Values	Year	Fishing rectangles P8, O8		Total	OWF Area		Total	Baltic Sea	% in squares P8, O8	% in OWF
		<12 m	>=12 m		<12 m	>=12 m				
tons	2019	0.2	1,209.7	1,209.9	0.1	0.9	1.0	145,962.9	0.83%	0.00%
	2020	0.1	590.0	590.1	0.0	12.9	12.9	130,391.4	0.45%	0.01%
	2021	0.1	177.7	177.8	0.0	1.3	1.3	123,307.7	0.14%	0.00%
	2022	-	228.7	228.7	-	0.0	0.0	109,758.8	0.21%	0.00%
	2023	1.3	304.3	305.6	0.0	0.9	0.9	95,382.3	0.32%	0.00%
thousand PLN	2019	1.6	1,150.1	1,151.7	0.6	4.6	5.2	189,210.3	0.61%	0.00%
	2020	1.8	680.0	681.8	0.0	30.3	30.3	154,268.1	0.44%	0.02%
	2021	3.8	251.8	255.6	0.3	13.1	13.4	163,641.2	0.16%	0.01%
	2022	-	417.3	417.3	-	0.0	0.0	169,158.2	0.25%	0.00%

Values	Year	Fishing rectangles P8, O8		Total	OWF Area		Total	Baltic Sea	% in squares P8, O8	% in OWF
		<12 m	>=12 m		<12 m	>=12 m				
	2023	2.0	643.0	645.0	0.0	1.4	1.4	195,927.1	0.33%	0.00%
average, tons		0.4	502.1	502.4	0.0	3.2	-	3.2	0.42%	0.00%
average, thousand PLN		2.3	628.4	630.7	0.2	9.9	-	10.1	0.36%	0.01%

When analysing the relative significance of the area of fishing squares to be partially occupied by the Baltic East OWF area as fishing places for fishing vessels located in various ports, it follows that it is only noticeable for vessels from Władysławowo, although it is still marginal (1.36%) [Table 27]. For vessels registered in other ports, catches in the area of the two analysed squares may be considered insignificant, their relative volume for none of the analysed years exceeded 0.5%. Similarly, the analysed area was of low importance in terms of value in 2019–2023.

Table 27 Average volume [t] of catches in fishing squares O8, P8 and in the Baltic East OWF area in 2019–2023 in relation to the total Polish catches in the Baltic Sea broken down by ports of registration of fishing vessels and their sizes [m] [Source: internal calculations based in the npzdr.pl data]

PORT	FISHING RECTANGLES O8, P8			OWF AREA			THE BALTIC SEA	PROPORTION [%]	
	<12 m	>12 m	Average	<12 m	>12 m	Average		in fishing squares	in the OWF area
Władysławowo	-	431.6	431.6	-	0.1	0.1	31,672.3	1.36%	0.00%
Ustka	0.0	52.6	32.9	0.0	0.5	0.3	13,225.6	0.40%	0.00%
Kołobrzeg	-	13.1	13.1	-	4.5	4.5	37,473.2	0.03%	0.01%
Hel	-	12.4	12.4	-	0.0	0.0	9,690.0	0.13%	0.00%
Jastarnia	-	6.3	6.3	-	0.0	0.0	5,893.4	0.11%	0.00%
Łeba	0.2	4.6	3.5	0.1	2.9	2.2	2,188.3	0.21%	0.10%
Other	0.4	0.2	0.3	0.0	0.0	0.0	374.4	0.05%	0.00%

Table 28 Average value [thousand PLN] of catches in the fishing squares O8, P8 and in the Baltic East OWF area in 2019–2023 in relation to the average value of Polish catches in the Baltic Sea broken down by ports of registration of fishing vessels and their sizes [Source: internal calculations based in the npzdr.pl data]

PORT	FISHING RECTANGLES O8, P8			OWF AREA			THE BALTIC SEA	PROPORTION [%]	
	<12 m	>12 m	Average	<12 m	>12 m	Average		in fishing squares	in the OWF Area
Władysławowo	-	547.2	547.2	-	0.1	0.1	35,691.6	1.53%	0.00%
Ustka	1.0	53.8	34.0	0.2	4.3	2.8	18,236.5	0.29%	0.02%
Hel	-	15.8	15.8	-	0.0	0.0	10,259.3	0.15%	0.00%
Łeba	0.8	15.4	11.7	0.3	7.4	5.6	2,950.2	0.52%	0.19%
Kołobrzeg	-	15.3	15.3	-	5.2	5.2	48,706.3	0.03%	0.01%
Jastarnia	-	5.6	5.6	-	0.0	0.0	6,705.4	0.08%	0.00%
Other	1.4	0.6	1.0	0.0	0.0	0.0	933.3	0.06%	0.00%

During the analysed period fishing vessels exceeding 12 m in length accounted for the vast majority of catches, both in terms of volume and value [Table 29]. This was due both to the advantage in terms of fishing capacity of large vessels and to the significant distance of the OWF area from the coastline and the nearest landings of fishing vessels.

Table 29 Volume and value of fish catches in fishing squares O8, P8 in 2019–2023 broken down by length of fishing vessels [Source: internal calculations based in the npzdr.pl data]

CATCH PARAMETER	VESSEL GROUP BY LENGTH [M]	YEAR				
		2019	2020	2021	2022	2023
Volume [t]	<12	0.2	0.1	0.1		1.3
	≥12	1,209.7	590.0	177.7	228.7	304.3
Value [thousand PLN]	<12	1.6	1.8	3.8		2.0
	≥12	1,150.1	680.0	251.8	417.3	643.0
Total volume [t]		1,209.9	590.1	177.8	228.7	305.6
Total value [thousand PLN]		1,151.7	681.8	255.6	417.3	645.0

The conducted analysis indicates significant variability and range of monthly catch values. In 2019–2023 they ranged from zero to slightly over PLN 300 000 (February 2019). Zero or near zero catches from May to August inclusive in 2020–2023 were the result of the introduction of the cod conservation regulations, which in practice prevented vessels over 12 m in length from catching all fish species (EU 2019/1838).

Due to the relatively low volume of fish caught in both fishing squares, the monthly variability of catches was determined by the aforementioned random involvement of individual vessels. The analysis of data from 2019–2023 allows us to observe a certain seasonality of catches concentrating in the autumn-winter period [Figure 37]. The highest relative value of catches in 2019–2023 was recorded in February (23%) and September and October – 19% and 17% respectively [Figure 38].

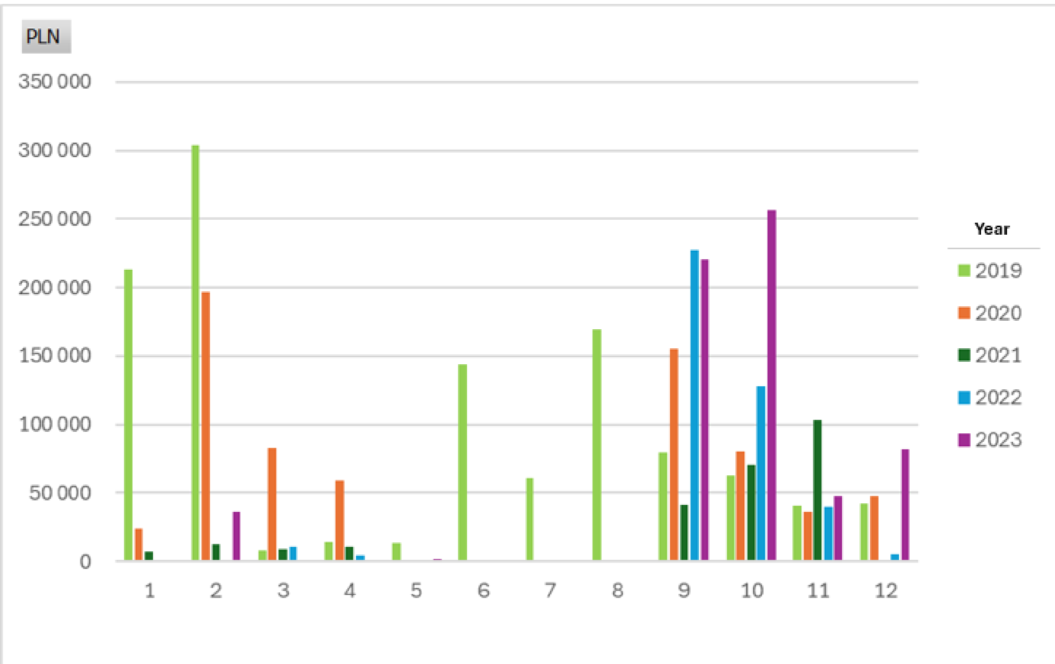

Figure 37 Monthly value of catches in the area of fishing squares O8, P8 in 2019–2023 [Source: internal materials based on the npzdr.pl data]

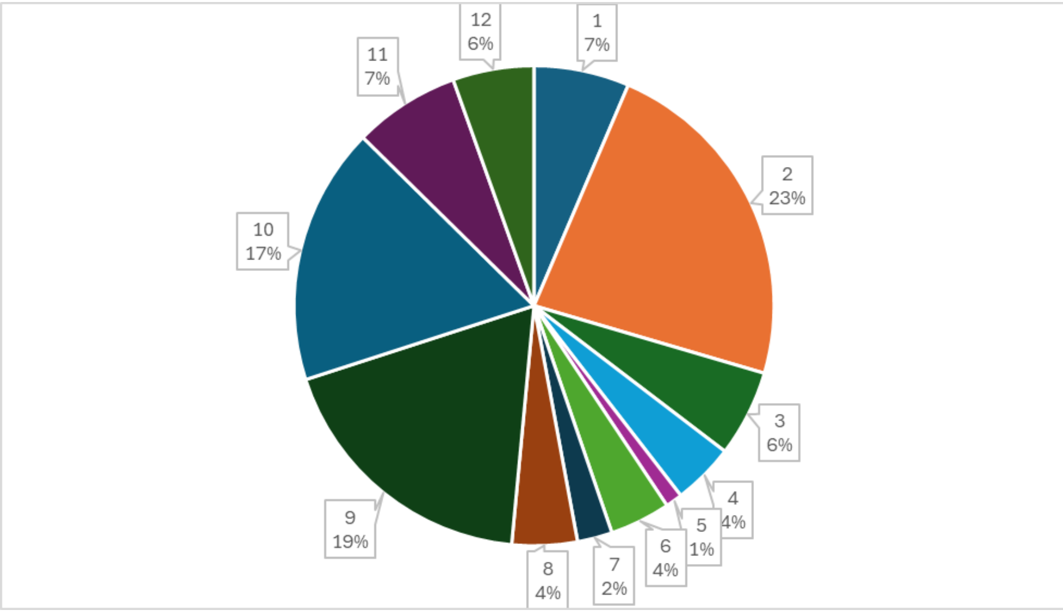

Figure 38 Relative value of catches in the area of fishing squares O8 and P8 in individual months in 2019–2023 [Source: internal materials based on the npzdr.pl data]

Midwater trawls were the primary fishing gear used in the analysed fishing squares in 2019–2023, with other fishing gears being unnoticeable in the fishing structure [Figure 39].

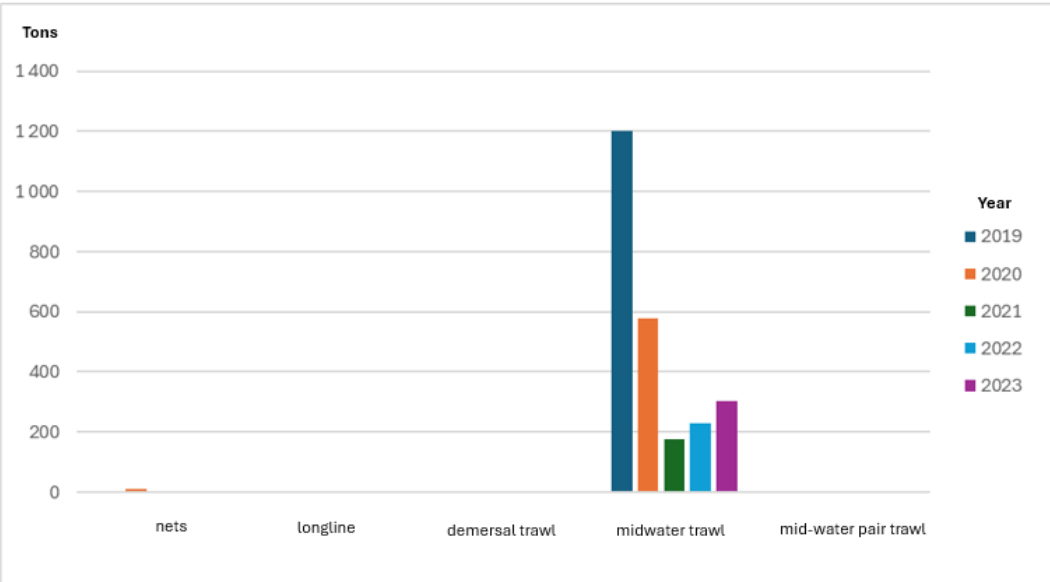

Figure 39 Volume of catches with individual gears in the area of fishing squares O8, P8 in 2019–2023 [Source: internal materials based on the npzdr.pl data]

3.8.2.2 Amount of fishing effort

From 2019 to 2023, the number of vessels fishing within the Baltic East OWF area fluctuated, with 6, 10, 13, 1, and 2 vessels operating respectively. During this period, the total number of active fishing vessels in the Baltic Sea (both within and outside the Polish Economic Zone) ranged from 789, 803, 809, 797 and 789 in total. The total fishing effort (measured with number of fishing days) in the Baltic East OWF area in 2019–2023 was also very low, with a maximum of 21 days in 2020 and 2021. In 2022 and 2023 fishing vessels caught fish for only one and three days.

3.8.3 Aviation

The structure of the Polish airspace available for air navigation and detailed conditions and manner of using the airspace by all its users are specified in the Regulation of the Minister of Infrastructure of December 27, 2018 *on the structure of the Polish airspace and detailed conditions and manner of its use* (Journal of Laws of 2019, item 619).

In the range of the Polish airspace, known as FIR EPWW (*Flight Information Region*), within the boundaries of which the flight information service and the alarm service are provided, there is the part of the airspace allocated by the ICAO over the Baltic Sea. This space is divided into aviation zones and their use requires prior agreement or reservation with the relevant services.

3.8.4 State defense

The area of the Baltic East OWF is not located in zones permanently or periodically closed to navigation and fisheries, established by the Minister of National Defense by virtue of a regulation in accordance with the Act of March 21, 1991 *on maritime areas of the Republic of Poland and maritime administration* (consolidated text, Journal of Laws of 2024, item 1125).

According to SIPAM, the Baltic East OWF area is located at a distance of:

- approx. 3 NM (approx. 6 km) north of sub-basin 34.923.B designated for Polish Navy fairways (0023, 0024, 0026, 0304, 0305);
- approx. 6 NM west of sub-basins 54.923.B designated for proving grounds P-14, P-15, P-16 and P-18 and 54.926.B for Polish Navy fairways (0301, 0302, 0303, 0304);
- less than 5 NM (approx. 9 km) south of sub-basin 16.923.B designated for proving grounds (P-15, P-16, P-18, P-19, P-22, P-23) of the Polish Navy.

The change of the existing condition of the development area requires arrangements with the minister competent for national defense. During the period of activities carried out by the Polish Armed Forces, the performance of other functions may be prevented in the above-mentioned sub-basins.

3.8.5 Other development and use of the area and tangible properties thereon

There are no structures permanently fixed to the seabed in the Baltic East OWF area. Nor are licenses issued for prospecting, exploration and extraction of hydrocarbons from submarine deposits. The prospecting and exploration licenses existing in this area even several years ago expired in 2016 and have not been renewed until the date of submitting of this EIA Report. According to the results of geophysical surveys (chapter 3.2.3), no mineral deposit or mining area was recorded in the Baltic East OWF area. The OWF area is located beyond the range of areas performing defense functions (proving grounds and routes of the Polish Navy).

As part of the conducted geophysical surveys (Appendix No. 1), several dozen facilities on the seabed were found in the Baltic East OWF area – they are described and presented in the figure in chapter 2.7.3. of this EIA Report, as they may pose a threat to or hinder the implementation of the Project.

The Baltic East OWF area is located within the sea basin POM.46.E [Figure 40], designated by the Regulation of the Council of Ministers of April 14, 2021 *on the adoption of the spatial development plan for internal sea waters, the territorial sea and the exclusive economic zone at a scale of 1:200 000* (Journal of Laws, item 935, as amended). For the sea basin, renewable energy generation was indicated as the basic function, at the same time allowing for the performance of other activities in the future, such as: aquaculture, scientific research, cultural heritage, technical infrastructure, prospecting and exploration of mineral deposits and extraction of minerals from deposits, fishing, artificial islands and structures, transport and tourism, sport and recreation. All functions allowed in the sea basin may be performed provided that the basic function is considered as primary function. The Baltic East OWF area is characterized by a low level of use by human activity, limited to relatively infrequent fishing activities and occasional navigation.

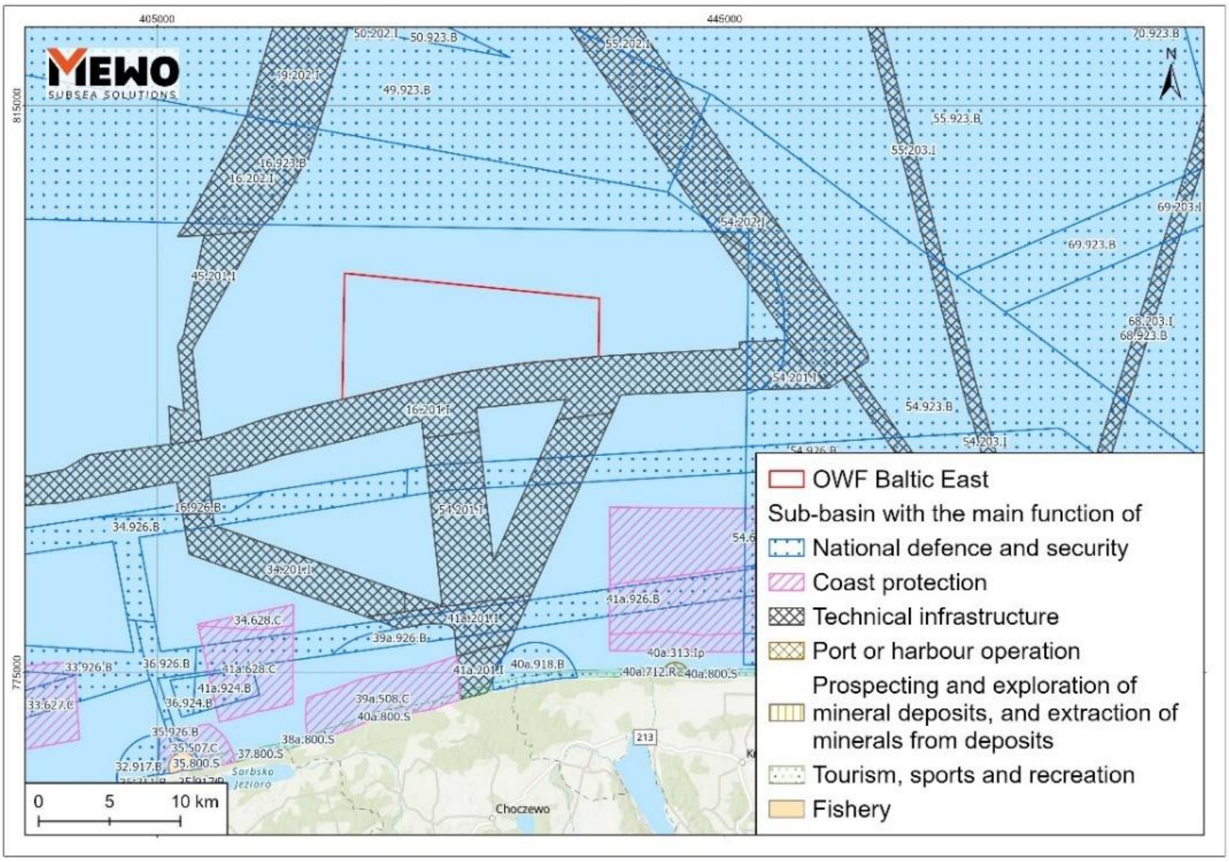

Figure 40 The Baltic East OWF area against SIPAM PSA sub-basins [Source: proprietary study based on SIPAM]

3.9 Landscape, including cultural landscape

The Baltic East OWF area is located at a distance of 22.5 km from the seashore. The landscape of the area is an open sea without existing topside structures. The landscape changes according to the weather condition; on windless days the sea is calm, steady, whereas with increased wind strength, reduced sunshine, increased cloud cover and increased humidity, including precipitation, the condition of the sea, wave motion and air clarity also change. Water vapor rises above the water surface, which also reduces visibility, making it difficult for the observer to determine the sea and sky contact on the horizon.

The land is rarely visible from the Baltic East OWF area and there are rarely any people.

Important navigation routes run through the Baltic East OWF area [Figure 41] and in its vicinity at a distance of several to several dozen kilometers. These routes are traversed by tanker vessels, container vessels, rail freight ferries and passenger ferries, passenger and cargo vessels, freighters, tankers and other vessels. On the northern side of the Baltic East OWF area runs a corridor of the north-eastern navigation route (sea basin POM.49.T). On the southern side of the Baltic East OWF area runs another corridor of the north-eastern navigation route (sea basin POM.34.T, POM.54.T).

The Baltic East OWF area is located in parts of two fishing squares where fishing vessel traffic takes place (chapter 3.8.1). Other nearest forms of development are areas of licenses for prospecting and exploration of oil and natural gas deposits, and the nearest Baltic-Beta production platform is located at a distance of over 40 km, i.e. beyond the range of visibility from the Baltic East OWF [Figure 41].

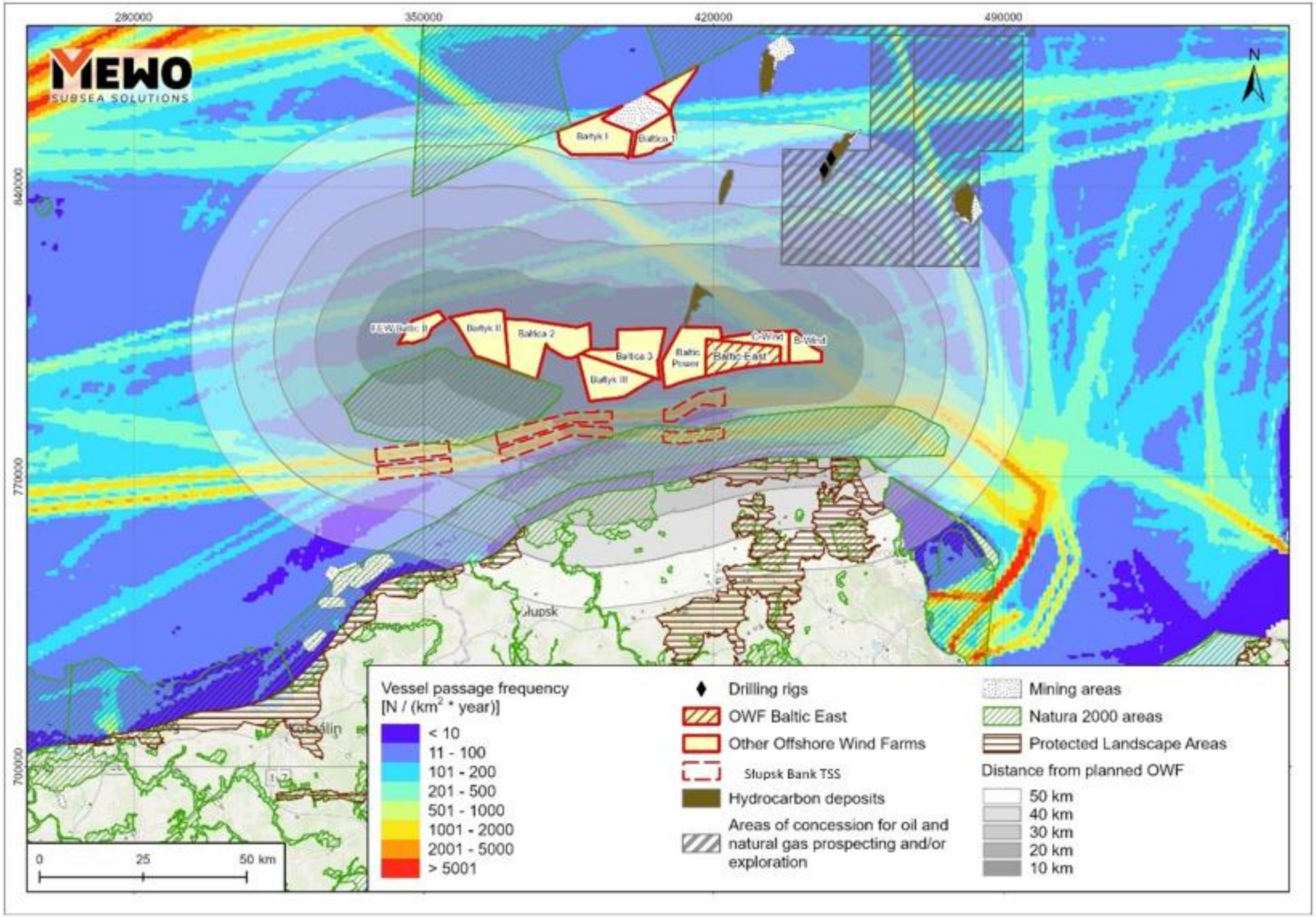

Figure 41 Development and use of the sea basin in the vicinity of the Baltic East OWF [Source: proprietary study]

The maritime cultural landscape includes anthropogenic development and the use of both the sea and the seabed, which is only accessible to divers and underwater vehicle operators. The landscape of the Baltic Sea is not subject to classification, and only the BALANCE project "Baltic Sea Management – Nature Conservation and Sustainable Development of the Ecosystem through Spatial Planning" (2005–2007) developed a concept of submarine landscapes. In the Baltic East OWF area and in its vicinity there are no permanent development elements.

The potential zone of the Baltic East OWF impact on the landscape includes the area of land from Ustka in the west to Hel in the east. Due to the shape of the coastal zone of the Baltic East OWF, it may be visible from beaches at this section. This is the Słowińskie Coast [Richling et al. 2021] creating a narrow strip of land along the coast of the Baltic Sea and the Hel Peninsula. The area is characterized by post-glacial relief. There are dune banks with a height ranging from several to several dozen meters above the sea level, covered with forest, obscuring the view to the sea, bogs and wetlands, as well as coastal lakes with sea-side spits and also sections with high cliff shores. The landscape is diversified by narrow valleys of watercourses entering the sea. There are various protected areas, including landscape protection of the areas in their vicinity. These are: Protected Landscape Area "Pas pobrzeża na zachód od Ustki (The Coastal Strip West of Ustka)", nature and landscape complex "Ostoja Łabędzi (Swan Refuge)" in Ustka, Protected Landscape Area "Pas pobrzeża na wschód od Ustki (The Coastal Strip East of Ustka)", Słowiński National Park, landscape nature reserve "Mierzeja Sarbska (Sarbska Spit)", Coastal Protected Landscape Area, Coastal Landscape Park. At studied section, under meteorological conditions with appropriate air transparency, the Baltic East OWF will be potentially visible from the lookout points located higher such as: Czołpino lighthouse, dunes in the Słowiński National Park, Stilo lighthouse and towns: Ustka, Rowy, Łeba and Jastrzębia Góra.

3.10 Population and living conditions of people

The population in coastal communes and cities located at a section from Ustka to Hel based on the Statistics Poland data from 2022 is: Ustka 13 950 persons, Ustka commune 8 006 persons, Smołdzino commune 3 073 persons, Wicko 5 561 persons, Łeba 3 100 persons, Choczewo 5 010 persons, Krokowa 10 545 persons, Władysławowo 14 463 persons, Jastarnia 3 782 persons, Hel 2 835 persons.

The largest population is in the communes of Ustka and Władysławowo. In recent years the population has declined in all analysed communes. Due to the coastal location and landscape and cultural values, these are communes with high tourist and recreational values. They are the basis for the existence of a significant number of inhabitants. This includes fishing, maritime tourism, marine navigation, marine sports and other human activities related to the immediate vicinity of the sea.

Based on the report "Województwo pomorskie w liczbach 2024" [*Pomorskie Voivodeship in figures 2024*] (Statistical Office in Gdańsk), the districts most visited by tourists are: Słupsk and Puck district, Lębork district, and Wejherowo district. The largest number of tourists arrive in these areas in summer months (July – August), when the weather conditions allow for seaside vacation.

The construction of the First Polish Nuclear Power Plant (NPP) has been started in the Choczewo commune. Deforestation and preparatory works for the construction were commenced. Preparation and construction of the NPP will change the development of many coastal communes. For a period of approx. 10 years, several thousand people will work on the project implementation (2 000 to 8 000 are estimated). Approximately 860 people are expected to work in the NPP during its operation.

The designated Baltic East OWF center is located at the following distances to the nearest ports:

- Darłowo – 116 km,
- Ustka – 81 km;
- Łeba – 36 km;
- Władysławowo – 47 km.

Due to the size of the transport vessels and vessels constructing the Baltic East OWF, the back-up facilities during the implementation and decommissioning phases of the Baltic East OWF are likely to be the ports in Świnoujście (located at a distance of approx. 245 km), Gdańsk, Gdynia, Władysławowo, Łeba and Rønne (located at a distance of approx. 165 km), as well as Aalborg. The Port of Rønne in Denmark (on the island of Bornholm) is the closest port with complete infrastructure used for the purposes of offshore wind energy activities.

During the operation phase of the Baltic East OWF it will be possible to use a smaller and at the same time closer port, i.e. the port in Władysławowo or Łeba (located at a distance of less than 30 km).

The Baltic East OWF area is located in the area of important, customarily used and planned navigation routes and routes to fishing grounds. The navigation issues in this area are described in detail in sub-chapter 3.8.1.

In the Baltic East OWF area, fishing activities are carried out. This area is located in parts of two fishing squares: O8 and P8. The fishing issues in this area are described in detail in sub-chapter 3.8.2.

To sum up, the Baltic East OWF area is of minor importance for commercial and recreational navigation and fishing.

3.11 Description of natural components and protected areas

3.11.1 Biotic components in offshore area

3.11.1.1 Phytobenthos

Phytobenthos (macrophytes) are underwater plants of at least a few millimeters in size. These include:

- macroalgae – plants with thallus structure, which include green algae, brown algae, and red algae. They cover hard substrate, i.e. pebbles, boulders, objects such as, e.g. wrecks or submerged hydraulic structures and other marine structures. Some species of macroalgae may deposit on the seabed in a non-fixed form (e.g. brown algae *Pylaiella littoralis* i *Ectocarpus siliculosus*);
- vascular angiosperms – aquatic flowering plants, covering sandy or silty seabed, fixed to it with a root system (seagrass, pondweeds) [Brzeska and Opioła 2020].

Phytobenthos develops only in sunlit water regions, which means that its distribution is limited only to the euphotic zone, reaching the depth of approx. 20 m in the Baltic Sea [Schiewer (ed.) 2008; Kautsky et al. 2017]. In the Polish Baltic Sea zone the maximum range of macroalgae occurrence in the form of communities fixed to the hard seabed is approx. 22 m. In deeper areas, at depths up to 26 m, occasional occurrence of single macroalgae specimens was found. Vascular plants rooted in the sandy seabed occur only in the Puck Bay, up to approx. 5–8 m of depth [Schiewer (ed.) 2008; Kruk-Dowgiałło et al. 2011; Błeńska et al. 2014, 2015 a and b; Brzeska-Roszczyk and Kruk-Dowgiałło 2017 and 2019; Brzeska-Roszczyk et al. 2017; Michałek et al. 2020; State Environmental Monitoring data 2010−2022].

In open waters of the Polish part of the Baltic Sea macroalgae in the form of communities, including protected and habitat-forming species, occur in two areas of the hard seabed, i.e. in the boulder site of the Słupsk Bank located at a distance of approx. 80 km from the boundaries of the area and in the Rowy boulder site, which is located at a distance of 65 km [Kruk-Dowgiałło et al. 2011; State Environmental Monitoring data 2010–2022; Michałek et al. 2020; Zalewska (ed.) 2024].

The Baltic East OWF survey area is poorly identified from a biological point of view, and in its vicinity there is no phytobenthos survey station designated in the State Environmental Monitoring. Phytobenthos surveys carried out in the context of the implementation of the offshore project in the neighboring areas have occasionally shown the occurrence of phytobenthos, mainly in the form of small patches or individual specimens dispersed on the seabed [Antczak et al., 2019) or its absence [Barańska et al., 2020].

Environmental surveys on phytobenthos were carried out in the Baltic East OWF area in June 2022. The seabed was filmed on 4 transects with a length of 120 – 122 m each, in the depth range from 24.6 to 27.7 m. The analysis of the film documentation showed the absence of underwater vegetation in the survey area. The surveys were carried out in shallowest sites of the area with rocky seabed, therefore it should be assumed that phytobenthos does not occur in the entire OWF area.

Detailed survey results are described in Appendix No. 1 to this Report.

3.11.1.2 Macrozoobenthos

Macrozoobenthos (benthic macrofauna) is a group of invertebrate organisms inhabiting the surface layer of bottom sediments (epifauna), including hard substrate (boulders, stones) or living inside the sediment (infauna), remaining when the sediment is washed over a 1 mm mesh screen. Clams (Bivalvia), crustaceans (Crustacea), polychaetes (Polychaeta), oligochaetes (Oligochaeta) and gastropods (Gastropoda) are the main groups of macrozoobenthos. Most of these are sedentary species with a life cycle of at least one year. Macrozoobenthos plays an important role in the trophic chain of marine ecosystems. Benthic invertebrates are food for many fish and seabird species. Moreover, they shape living conditions of other organisms (habitat-forming role) and affect the state of the environment (e.g. sediment oxygenation, biofiltration of suspended matter from water depth). Taxonomic diversity, abundance and sensitivity of individual taxons forming a complex of benthic organisms indicate the ecological quality of the seabed.

The survey area of the Baltic East OWF macrozoobenthos is located in the open waters of the Eastern Gotland Basin in the depth range from 26.39 m to 45.94 m. It is characterized by the presence of an abrasion and accumulation platform in 75.29% of the surveyed area. Therefore, as much as 70.03% of the survey area is cohesive sediments with a thin discontinuous sandy cover and erosion lag on the surface and frequent accumulation of stones and high densities of boulders. The remaining seabed type consists of sands (29.97%), located mainly in the eastern and south-eastern part of the survey area. This is confirmed by the EUNIS classification of habitats presented on the EUSeaMap 2021 (https://www.emodnet-seabedhabitats.eu/), on the basis of which circalittoral coarse sediments prevail in this area.

There are no macrozoobenthos survey stations of the State Environmental Monitoring in the described area, therefore this site was excluded from the assessment of benthic habitats status in the PSA in “Druga aktualizacja wstępnej oceny stanu środowiska wód morskich” [*Second update of the preliminary assessment of the environmental status of sea waters*] (2024). Therefore, until the performance of surveys in 2022 and 2023, there was no historical knowledge of macrozoobenthos in the Baltic East OWF area.

For the purpose of this EIA Report separate pre-investment macrozoobenthos surveys were performed on the soft seabed (sandy, gravel, gravel and sandy sediments, gravel and stone sediments, sandy and gravel sediments) and on the hard seabed (stones, boulders) in the Baltic East OWF area, obtaining comprehensive data for qualitative and quantitative analysis of benthic invertebrate communities and assessment of the ecological quality status of seabed habitats.

Detailed survey results are described in Appendix No. 1 to this Report.

The results of qualitative macrozoobenthos surveys showed that this area inhabited quite diversified benthic macrofauna. Twenty-two macrozoobenthos taxa were found on the soft seabed. The dominant taxa were typical of shallow to intermediate depth seabeds (down to approx. 40 m b.s.l.) of open waters of the southern Baltic. However, the community of bioufouling and accompanying fauna formed 20 macrozoobenthos taxa on the hard seabed.

The average macrozoobenthos population size from the survey area soft seabed amounted to 2 198 individuals m^{-2}. The largest share in terms of population size in the macrozoobenthos dominance structure of the gravel and sandy seabed had the *Pygospio elegans* bristleworm (69.10%). However, the average biomass of soft seabed macrozoobenthos amounted to 15.93 g m^{-2}, and the largest share in the overall biomass of this habitat had one species of bivalve – *Macoma balthica* (49.47%). A significant part of the survey area consisted of a layer of boulders and large stones in the depth range of approx. 25–35 m. Their surface was dominated, both in terms of population size (95%) and biomass (99%), by the *Mytilus trossulus* bivalve, which is a component of the diet of benthivorous birds. Juvenile bivalves from size class 1–5 mm were definitely predominant in terms of population size, while in terms of biomass, individuals from the shell length range from 21 to 25 mm. In the southern part of the surveyed area, macrozoobenthos population size was much lower than in the northern part, but even there it did not exceed 4 000 individuals m^{-2}. The highest macrozoobenthos population size on the hard seabed, amounting to more than 80 000 individuals m^{-2}, was found in the central part of the surveyed area, which was related to the aggregations of juvenile *Mytilus trossulus* bivalve on the boulder site. The highest macrozoobenthos biomass was found in the central part of the Baltic East OWF area, both in the soft seabed (up to 150 g m.m.$\cdot m^{-2}$ – due to the high biomass of the *Macoma balthica* bivalve) and in the boulder site (more than 4000 g m.m.$\cdot m^{-2}$ – due to the high biomass of *Mytilus trossulus*).

Minor comparative material for the Baltic East OWF area in terms of assessment of taxonomic composition, stability of occurrence and dominance of macrozoobenthos in population size and biomass may be the results of benthos surveys carried out for the planned neighboring projects, i.e. the BC-Wind OWF area adjacent to the survey area from the north-east, with higher depths – up to

63 MBSL (EIA Report for BC-Wind OWF 2021) and Baltic Power OWF area (1 NM) located west of the surveyed area (EIA Report for Baltic Power 2022 OWF) [Table 30].

Table 30 Characteristics of the macrozoobenthos surveys of the Baltic East OWF area in 2022 and 2023 against the results of macrozoobenthos surveys of the Baltic Power OWF area of 2019 and BC-Wind OWF of 2020.

PARAMETER	SURVEY AREA	BALTIC POWER OWF AREA (1 NM)	BC-WIND OWF AREA
Number of stations	108	200	146
Depth [m]: range	27 – 42	29 – 43	30 – 63
Number of taxa: max, range (soft seabed)	22, 4 – 12	25, 4 – 15	21, 4 – 13
Absolutely permanent taxa (soft seabed)	*Pygospio elegans, Marenzelleria spp., Bylgides sarsi, Macoma balthica, Oligochaeta*	*Marenzelleria sp., Pygospio elegans, Macoma balthica, Bylgides sarsi, Monoporeia affinis*	*Pygospio elegans, Marenzelleria sp., Macoma balthica, Diastylis rathkei, Bylgides sarsi*
Absolutely permanent taxa (hard seabed)	*Bylgides sarsi, Einhornia crustulenta, Gammarus juvenes, Gonothyraea loveni, Jarea (Jarea) spp.*	*Bylgides sarsi, Mytilus sp., Pygospio elegans, Gammarus salinus, Einhornia crustulenta*	*Bylgides sarsi, Mytilus trossulus, Einhornia crustulenta, Gonothyraea loveni, Jaera albifrons*
Dominance in population size (soft seabed)	*Pygospio elegans*	*Pygospio elegans*	*Pygospio elegans*
Dominance in biomass (soft seabed)	*Macoma balthica, Marenzelleria spp.*	*Macoma balthica*	*Macoma balthica*
Dominance in population size (hard seabed)	*Mytilus trossulus*	*Mytilus trossulus*	*Mytilus trossulus*
Dominance in biomass (hard seabed)/Average biomass of hard seabed macrozoobenthos	*Mytilus trossulus/approx. 3117 g m.m.·m^{-2}*	*Mytilus trossulus/approx. 2397 g m.m.·m^{-2}*	*Mytilus trossulus/ approx. 2081 g m.m.·m^{-2}*

The list of results of macrozoobenthos surveys carried out as part of the three aforementioned projects in 2019–2022 indicates that macrozoobenthos in any of the indicated neighboring areas of the PSA was not distinguished in terms of composition characteristics, taxonomic diversity or composition of dominants in the population size and biomass of individual habitats of soft and hard seabed. However, in the Baltic East OWF area as many as four common macrozoobenthos taxa of soft seabed (*Marenzelleria* spp., *Bylgides sarsi*, *Macoma balthica* and Oligochaeta) are opportunistic taxa with low sensitivity, characteristic of seabed contaminated with an excessive load of organic matter. More significant differences between the compared areas of the planned projects were found in the case of the hard seabed. In the Baltic East OWF area the average macrozoobenthos biomass on boulders and stones was higher than in the neighboring areas, in the composition of which all four typical taxa characteristic of this community were recorded, i.e. *Mytilus trossulus*, *Einhornia crustulenta*, *Amphibalanus improvisus* and amphipods of the genus *Gammarus*, occurring absolutely permanently or permanently.

3.11.1.3 Ichthyofauna

The purpose of the conducted surveys was to determine the characteristics of the ichthyofauna complex occurring during the year in the Baltic East OWF area together with the zone of its potential impact [hereinafter: the survey area]. A number of survey tools recommended and used in the Baltic Sea surveys by international scientific bodies were used, including hydroacoustic surveys, control pelagic hauls, ichthyoplankton surveys and demersal fish catches with non-selective set of gillnets.

The analysis of the results of fishing and fishing capacity of the set of fish living within the survey area shows that the area is typical for the southern Baltic Sea in terms of species diversity, with a clear predominance of cod and European flounder in bottom fisheries and herring and sprat in pelagic fisheries. All survey tools in the survey area caught fish belonging to 22 taxa [Table 31]. Three of the taxa recorded in the ichthyoplankton samples – gobies, common seasnail and straightnose pipefish – belong to species under partial protection in accordance with the Regulation of the Minister of Environment of December 16, 2016 *on the protection of animal species* (consolidated text, Journal of Laws of 2022, item 2380). Although gobies were not identified by the species, it can be assumed, based on the literature, that the dominant species in the collected samples was the sand goby [Horackiewicz and Skóra, 1996; 1998]. However, no adult stages of these species were found in the survey area.

Permanent fish communities of the area include cod, European flounder, shorthorn sculpin, sandeel, herring, sprat, fourbeard rockling, turbot, lumpfish, vivaparous eelpout.

Table 31 Specification of all taxa recorded during survey fishing in the survey area [Source:Maritime Institute for Fisheries – National Research Institute data]

SPECIES	PELAGIC FISHING	BOTTOM FISHING	ICHTHYOPLANKTON FISHING
Gobies			X
Common seasnail			X
Great sand eel	X	X	X
Cod		X	X
Plaice		X	X
Shorthorn sculpin		X	X
Longspined bullhead			X
Armed bullhead		X	
Salmon	X	X	
Mackerel		X	
European river lamprey	X		
Fourbeard rockling		X	X
Rock gunnel			X
European anchovy	X		
Turbot		X	
European flounder	X	X	X
Sprat	X	X	X
Herring	X	X	X

SPECIES	PELAGIC FISHING	BOTTOM FISHING	ICHTHYOPLANKTON FISHING
Lumpfish	X	X	
Vivaparous eelpout		X	
Straightnose pipefish			X
Whiting		X	

In the case of ichthyoplankton fishing, low taxonomic diversity was found (eggs of two species and larvae of thirteen fish taxa). Late spring and summer sprat spawning was found, but its intensity is relatively low compared to other shallow water areas. The presence of numerous gobies larvae in the collected samples indicates intensive spawning of these fish in July, which takes place in summer outside the survey area in waters at lower depths. A moderate number of sandeel larvae indicate spawning of this taxa in the summer season outside the survey area at lower depths. No cod, European flounder and plaice were found in the survey area. Spawning is not possible due to low water salinity. Larvae caught in spring came from spawning taking place in the Gdańsk Deep or the Słupsk Furrow, from where they were transferred together with currents to a shallower survey area.

Small numbers of larvae of the shorthorn sculpin, long-spined bullhead, rock gunnel, herring, common seasnail and straightnose pipefish combined with their environmental preferences for spawning (very shallow areas) indicate that the Baltic East OWF area is not a spawning ground for these taxa.

A total of 1868 kg of fish belonging to 15 taxa were caught with bottom gillnets. European flounder and cod dominated. Other species constituted small by-catches (great sand eel, plaice, shorthorn sculpin, pogge, Atlantic mackerel, turbot, herring, vivaparous eelpout and one individual of whiting, fourbeard rockling, lumpfish and sprat.

The analysis of the capacity of set survey tools showed that the peak of fish densities occurred in summer, as the survey area in this period is a feeding ground. In autumn and spring capacity was similar. In winter the lowest capacities were recorded.

The highest surface density of herring biomass in the survey area, 29.58 tons·Mm^{-2}, was estimated for the summer measurement campaign and it was more than twice as high as the average value of this parameter determined on the basis of the autumn BIAS cruises from 2017–2021. On the other hand, during the autumn campaign the lowest value of surface herring biomass was recorded in this area – 0.52 tons·Mm^{-2} – which was many times lower than the average of the autumn BIAS cruises. The surface densities of herring biomass determined during the winter and spring measurement campaigns, 1.29 and 1.08 tons·Mm^{-2} respectively, were at a level close to the average value of this parameter calculated on the basis of SPRAS cruises in May for the reference period.

The results of research surveys of herring indicate that the Baltic East OWF area was a place of temporary aggregation of a part of the herring stock in the monitored benthopelagic layer of the Baltic Sea in summer. Due to a relatively high depth and lack of appropriate substrate, the survey area does not constitute a significant spawning ground for herring.

The highest surface density of sprat biomass in the survey area – 16.79 tons·Mm^{-2} – was estimated for the spring measurement campaign, however, it was more than three times lower than the average value of this parameter determined on the basis of SPRAS cruises in May from 2017–2021. The surface biomass density of sprat determined during the autumn campaign – 2.10 tons·Mm^{-2} – was twice as low as the average from the autumn BIAS cruises calculated for the reference period.

Spawning and spawning migration of sprat takes place from March to July. Despite the absence of adult sprat in catches using midwater trawl in the summer season, based on the results of ichthyoplankton surveys and literature, it can be assumed that sprat spawning takes place late spring and summer in July in the survey area. However, the survey area is not a significant spawning ground for this species.

The results of cod population size surveys carried out in individual survey seasons indicate significant quantitative diversity and, at the same time, numerous occurrence of these fish in the annual cycle in the Baltic East OWF area during the winter season. Therefore, the above results of cod population size surveys may indicate that the Project area is, regardless of the season, an important habitat for fish of this species. The monitored area is not a breeding ground for cod.

The survey area was a place of seasonal living of mainly adult individuals of European flounder. Taking into account the hydrological conditions prevailing in this place (maximum observed salinity below 10 psu) unfavorable for the reproduction of European flounder (*Platichthys flesus*) – present in the survey area [Momigliano et al. 2018], it can be assumed that fish from the surveyed area to moved to the nearby Słupsk Furrow or Gdańsk Deep for spawning. This assumption may be confirmed by the results of ichthyoplankton catches, in which the presence of European flounder larvae in the surveyed area was recorded in winter and spring. Most probably they drifted to this place from spawning grounds located at the above-mentioned depths.

Taking into account the presence of species of Community interest, legally protected in Poland, critically endangered (CR) and endangered (EN) species included in red lists (at national and HELCOM level), key to the ecosystem of the southern Baltic Sea (predatory fish and sandeel) and the function of the area as feeding grounds for ichthyofauna, spawning grounds or fry development sites, the validity of the survey area for ichthyofauna was determined as average.

Detailed survey results are described in Appendix No. 1 to this Report.

3.11.1.4 Seabirds

The Baltic Sea sea basin is used by seabirds as a wintering site or as a stop during migration. Most of the birds surveyed reach their highest population size in the high sea zone located over 1 km from the coast. Seagulls, which accompany fishing vessels in fishing grounds, are an exception to this rule, and their occurrence in the open sea is strongly dependent on human activity.

Seabirds were observed in the Baltic East OWF Area together with a buffer zone 2 nautical miles wide and in the reference area, located at a distance of 112 km south-westwards from the OWF in question [Figure 42].

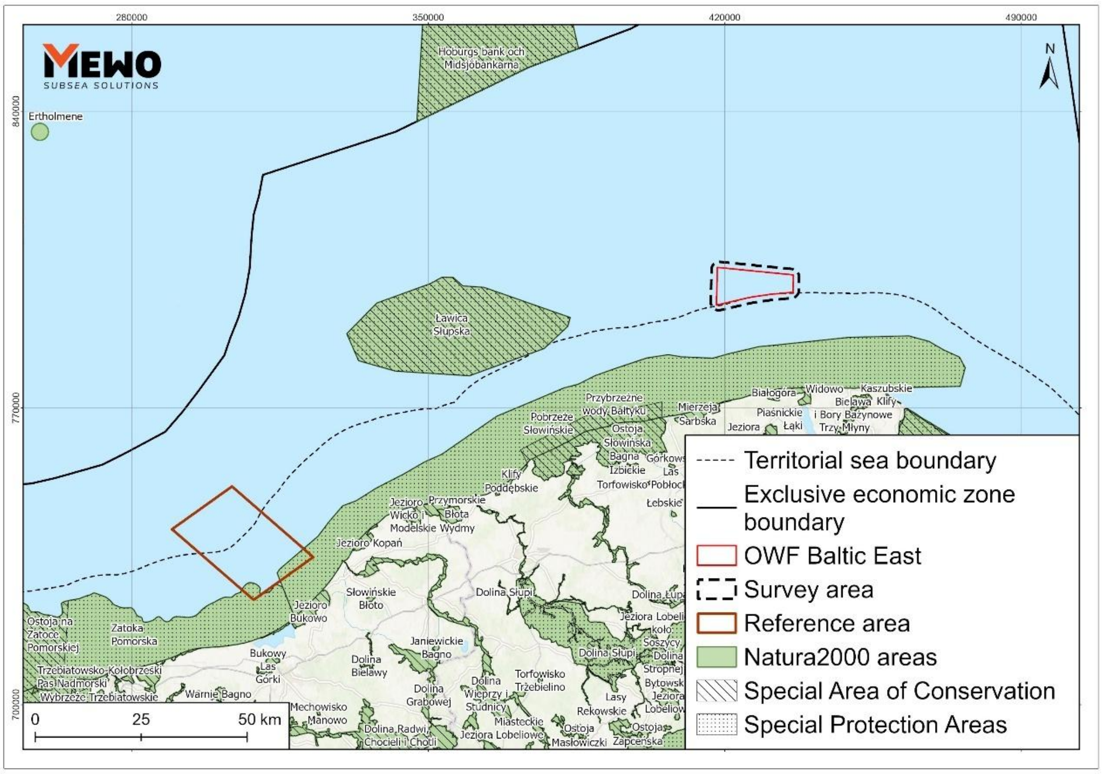

Figure 42 Location of the Baltic East OWF Area and the reference area of the seabird surveys conducted [source: internal materials]

The reference area was selected so that the environmental conditions are similar to the Baltic East OWF Area, which enables direct comparison of the avifauna group in both these sea basins. However, a significant distance (120 km) between these areas means that the comparison may be subject to error due to differences in the abundance and species composition of seabird groups in different parts of the Polish Baltic Sea zone [Chodkiewicz *et al.* 2018, Wardecki *et al.* 2022]. The species composition of birds in both these areas was very similar and changed in subsequent phenological periods. Observations were carried out in the period from June 2022 to May 2023. Detailed results of the surveys for these areas are included in Appendix No. 1 to the EIA Report.

Species composition of birds sitting on water in the Baltic East OWF Area

As part of the observation in the Baltic East OWF Area, a total of 23 species of birds staying on water were recorded, including 12 species related to the marine environment and 11 species of aquatic birds rarely encountered at sea away from the coast, were recorded in all phenological periods [Table 32].

Table 32 Abundance and proportion in the group of individual bird species sitting on water found in the Baltic East OWF Area along the route of the cruise in the entire period from June 2022 to May 2023.

ITEM NO.	SPECIES	ABUNDANCE OF INDIVIDUALS OBSERVED [IND.]	PROPORTION IN THE GROUP [%]
	Seabirds		
1.	long-tailed duck *Clangula hyemalis*	1,286	53.6
2.	razorbill *Alca torda*	512	21.3
3.	common guillemot *Uria aalge*	199	8.3
4.	European herring gull *Larus argentatus*	187	7.8
5.	velvet scoter *Melanitta fusca*	35	1.5
6.	black-throated diver *Gavia arctica*	34	1.4
7.	little gull *Hydrocoloeus minutus*	11	0.5
8.	lesser black-backed gull *Larus fuscus*	11	0.5
9.	great black-backed gull *Larus marinus*	6	0.2
10.	black guillemot *Cepphus grylle*	3	0.1
11.	red-throated diver *Gavia stellata*	2	0.1
12.	common scoter *Melanitta nigra*	1	<0.1
	Waterbirds rarely encountered at sea away from the coast		
13.	mallard *Anas platyrhynchos*	27	1.1
14.	greylag goose *Anser anser*	18	0.7
15.	common teal *Anas crecca*	17	0.7
16.	common merganser *Mergus merganser*	12	0.5
17.	greater scaup *Aythya marila*	8	0.3
18.	common gull *Larus canus*	4	0.2
19.	coot *Fulica atra*	2	0.1
20.	common goldeneye *Bucephala clangula*	1	<0.1
21.	Eurasian wigeon *Mareca Penelope*	1	<0.1
22.	great cormorant *Phalacrocorax carbo*	1	<0.1
23.	black-headed gull *Chroicocephalus ridibundus*	1	<0.1
	Birds undetermined as to the species		

ITEM NO.	SPECIES	ABUNDANCE OF INDIVIDUALS OBSERVED [IND.]	PROPORTION IN THE GROUP [%]
24.	undetermined ducks *Anatidae*	15	0.6
25.	unidentified divers *Gavia sp.*	7	0.3
	Total	2,401	100

In total, 2401 birds staying along transects in the Baltic East OWF Area were observed. 17 bird species covered in Poland by strict species protection (long-tailed duck, razorbill, common guillemot, black guillemot, velvet scoter, great black-backed gull, lesser black-backed gull, little gull, common gull, common scoter, red-throated diver, black-throated diver, greater scaup, common goldeneye, Eurasian wigeon, black-headed gull, and common merganser) and two species covered in Poland by partial protection (great cormorant and European herring gull) were found. In addition, 4 species subject to hunting management were found (mallard, Eurasian coot, common teal and graylag goose). Three species of birds staying on water are listed in Annex I to the Birds Directive (little gull, red-throated diver and black-throated diver). Moreover, two of the observed species (long-tailed duck and velvet scoter) have a higher category VU (vulnerable) while the Eurasian coot is classified as NT (near threatened), according to the International Union for Conservation of Nature (IUCN) classification for the world, also used by HELCOM. Moreover, the HELCOM Red List distinguished both species of divers as critically endangered (CR), common scoter as endangered species (EN) and little gull as near threatened species (NT) [HELCOM 2013] [Figure 43].

The species structure of the seabird group found there was typical for most sea basins located in the Baltic Sea away from the coast [Durinck et al. 1994, Rydell et al. 2011; Meissner 2014a; Meissner 2014b; Markones et al. 2015; Meissner 2015], however, of the three most abundant wintering species of sea ducks, only the long-tailed duck was abundant in both areas. The common guillemot, for which large post-breeding groups were observed, and the razorbill, which appears in greater numbers in autumn and winter, were also quite abundant. In the case of the common guillemot, as in the case of other alcid species, young birds leaving breeding colonies are not yet prepared for independent living and require a long period of staying under the care of adult birds [Cramp et al. 1983]. In this period, sea basins with a sufficiently abundant food base, where young individuals learn to obtain food themselves, are of key importance for this species.

The relatively high proportion of common guillemot and razorbill in the Baltic East OWF Area is a result deviating from the previous knowledge about the species structure of seabird groups in sea basins in the Polish Baltic Sea zone. Knowledge about the occurrence of these species in the Baltic Sea outside breeding colonies is still insufficient. During the post-breeding period in the open sea, they are usually very much dispersed [Cramp et al. 1983; Durinck et al. 1994]. Higher concentrations were observed in winter, e.g. in the Danish straits [Cramp et al. 1983; Durinck et al. 1994], however, according to the available scientific literature, their larger groups have not been detected so far in the Polish Baltic Sea zone [Tomiałojć et al. 2003]. High abundance of both these species was also observed during the surveys carried out in the area of the neighboring OWFs [Meissner 2015, Opioła et al. 2020; Gajewski et al. 2021]. This may indicate that at the Polish coasts, these species form concentrations in sea basins with deeper depths than diving benthivorous birds. Therefore such sites have not been known so far, as the surveys so far have mainly focused on shallower areas, where high numbers of birds are expected, especially diving benthivorous birds [Chodkiewicz et al. 2018; Wardecki et al. 2022].

In the Baltic East OWF Area, the European herring gull was also abundant, which is a species widely distributed in the Baltic Sea and is not a species with a high conservation priority, under partial protection. European herring gulls penetrate the offshore area to seek food, mainly waste generated during fishing and fish processing on fishing vessels [MDI 2015; Garthe et al. 2003; Garthe 1997]. They therefore often accompany fishing vessels at fishing grounds far from the coast. Therefore, most of the observations of European herring gulls during the survey concerned individuals flying over water.

Detailed information on the results of seabird observations is included in Appendix No. 1 to the EIA Report.

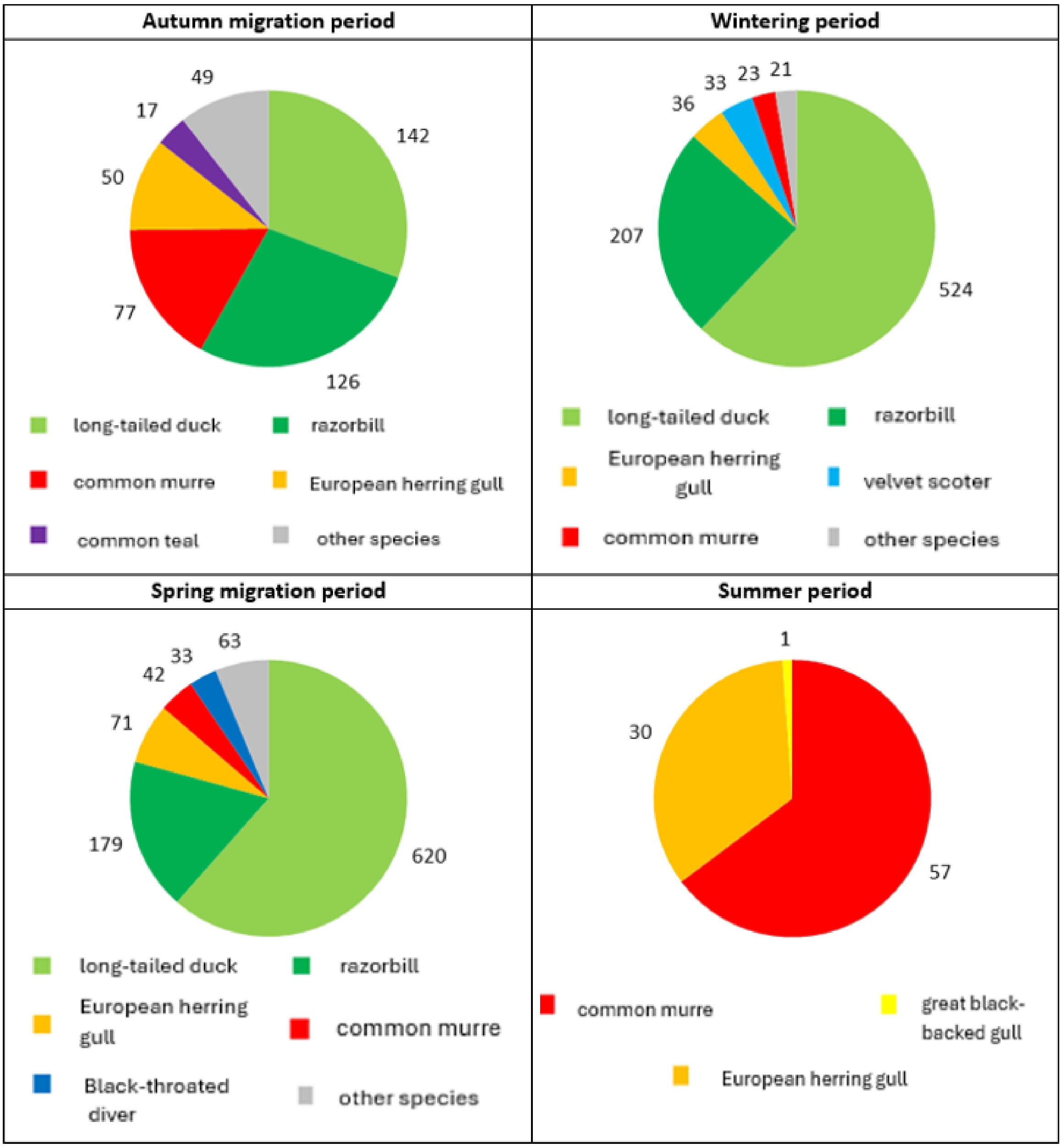

Figure 43 Proportion of dominant bird species sitting on water in the entire group of birds in the Baltic East OWF Area throughout the period from June 2022 to May 2023.

Species composition of birds sitting on water in additional areas of significant importance for birds

As part of the observations within the reference area, a total of 21 species of birds staying on water were recorded, including 13 species related to the marine environment and 8 species of aquatic birds rarely encountered at sea away from the coast [Table 33].

Table 33 Abundance and percent share in the group of individual bird species sitting on water found in the reference area in the period from June 2022 to May 2023.

ITEM NO.	SPECIES	ABUNDANCE OF INDIVIDUALS OBSERVED [IND.]	PROPORTION IN THE GROUP [%]
Seabirds			
1.	long-tailed duck *Clangula hyemalis*	1,522	48.3
2.	European herring gull *Larus argentatus*	703	22.3
3.	common guillemot *Uria aalge*	225	7.1
4.	velvet scoter *Melanitta fusca*	195	6.2
5.	razorbill *Alca torda*	192	6.1
6.	black-throated diver *Gavia arctica*	56	1.8
7.	little gull *Hydrocoloeus minutus*	11	0.3
8.	common scoter *Melanitta nigra*	11	0.3
9.	great black-backed gull *Larus marinus*	8	0.3
10.	lesser black-backed gull *Larus fuscus*	7	0.2
11.	red-throated diver *Gavia stellata*	6	0.2
12.	black guillemot *Cepphus grylle*	3	0.1
13.	horned grebe *Podiceps auritus*	1	< 0.1
Waterbirds rarely encountered at sea away from the coast			
14.	great cormorant *Phalacrocorax carbo*	41	1.3
15.	greater scaup *Aythya marila*	27	0.9
16.	mute swan *Cygnus olor*	19	0.6
17.	common gull *Larus canus*	5	0.2
18.	black-headed gull *Chroicocephalus ridibundus*	2	0.1
19.	coot *Fulica atra*	1	< 0.1
20.	greater white-fronted goose *Anser albifrons*	1	< 0.1
21.	common teal *Anas crecca*	1	< 0.1
Birds undetermined as to the species			
22.	unidentified divers *Gavia sp.*	55	1.7
23.	undetermined ducks *Anatidae*	33	1.0
24.	unidentified gulls *Laridae*	20	0.6
25.	unidentified geese *Anserinae*	3	0.1
26.	unidentified diving ducks *Aythya sp.*	1	< 0.1
	Total	**3,149**	**100**

Detailed results of the survey of seabirds carried out in the Baltic East OWF Area and in the reference areas together with the analysis are included in Appendix No. 1 to the EIA Report.

Distribution and densities of waterbirds in the sea basins surveyed

In the Baltic East OWF Area and in the reference area, the dependence of the observed densities of the long-tailed duck on the depth was not clearly visible. Usually, the highest densities of diving benthivorous birds, including long-tailed ducks, are recorded in the shallowest parts of the sea basins surveyed [Durinck *et al.* 1994; Meissner 2014, 2015; Antczak *et al.* 2018]. The lack of such dependence may result from low densities of mussels, which are the basic food for birds from this morpho-ecological group, as their distribution in sea basins during the post-breeding period strongly depends on the availability of food [Kirk *et al.* 2008; Cervencl *et al.* 2015]. It cannot be excluded that this dependence is less pronounced with low numbers of benthivorous birds. However, in the case of common guillemot and razorbill which feed on fish, it should not be expected that their density will depend on the depth of the sea basin, as in the case of piscivorous birds, higher concentrations are most often related to the presence of pelagic fish constituting their food and do not depend as much on the depth of the sea basin as in the case of benthivorous birds [Cramp *et al.* 1983; Durinck *et al.* 1994].

In the deepest part of the Baltic East OWF Area, the densities of the entire group of seabirds were very low. However, in its shallowest part, where the depth was less than 30 m, the densities were very diverse. In the reference area, such dependence is not visible and the distribution of average densities of the entire avifauna group was slightly diversified. However, the average density of birds in the reference area was higher than in the Baltic East OWF Area and it remained within the range from 10 to 20 ind./km^2 over 90% of its surface area. The lack of the expected relationship between the average density of birds and depth could result from the low average annual abundance of diving benthivorous birds (including long-tailed ducks), which determine the occurrence of such a relationship, or from low densities of zoobenthos, which constitutes their food.

The total number of long-tailed ducks and density in both areas analysed were not high. This is most probably due to the significant depth of these sea basins. For see ducks, feeding on shallower sea basins (down to a depth of 20–25 m), rich in food, is the most energy-effective, and only a decrease in the density of benthic organisms forces them to move to other places, also those with greater depths [Kirk *et al.* 2008; Meissner 2010].

To sum up, the Baltic East OWF Area is not a place of high concentrations of seabirds, as in most of its area, bird densities were low or very low. Only during spring migration from wintering sites in the Baltic Sea to Siberian breeding grounds, a slightly higher concentration of long-tailed ducks staying in the shallowest south-eastern part of this sea basin was recorded there. However, both the average and maximum density of this species in spring was significantly lower than in other areas intended for the construction of offshore wind farms [Meissner 2014, 2015, Opioła *et al.* 2020; Gajewski *et al.* 2021].

However, the area of the future wind farm turned out to be a place of post-breeding, summer and autumn concentrations of the common guillemot. In the case of this species, as in the case of other alcid species, young birds leaving breeding colonies are not volatile and remain under adult bird care. The closest breeding grounds of razorbills, from where the individuals found in the Baltic East OWF Area may come, are the colonies on the Graesholm island in Denmark (approximately 165 km to the north-west) and in Sweden: on the coast of Småland (approximately 175 km northwest), Greenland (approximately 205 km northwards) and Stora Karlsö (approximately 245 km northwards) [Haubeck *et al.* 2011; SLU species Database: artfakta.se]. It can be assumed that the construction of an offshore wind farm will force them to leave this place, but these birds will be able to move to other sea basins with a sufficient abundance of pelagic fish. In the case of piscivorous birds, the depth of the sea basin does not affect their distribution, as in the case of diving benthivorous birds.

The distribution and densities of the entire seabird group, obtained as a result of geostatistical analyses in individual phenological periods, are presented in figures Figure 44–Figure 47. A detailed description of the methodology and results of analyses is described in Appendix No. 1 to the EIA Report. A methodology similar to that used in the surveys for the neighboring OWFs was applied, and the bird density results in the Baltic East OWF are comparable to those of surveys conducted for other OWF projects in the Polish maritime areas.

Seabird species included in the impact assessment

The environmental impact assessment for the Baltic East OWF includes birds that were present (seating on the water) along transects during the survey campaigns. The assessment does not take into account the results obtained from radar surveys, dealing in detail with the issue of avifauna migration. These data were analysed in the section dedicated to migratory birds. When conducting the assessment, the following was taken into account:

1. The most numerous species of seabirds whose proportion in the number in the Baltic East OWF development area and the reference area reached at least 1% (rounded up to more than 0.5%) in at least one phenological period.
2. Subjects of protection of the Natura 2000 site PLB990002 *Przybrzeżne wody Bałtyku.*
3. Subjects of protection of the Natura 2000 site PLB990001 *Ławica Słupska*.

Based on the surveys conducted, the first condition was met by 17 bird species, i.e. long-tailed duck *Clangula hyemalis*, velvet scoter *Melanitta fusca*, common scoter *Melanitta nigra*, razorbill *Alca torda*, common guillemot *Uria aalge*, black-throated diver *Gavia arctica,* Eurasian teal *Anas crecca*, mallard *Anas platyrhynchos*, greater scaup *Aythya marila*, common merganser *Mergus merganser*, greylag goose *Anser anser*, great cormorant *Phalacrocorax carbo*, mute swan *Cygnus olor* and gulls: European herring gull *Larus argentatus*, lesser black-backed gull *Larus fuscus,* great black-backed gull *Larus marinus* and little gull *Hydrocoloeus minutus*. However, further environmental impact assessment of the proposed project excluded 7 species of waterbirds rarely found at sea away from the coast, whose high proportion in the group (above 1%) resulted from the low total number of birds staying in both sea basins. These species were: greater scaup (maximum 27 ind. in a phenological period), great cormorant (max. 20 ind.), mute swan (max. 19 ind.), graylag goose (max. 18 ind.), common teal (max. 17 ind.), mallard (max. 13 ind.), greater scaup (max. 8 ind.) and common merganser (max. 6 ind.).

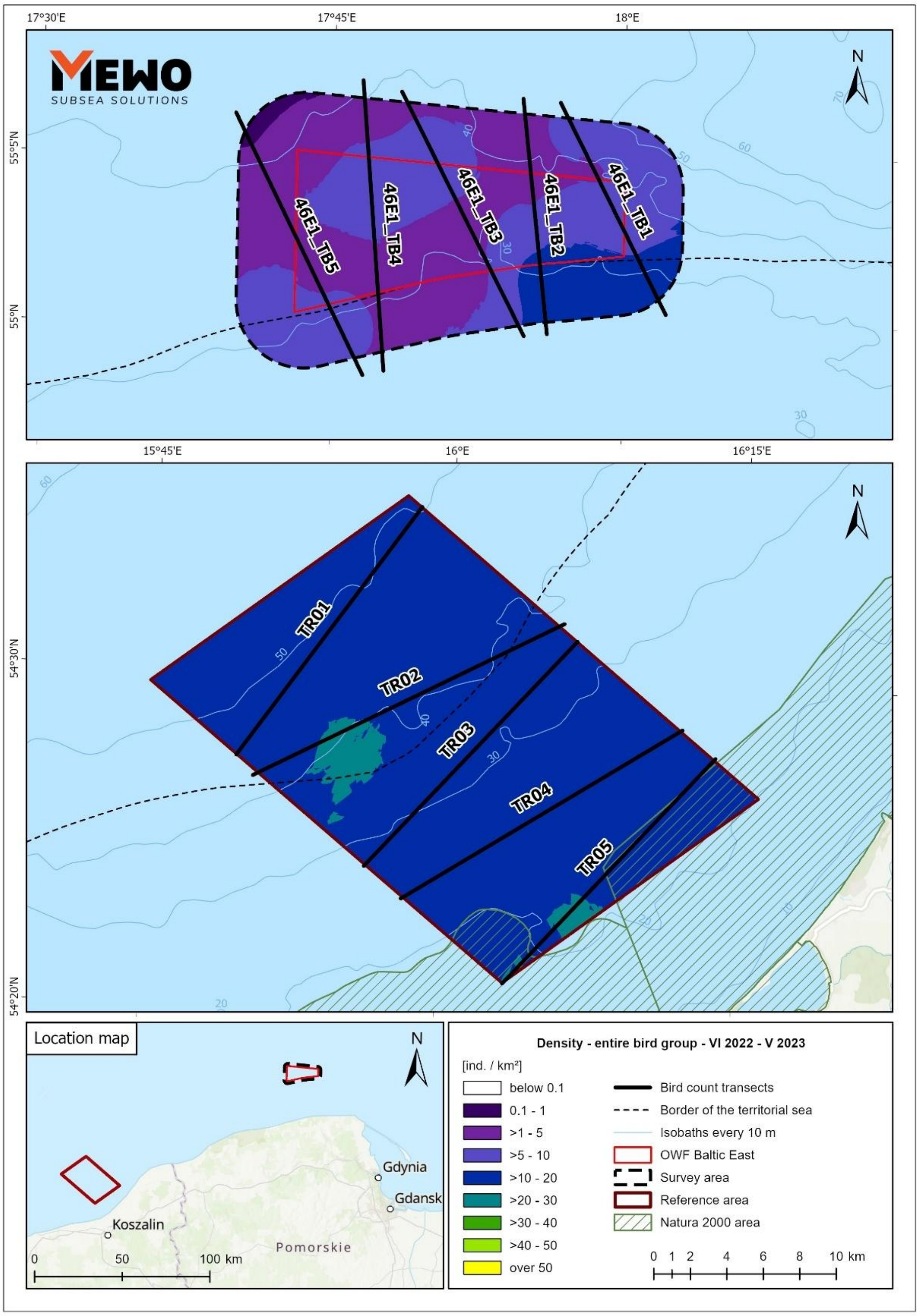

Figure 44 Spatial distribution of average densities of all seabirds in the Baltic East OWF Area and reference area in summer

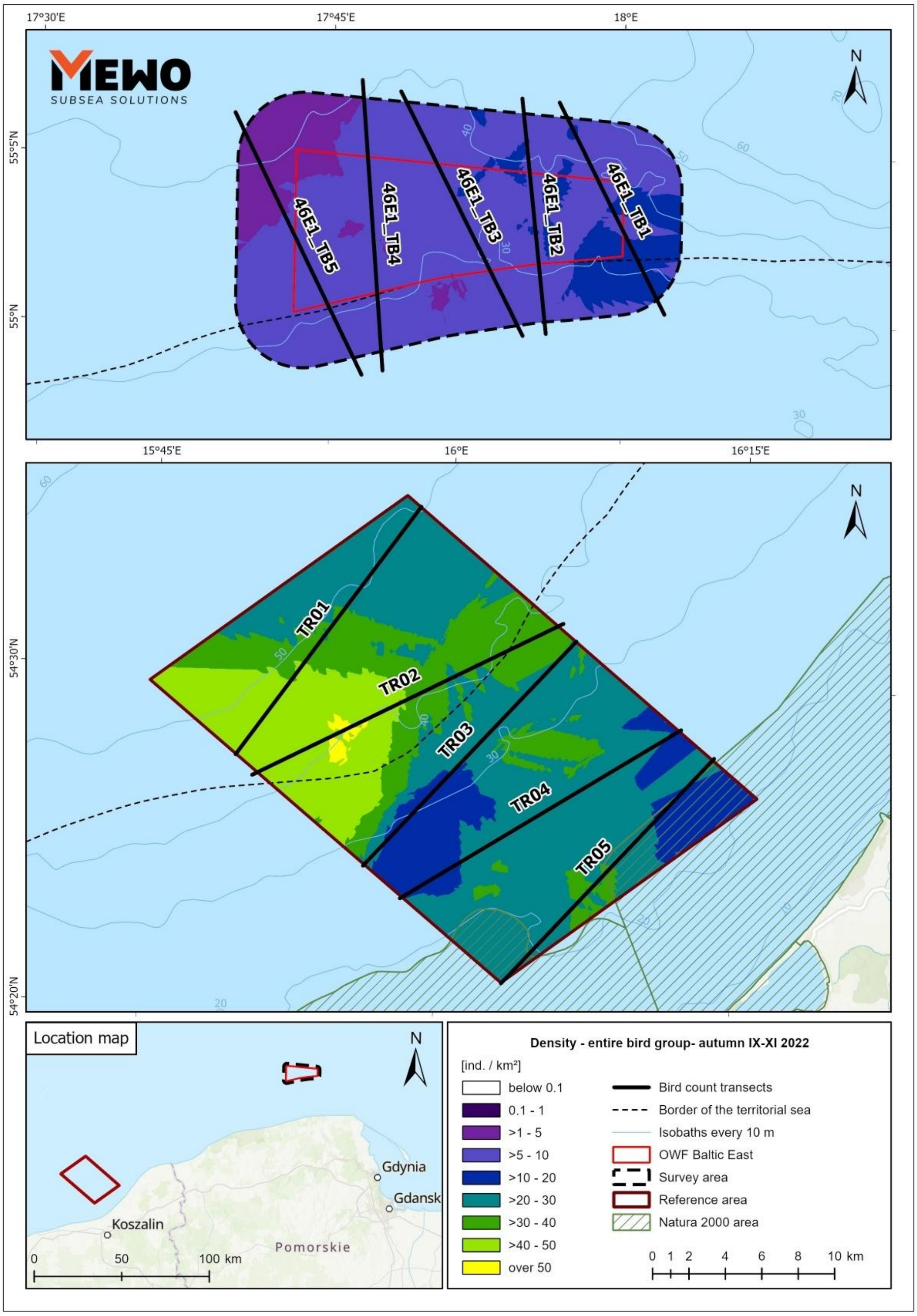

Figure 45 Spatial distribution of average densities of all seabirds in the Baltic East OWF Area and reference area during the autumn migration period

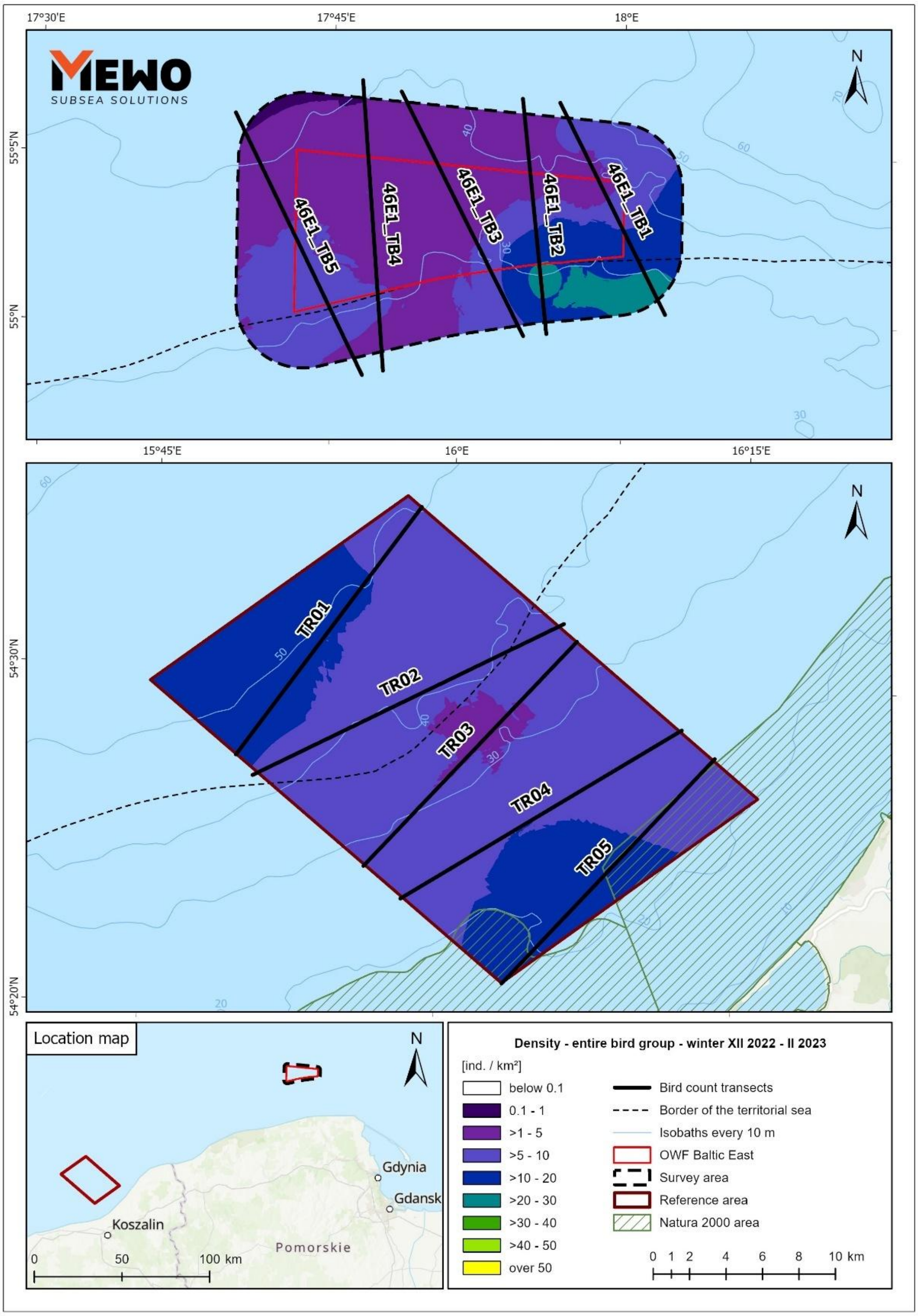

Figure 46 Spatial distribution of average densities of all seabirds in the Baltic East OWF Area and reference area in the wintering period

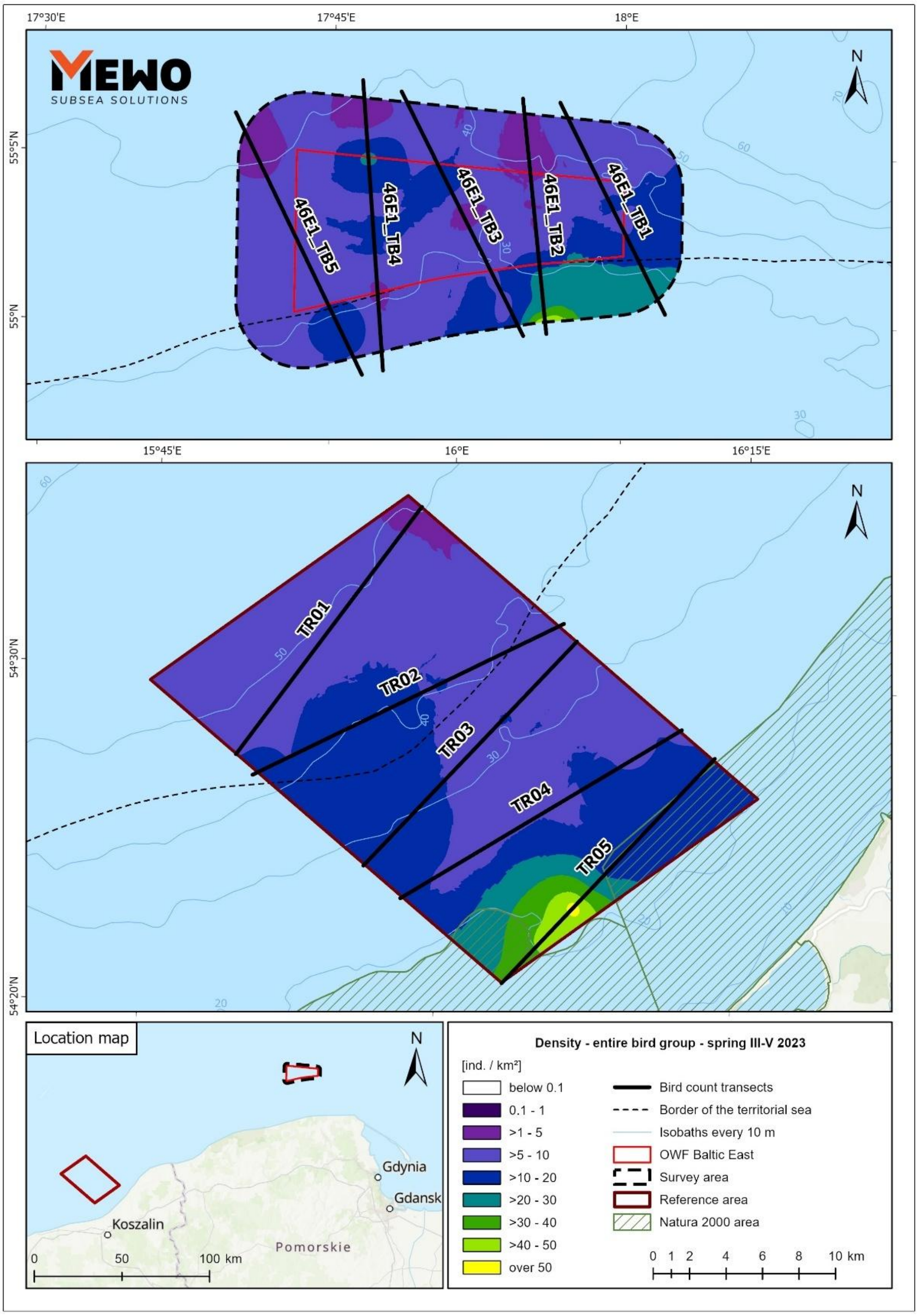

Figure 47 Spatial distribution of average densities of all seabirds in the Baltic East OWF Area and reference area during the spring migration period.

The subjects of protection in the *Ławica Słupska and Przybrzeżne wody Bałtyku* Special Protection Areas are the wintering and migrating populations of: velvet scoter *Melanitta fusca*, long-tailed duck *Clangula hyemalis*, and black guillemot *Cepphus grylle.* In addition, the wintering populations of European herring gull *Larus argentatus* and common gull *Larus canus*, common scoter *Melanitta* *nigra*, razorbill *Alca torda* and black-throated diver *Gavia arctica* and red-throated diver *Gavia stellata* are protected in the *Przybrzeżnych wód Bałtyku* site.

The birds subject to the assessment were classified into 3 ecological groups, bringing together species with similar habitat requirements and comparable sensitivity to impacts related to the OWF construction, operation and decommissioning. These are:

1. Benthivorous birds:
   - long-tailed duck *Clangula hyemalis,*
   - velvet scoter *Melanitta fusca,*
   - common scoter *Melanitta nigra.*
2. Piscivorous birds:
   - razorbill *Alca torda,*
   - common guillemot *Uuria aalge*,
   - black guillemot *Cepphus grylle,*
   - black-throated diver *Gavia arctica,*
   - red-throated diver *Gavia stellata.*
3. Seagulls:
   - European herring gull *Larus argentatus,*
   - great black-backed gull *Larus marinus,*
   - little gull *Hydrocoloeus minutus,*
   - common gull *Larus canus,*
   - lesser black-backed gull *Larus fuscus.*

3.11.1.5 Migratory birds

Bird migration surveys were carried out during the autumn migration (August – November 2022) and spring migration (March – May 2023). Data was collected during fifteen survey cruises, covering a total of 40 days of visual observations, vertical and horizontal radar tracking and acoustic recordings.

Detailed survey results are described in Appendix No. 1 to this Report.

The most abundant migratory bird species observed during the surveys were the long-tailed duck, razorbill, greater white-fronted goose, Eurasian skylark and velvet scoter, as well as geese, ducks, alcids and passerines unidentified to the species. Great cormorant, Eurasian wigeon and common scoter were also found in large numbers. Geese (nearly 30% of all visual observations) were most frequently observed in autumn: mainly unidentified to the species, greater white-fronted geese and bean geese. However, during visual observations in spring, the most numerous species found were the long-tailed duck, alcids, common scoter, great cormorant, graylag goose and little gull. Migratory bird species observed during visual observations together with their conservation status and total number of individuals are presented in Table 34. The number of observations in categories marked only for rows or families is included in the next table [Table 34].

Twenty-one species are listed in Annex I to Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 *on the conservation of wild birds*. On the basis of the International Union for Conservation of Nature (IUCN) classification, common eider *Somateria mollissima* is recognised at European level as endangered (EN). The following are considered vulnerable (VU): velvet scoter *Melanitta fusca*, northern pintail *Anas acuta*, tundra swan *Cygnus columbianus*, rook *Corvus frugilegus*, common snipe *Gallinago gallinago* and northern lapwing *Vanellus vanellus*, whereas the following are considered near threatened (NT): hen harrier *Circus cyaneus*, Eurasian curlew *Numenius arquata*, red-footed falcon *Falco vespertinus*, tufted duck *Aythya fuligula*, red-breasted merganser *Mergus serrator*, common swift *Apus apus* and horned grebe *Podiceps auritus*. According to the HELCOM threat category, wintering populations of both species of divers are critically endangered (CR), whereas wintering populations of horned grebe *Podiceps auritus*, common eider *Somateria mollissima*, velvet scoter *Melanitta fusca*, common scoter *Melanitta nigra*, taiga bean goose *Anser fabalis*, long-tailed duck *Clangula hyemalis* and the breeding population of dunlin *Calidris alpina schinzii* are classified as endangered (EN). Breeding populations of horned grebe *Podiceps auritus*, common eider Somateria mollissima, and velvet scoter Melanitta fusca, the entire population of lesser black-backed gull *Larus fuscus*, greater scaup *Aythya marila*, Caspian tern *Hydroprogne caspia* and red-breasted merganser *Mergus serrator* were identified as vulnerable. The little gull *Larus minutus*, Temminck's stint *Calidris temminckii*, northern wheatear *Oenanthe oenanthe*, tufted duck *Ayhthya fuligula* and northern lapwing *Vanellus vanellus* are listed as near-threatened (NT). Among the listed species, very few (up to 10 individuals) were observed: horned grebe *Podiceps aur*itus, common eider *Somateria mollissima*, Caspian tern *Hydroprogne caspia*, northern wheatear *Oenanthe oenanthe*, Temminck's stint *Calidris temminckii,* common snipe *Gallinago gallinago*, sandwich tern *Thalasseus sandvicensis*, dunlin *Calidris alipca schinzii*, rook *Corvus frugilegus*, black guillemot *Cepphus grylle* and northern lapwing *Vanellus vanellus*. Among the particularly abundant species observed on the basis of the visual and radar observations in total are the long-tailed duck *Clangula hyemalis* (almost 2000 ind. in total), razorbill *Alca torda* (more than 1400), velvet scoter *Melanitta fusca* (more than 1200), Eurasian skylark *Alauda arvensis* (almost 1200), Eurasian wigeon *Mareca penelope* (more than 1000), common scoter *Melanitta nigra* (more than 900), taiga bean goose *Anser fabalis* and greater white-fronted goose *Anser albifrons* (both species more than 800), great cormorant *Phalacrocorax carbo* (more than 800), little gull *Larus minutus* (more than 600), common murre *Uria aalgae*, whooper swan *Cygnus cygnus* (both species more than 400 ind.).

Table 34 Number of birds identified to the species, recorded during visual observations in autumn of 2022 and spring of 2023 and their national and international conservation status [source: internal materials based on Baltic East OWF data]

ENGLISH NAME	LATIN NAME	NUMBER OF INDIVIDUALS	SPECIES PROTECTION IN POLAND	ANNEX I TO THE BIRDS DIRECTIVE	IUCN	CAT. HELCOM THREAT CATEGORY	NATURA 2000
Long-tailed duck	*Clangula hyemalis*	550	SP	No	LC/VU	EN (wp)	1,2,3,4
Razorbill	*Alca torda*	342	SP	No	LC	-	2
Greater white-fronted goose	*Anser albifrons*	341	G	No	LC	-	-
Eurasian skylark	*Alauda arvensis*	313	SP	No	LC	-	-
Velvet scoter	*Melanitta fusca*	301	SP	No	VU	VU (bp) EN (wp)	1,2,4
Great cormorant	*Phalacrocorax carbo*	197	PP	No	LC	-	-
Eurasian wigeon	*Mareca penelope*	189	SP	No	LC	-	-
Common scoter	*Melanitta nigra*	175	SP	No	LC	EN (wp)	4
Common guillemot	*Uria aalge*	137	SP	No	LC	-	-
Grayleg goose	*Anser anser*	135	G	No	LC	-	-
Little gull	*Larus minutus*	129	SP	Yes	LC	NT	-
Lesser black-backed gull	*Larus fuscus*	88	SP	No	LC	VU	-
Black-throated diver	*Gavia arctica*	73	SP	Yes	LC	CR (wp)	1,2,4
Siskin	*Spinus spinus*	72	SP	No	LC	-	-
European herring gull	*Larus argentatus*	63	PP	No	LC	-	-
Common gull	*Larus canus*	59	SP	No	LC	-	2
Common teal	*Anas crecca*	58	G	No	LC	-	-
Tufted duck	*Aythya fuligula*	57	G	No	NT/LC	NT	-
Northern shoveler	*Anas clypeata*	52	SP	No	LC	-	-
Mallard	*Anas platyrhynchos*	52	G	No	LC	-	-
Chaffinch	*Fringilla coelebs*	47	SP	No	LC	-	-
Black tern	*Chlidonias niger*	46	SP	Yes	LC	-	-
Greater scaup	*Aythya marila*	45	SP	No	LC	VU	-
Whopper swan	*Cygnus cygnus*	45	SP	Yes	LC	-	-
Taiga bean goose	*Anser fabalis*	40	G	No	LC	EN (wp)	-
Black-headed gull	*Croicocephalus ridibundus*	34	SP	No	LC	-	-
Barn swallow	*Hirundo rustica*	32	SP	No	LC	-	-
Common merganser	*Mergus merganser*	26	SP	No	LC	-	-
Red-throated diver	*Gavia stellata*	23	SP	Yes	LC	CR (wp)	-
Common starling	*Sturnus vulgaris*	23	SP	No	LC	-	-
White wagtail	*Motacilla alba*	19	SP	No	LC	-	-
Northern pintail	*Anas acuta*	14	SP	No	VU/LC	-	-
Common swift	*Apus apus*	13	SP	No	NT/LC	-	-
Red-breasted merganser	*Mergus serrator*	13	SP	No	NT/LC	VU	-
Great egret	*Ardea alba*	12	SP	Yes	LC	-	-

ENGLISH NAME	LATIN NAME	NUMBER OF INDIVIDUALS	SPECIES PROTECTION IN POLAND	ANNEX I TO THE BIRDS DIRECTIVE	IUCN	CAT. HELCOM THREAT CATEGORY	NATURA 2000
European golden plover	*Pluvialis apricaria*	12	SP	Yes	LC	-	-
Siskin	*Spinus spinus*	10	SP	No	LC	-	-
Gadwall	*Anas strepera*	9	SP	No	LC	-	-
Parasitic jaeger	*Stercorarius parasiticus*	9	SP	No	LC	-	-
Meadow pipit	*Anthus pratensis*	8	SP	No	LC	-	-
Crane	*Grus grus*	8	SP	Yes	LC	-	-
European goldfinch	*Carduelis carduelis*	6	SP	No	LC	-	-
Yellow wagtail	*Motacilla flava*	6	SP	No	LC	-	-
Blue tit	*Parus caeruleus*	6	SP	No	LC	-	-
Great black-backed gull	*Larus marinus*	5	SP	No	LC	-	-
Common tern	*Sterna hirundo*	5	SP	Yes	LC	-	-
Eurasian wren	*Troglodytes troglodytes*	5	SP	No	LC	-	-
Lapwing	*Vanellus vanellus*	5	SP	No	VU/NT	NT	-
Mute swan	*Cygnus olor*	4	SP	No	LC	-	-
Robin	*Erithacus rubecula*	4	SP	No	LC	-	-
Sandwich stern	*Sterna sandvicensis*	4	SP	Yes	LC	LC	-
Canada goose	*Branta canadensis*	3	SP	No	LC	-	-
Common redpoll	*Acanthis flammea*	3	SP	No	LC	-	-
Jackdaw	*Corvus monedula*	3	SP	No	LC	-	-
Kestrel	*Falco tinnunculus*	3	SP	No	LC	-	-
Red-footed falcon	*Falco vespertinus*	3	SP	No	NT	-	-
Twite	*Linaria flavirostris*	3	SP	No	LC	-	-
Eurasian sparrowhawk	*Accipiter nisus*	2	SP	No	LC	-	-
Short-eared owl	*Asio flammeus*	2	SP	Yes	LC	-	-
Common wood pigeon	*Columba palumbus*	2	G	No	LC	-	-
Rook	*Corvus frugilegus*	2	PP	No	VU/LC	-	-
Brambling	*Fringilla montifringilla*	2	SP	No	LC	-	-
Caspian tern	*Hydroprogne caspia*	2	SP	No	LC	VU	-
Eurasian whimbrel	*Numenius phaeopus*	2	SP	No	LC	-	-
Goldcrest	*Regulus regulus*	2	SP	No	LC	-	-
Common blackbird	*Turdus merula*	2	SP	No	LC	-	-
Song thrush	*Turdus philomelos*	2	SP	No	LC	-	-
Hawk	*Accipiter gentilis*	1	SP	No	LC	-	-
Grey heron	*Ardea cinerea*	1	PP	No	LC	-	-
Red knot	*Calidris canutus*	1	SP	No	LC/NT	-	-
Temminck's stint	*Calidris temminckii*	1	SP	No	LC	NT	-
Western marsh-harrier	*Circus aeruginosus*	1	SP	Yes	LC	-	-

ENGLISH NAME	LATIN NAME	NUMBER OF INDIVIDUALS	SPECIES PROTECTION IN POLAND	ANNEX I TO THE BIRDS DIRECTIVE	IUCN	CAT. HELCOM THREAT CATEGORY	NATURA 2000
Tundra swan	*Cygnus columbianus*	1	SP	No	VU/LC	-	-
Yellowhammer	*Emberiza citrinella*	1	SP	No	LC	-	-
Caspian gull	*Larus cachinnans*	1	SP	No	LC	-	-
Woodlark	*Lullula arborea*	1	SP	Yes	LC	-	-
Citrine wagtail	*Motacilla citreola*	1	SP	No	LC	-	-
Spotted flycatcher	*Muscicapa striata*	1	SP	No	LC	-	-
Common redstart	*Phoenicurus phoenicurus*	1	SP	No	LC	-	-
Whinchat	*Saxicola rubetra*	1	SP	No	LC	-	-
Arctic tern	*Sterna paradisaea*	1	SP	Yes	LC	-	-
Lesser whitethroat	*Sylvia curruca*	1	SP	No	LC	-	-

[1]Regulation of the Minister of Environment of 16 December 2016 on the protection of animal species (consolidated text: Journal of Laws of 2022, item 2380); regulation of the Minister of the Environment of 11 March 2005 on establishing a list of game species (consolidated text: Journal of Laws of 2023, item 2454): SP – strict species protection, PP – partial species protection, G – game species

[2]IUCN: EN – endangered, VU – vulnerable, NT – near threatened, LC – least concern; the first value refers to the European population, the second to the world population

[3]HELCOM: CR – critically endangered; EN – endangered; VU – vulnerable, NT – near threatened, LC – last concern; WP – wintering population, BP – breeding population

[4]Natura 2000: species referred to in Article 4 of Directive 2009/147/EC and listed in Annex II of Directive 92/43/EEC for the site: 1) Ławica Słupska [Słupsk Bank], 2) Przybrzeżne Wody Bałtyku [Coastal Waters of the Baltic Sea], 3) Hoburgs bank och Midsjöbankarna, 4) Zatoka Pomorska [Pomeranian Bay]

Table 35 Number of birds identified to the species groups recorded during all visual observations in autumn of 2022 and spring of 2023 [source: internal materials based on Baltic East OWF data]

SPECIES GROUP	LATIN NAME	NUMBER OF INDIVIDUALS
Unidentified goose	*Anserini indet.*	1007
Unidentified duck	*Anatinae indet.*	843
Razorbill/common guillemot	*Alca torda / Uria aalge*	472
Unidentified passerines	*Passeriformes indet.*	194
Unidentified diver	*Gavia indet.*	91
Unidentified Charadriiforme	*Limicolae indet.*	34
Unidentified Melanitta	*Melanitta indet.*	21
Unidentified swan	*Cygnidae indet.*	17
Unidentified dunlin	*Calidris indet.*	8
Unidentified pigeon	*Columba indet.*	2
Long-tailer jaeger/parasitic jaeger	*Stercorarius parasiticus / pomarinus*	2
Common tern /Arctic tern	*Sterna hirundo / paradisaea*	2

SPECIES GROUP	LATIN NAME	NUMBER OF INDIVIDUALS
Unidentified falcon	*Falco indet.*	1
Red-breasted merganser/common merganser	*Mergus serrator/merganser*	1
Unidentified tern	*Sterninae indet.*	1

For the purpose of the analysis of the proposed project impact assessment on migratory birds, some species and categories were summed up at the family level (e.g. geese, jaegers, terns) or at the order level (e.g. alcids). Pigeons and jaeger were summed up with all passerine birds due to similar migration phenology. The category of ducks includes species from tribe *Anatini* [Table 36]. Due to the significant number of observations, the Eurasian wigeon was extracted from this category.

Table 36 Number of individuals of individual groups of birds and migratory species observed in autumn and spring during visual observations [source: internal materials based on Baltic East OWF data]

ITEM	ENGLISH NAME	LATIN NAME	NUMBER OF OBSERVATIONS			(%) OF ALL OBSERVATIONS
			AUTUMN	SPRING	TOTAL	
1	Geese	*Anserini*	1226	300	1526	22.98%
2	Auks	*Alcidae*	536	415	951	14.32%
3	Unidentified ducks	*Anatinae indet.*	593	250	843	12.69%
4	Passerine/pigeons	*Passeriformes/Columbinae*	403	385	788	11.87%
5	Long-tailed duck	*Clangula hyeamlis*	299	251	550	8.28%
6	Velvet scoter	*Mellanita fusca*	209	92	301	4.53%
7	Great cormorant	*Phalacrocorax carbo*	61	136	197	2.97%
8	Dabbling ducks	*Anatini*	128	64	192	2.89%
9	Divers	*Gaviidae*	57	130	187	2.82%
10	Eurasian wigeon	*Mareca penelope*	182	0	182	2.74%
11	Common scoter	*Mellanita nigra*	35	140	175	2.64%
12	Little gull	*Hydrocoloeus minutus*	24	105	129	1.94%
13	Lesser black-backed gull	*Larus fuscus*	20	68	88	1.33%
14	Swans	*Cygnidae*	54	13	67	1.01%
15	European herring gull	*Larus argentatus*	63	0	63	0.95%
16	Common gull	*Larus canus*	26	33	59	0.89%
17	Charadriiformes	*Charadriidae*	39	19	58	0.87%
18	Tufted duck	*Aythya fuligula*	50	7	57	0.86%
19	Black tern	*Chlidonias niger*	12	34	46	0.69%
20	Greater scaup	*Aythya marila*	28	17	45	0.68%
21	Common merganser/red-breasted merganser	*Mergus merganser/serrator*	23	17	40	0.60%
22	Black-headed gull	*Croicocephalus ridibundus*	7	27	34	0.51%
23	Terns	*Sternidae*	5	8	13	0.20%
24	Predatory/owls	*Accipitriformes/Strigiformes*	5	8	13	0.20%
25	Great egret	*Ardea alba*	0	12	12	0.18%
26	Jaegers	*Stercorariidae*	4	7	11	0.17%
27	Crane	*Grus grus*	0	8	8	0.12%

ITEM	ENGLISH NAME	LATIN NAME	NUMBER OF OBSERVATIONS			(%) OF ALL OBSERVATIONS
			AUTUMN	SPRING	TOTAL	
28	Great black-backed gull	*Larus marinus*	5	0	5	0.08%
29	Grey heron	*Ardea cinerea*	1	0	1	002%
30	*Other observations*		20	9	29	0.44%
Total			4095	2546	6641	100.00%

The analysis of migration fluxes (the width of passage through the Baltic East Area taken into account in the analysis was 10 km) showed that the long-tailed ducks flying across the area during the autumn migration accounted for 1.12% and in spring for 0.23% of this species' biogeographical population [Table 37]. In the case of common scoter, in spring and autumn, values below 1% of the biogeographical population were obtained, 0.76% and 0.48% respectively. Higher values were obtained for velvet scoters – nearly 2.5% of this species' biogeographical population is expected to pass through the Baltic East OWF Area in autumn, with 0.56% passing in spring. Estimates obtained for the little gull are also high – up to nearly 3% of the biogeographical population may fly through the survey area both in spring and autumn. It is estimated that more than 1% of the total population migrating through the Baltic Sea will fly through the Baltic East OWF Area, in the case of divers in spring, and in the case of the Eurasian wigeon in autumn. On the basis of the total estimation of the flight size, it can be concluded that in the survey area, autumn migration was more marked than spring migration. The spring flight was more abundant only in the case of the common scoter, divers, little gull, lesser black-backed gull and common crane.

Table 37 Estimation of the size of passage of birds migrating in greatest numbers in spring and autumn through the survey area [source: internal materials based on Baltic East OWF data]

ENGLISH NAME	LATIN NAME	BIOGEOGRAPHIC POPULATION ABUNDANCE	MIGRATION SEASON	ESTIMATION OF FLIGHT SIZE [N OF INDIVIDUALS]	PROPORTION OF MIGRATORY BIRD POPULATION [%]
Long-tailed duck	*Clangula hyemalis*	1600000	spring	3,661	0.23%
			autumn	17,890	1.12%
Common scoter	*Melanitta nigra*	550,000	spring	4,184	0.76%
			autumn	2,634	0.48%
Velvet scoter	*Melanitta fusca*	450,000	spring	2,513	0.56%
			autumn	10,931	2.43%
Dabbling ducks (excl. leaf warbler)	*Anatini*	6,500,000	spring	676	0.01%
			autumn	6,840	0.11%
Greater scaup	*Aythya marila*	310,000	spring	497	0.16%
			autumn	1,263	0.41%
Geese	*Anserini*	3,500,000	spring	8,965	0.26%
			autumn	22,560	0.64%
Swans	*Cygnus sp.*	300,000	spring	150	0.05%
			autumn	2,565	0.86%
Divers	*Gaviidae*	400,000	spring	4,294	1.07%

ENGLISH NAME	LATIN NAME	BIOGEOGRAPHIC POPULATION ABUNDANCE	MIGRATION SEASON	ESTIMATION OF FLIGHT SIZE [N OF INDIVIDUALS]	PROPORTION OF MIGRATORY BIRD POPULATION [%]
			autumn	2,839	0.71%
Auks	*Alcidae*	5,000,000	spring	11,892	0.24%
			autumn	36,256	0.73%
Great cormorant	*Phalacrocorax carbo*	515,000	spring	2,958	0.57%
			autumn	3,917	0.76%
Little gull	*Hydrocoloeus minutus*	72,000	spring	2,141	2.97%
			autumn	1,919	2.67%
Lesser black-backed gull	*Larus fuscus*	1,200,000	spring	8,347	0.70%
			autumn	8,231	0.69%
Common gull	*Larus canus*	1,200,000	spring	1,813	0.15%
			autumn	8,313	0.69%
Terns	*Sternidae*	1,800,000	spring	2,631	0.15%
			autumn	3,534	0.20%
Charadriiformes	*Charadriidae*	1,600,000	spring	844	0.05%
			autumn	3,205	0.20%
Crane	*Grus grus*	240,000	spring	339	0.14%
			autumn	0	0.00%
Passerine	*Paseriformes*	100,000,000	spring	39,192	0.04%
			autumn	85,502	0.09%
Eurasian wigeon	*Mareca penelope*	1,300,000	spring	1,941	0.15%
			autumn	14,884	1.14%

The visual observations conducted indicate that the vast majority of analysed groups of birds and species flew at altitudes up to 20 MASL [Table 38]. In spring, more than 84.1% and in autumn, more than 71% of all birds observed flew at altitudes below 20 MASL. Most sea ducks, divers and ducks as well as all alcids were also observed at these altitudes. Only in the case of the common crane, all observed flights were recorded above 20 MABSL, whereas in the case of Charadriiformes and geese, this was nearly 67% and 59%, respectively. Similar results were obtained in the case of surveys at other OWFs in this area [Opioła *et al.*, 2020; Gajewski *et al.*, 2021]. It should be remembered that flight altitudes obtained from visual observations represent only a part of all birds flying and these values should be treated as auxiliary information. Visual observations are aimed at identifying as many birds as possible, but due to the nature of this type of monitoring, birds flying low are much more frequently recorded than birds flying at altitudes above 100 MASL. The auxiliary nature of these flight altitude observations should be emphasised as they are subject to an error resulting from limited possibility of detecting birds at high altitudes, for birds flying lower and closer to the observers at the survey station.

Table 38 Flight altitude of species and groups of species observed at a distance of up to 20 m and more than 20 m from the water table [source: internal materials based on Baltic East OWF data]

ENGLISH NAME	LATIN NAME	BELOW 20 MASL	ABOVE 20 MASL
Long-tailed duck	*Clangula hyemalis*	98.7%	1.3%

ENGLISH NAME	LATIN NAME	BELOW 20 MASL	ABOVE 20 MASL
Common scoter	*Melanitta nigra*	88.0%	12.0%
Velvet scoter	*Melanitta fusca*	92.7%	7.3%
Dabbling ducks (excl. leaf warbler)	*Anatini*	73.3%	26.7%
Greater scaup	*Aythya marila*	64.4%	35.6%
Geese	*Anserini*	41.4%	58.6%
Swans	*Cygnus indet.*	95.5%	4.5%
Divers	*Gaviidae*	82.9%	17.1%
Auks	*Alcidae*	100.0%	0.0%
Great cormorant	*Phalacrocorax carbo*	58.9%	41.1%
Little gull	*Hydrocoloeus minutus*	88.4%	11.6%
Lesser black-backed gull	*Larus fuscus*	84.1%	15.9%
Common gull	*Larus canus*	94.9%	5.1%
Terns	*Sternidae*	100.0%	0.0%
Charadriiformes	*Charadriidae*	33.3%	66.7%
Crane	*Grus grus*	0.0%	100.0%
Passerine	*Passeriformes*	96.4%	3.6%
Eurasian wigeon	*Mareca penelope*	78.0%	22.0%

On the basis of the collected acoustic recordings, 2942 voices were identified in spring and 2338 voices were identified in autumn for 32 bird species and categories. Among passerines, during night hours, the common blackbird, redwing, European robin, and song thrush were most frequently identified, and during bright hours, the blue tit, siskin, goldcrest, and brambling were identified [Table 39]. Three species of Charadriiformes were also identified – during night hours: the common sandpiper and European golden plover, during the day: common ringed plover. In spring, as in autumn, gull voices dominated. The vast majority of the voices recorded in spring and autumn were recorded during daytime hours.

Table 39 Bird voices identified on the basis of acoustic recordings during spring and autumn migrations [source: internal materials based on Baltic East OWF data]

ITEM	ENGLISH NAME	LATIN NAME	DAY/NIGHT (VOICE REGISTRATION TIME)	AUTUMN	SPRING	TOTAL
1	Common sandpiper	*Actitis hypoleucos*	N	0	20	20
2	Common redpoll	*Acanthis flammea*	D	6	0	6
3	Siskin	*Spinus spinus*	D/N	5	87	92
4	Song thrush	*Turdus philomelos*	N	12	7	19
5	Redwing	*Turdus iliacus*	N	128	72	200
6	Barn swallow	*Hirundo rustica*	D	3	0	3
7	Greater white-fronted goose	*Anser albifrons*	D	0	32	32
8	Taiga bean goose/tundra goose	*Anser fabalis/serrirostris*	N	11	0	11
9	Common blackbird	*Turdus merula*	D/N	309	107	416

ITEM	ENGLISH NAME	LATIN NAME	DAY/NIGHT (VOICE REGISTRATION TIME)	AUTUMN	SPRING	TOTAL
10	Common linnet	*Linaria cannabina*	D	0	9	9
11	Caspian gull	*Larus cachinnans*	D	22	7	29
12	Common gull	*Larus canus*	D/N	5	7	12
13	European herring gull	*Larus argentatus*	D/N	140	132	272
14	Lesser black-backed gull	*Larus fuscus*	D/N	0	44	44
15	Blue tit	*Parus caeruleus*	D/N	0	1,014	1,014
16	Goldcrest	*Regulus regulus*	D	164	0	164
17	Unidentified small gull	*Laridae indet.*	D	0	7	7
18	Unidentified gull	*Laridae indet.*	D	4	0	4
19	Unidentified bird	*Aves spec.*	N	1	0	1
20	Unidentified passerines	*Passeriformes indet.*	D/N	13	0	13
21	Unidentified large gull	*Larus indet.*	D/N	1,437	1,164	2,601
22	Common chiffchaff	*Phylloscopus collybita*	D	9	18	27
23	White wagtail	*Motacilla alba*	D	42	71	113
24	Yellow wagtail	*Motacilla flava*	D	11	27	38
25	Dunnock	*Prunella modularis*	D	0	2	2
26	Robin	*Erithacus rubecula*	D/N	5	80	85
27	Common ringed plover	*Charadrius hiaticula*	D	1	0	1
28	European golden plover	*Pluvialis apricaria*	N	3	0	3
29	Eurasian skylark	*Alauda arvensis*	D/N	7	6	13
30	Tree pipit	*Anthus trivialis*	D	0	5	5
31	Meadow pipit	*Anthus pratensis*	D	0	5	5
32	Chaffinch	*Fringilla coelebs*	D	0	19	19
Total sum				2,338	2,942	5,280

Tracking individual flying birds and recording their flight route allowed the determination of flight direction during migration for individual species or groups of species. In spring, a total of 3117 flight paths were recorded for 116 species and 15 categories of birds unidentified to the species, and in autumn, 2435 flight paths were recorded for 112 species and 17 systematic categories in the cases where identification to the species was not possible. Analyses using a horizontal radar indicate quite homogeneous directions of migratory bird migrations both in spring (directions NE and E) and in autumn (directions SW-W) [Figure 48 and Figure 49]. In the case of sea ducks (long-tailed duck, common scoter, velvet scoter, common eider), the NE-E direction clearly dominated in spring, indicating movement towards various breeding areas in northern Russia, Finland or Sweden. Alcids showed the same distribution of flight directions as in the case of all flight paths analysed in total (NW and NE), with a slight predominance of direction NW, which is in line with the knowledge of their European breeding sites in Denmark and Sweden. For the same reason, even clearer division of flight directions was observed in divers (NW, NE and E). In autumn, alcids chose W-SW directions. There are no important alcids wintering sites in the south-western Baltic Sea, but single birds are observed in this area throughout winter. Anatini ducks (e.g. mallard, northern pintail, northern shoveler) and geese were flying mainly in the W-SW direction, which corresponds to the expected migration routes. The observed patterns of displacements are comparable to the directions of flights recorded during spring and autumn surveys in other OWFs in this area [Opioła *et al.* 2020; Gajewski *et al.* 2021].

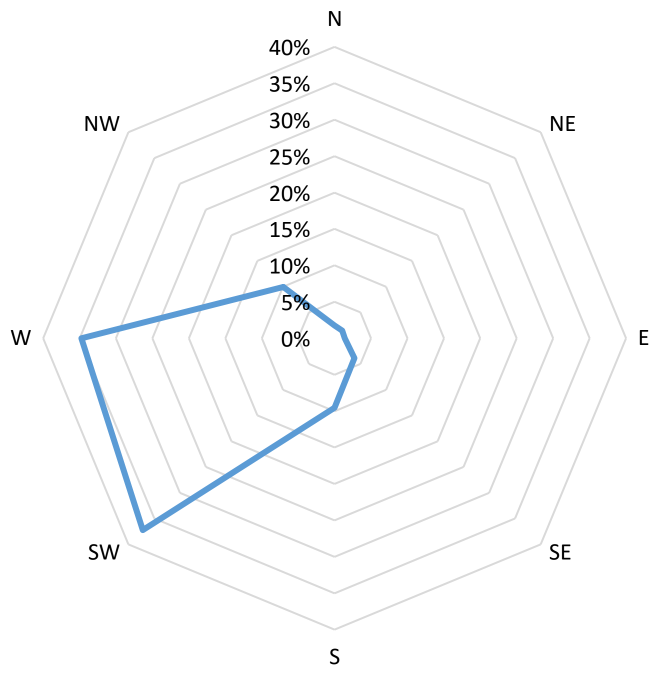

Figure 48 Directions of flights of all birds recorded during the autumn migration period [source: internal materials based on Baltic East OWF data]

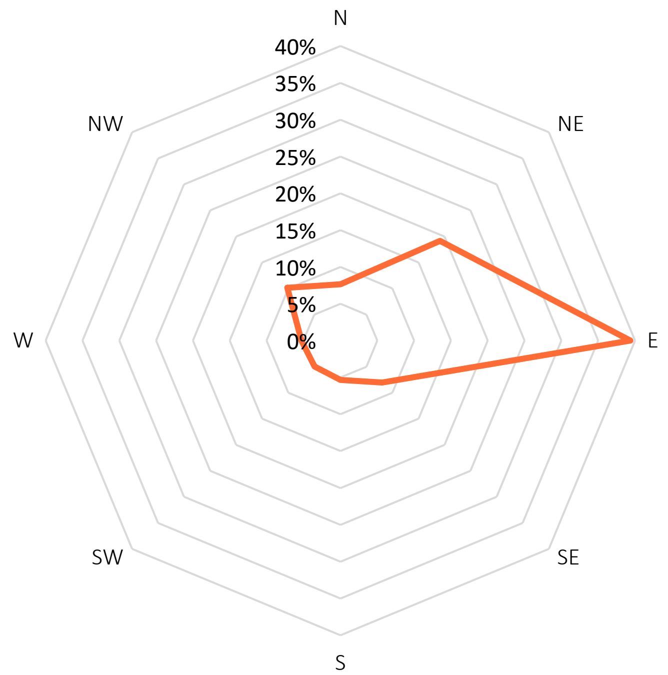

Figure 49 Directions of flights of all birds recorded during the spring migration period [source: internal materials based on Baltic East OWF data]

For further analyses for the purpose of modeling the risk of collision and the barrier effect of the environmental impact assessment, species were selected according to the criterion of abundance –

number of observations (the most numerous observed species and groups of species were taken into account), as well as according to the criterion of expert knowledge concerning species usually migrating through the Baltic Sea area and found in small numbers during the surveys (e.g. common crane). Additionally, information on the status of the species protection and the significance of the species as a receptor were taken into account on the basis of the methodology adopted in the EIA Report.

3.11.1.6 Marine mammals

The proposed Baltic East OWF Area is located in the central part of the Polish maritime areas, in the southern area of the Baltic Proper. In this area, four species of marine mammals – harbour porpoise (*Phocoena phocoena*) and three species of seals – gray seal (*Halichoerus grypus*), harbor seal (*Phoca vitulina*) and occasionally ringed seal (*Pusa hispida*) can be found.

Common porpoise

Occurrence in the PSA – state of the art

Harbour porpoise is the only representative of cetaceans present in the Baltic Sea. Knowledge of the population status of this animal remains limited. The most detailed data on the population of porpoises in the Baltic Sea come from surveys using Passive Acoustic Monitoring, mainly from the SAMBAH (Static Acoustic Monitoring of the Baltic Sea Harbour Porpoise) project carried out in 2011–2013. On the basis of the results obtained in the project, it was confirmed that there are two subpopulations of the species: the Baltic Proper and the Western Baltic subpopulations. The size of the Baltic Proper subpopulation was estimated at approximately 491 individuals (confidence interval: 95%, number of individuals: 71–1105). Moreover, on the basis of the data collected, it was found that during the breeding season, from May to October, animals from the Baltic Proper subpopulation are concentrated in Swedish waters, mainly in the area of *Hoburgs bank och Midsjöbankarna* [SAMBAH, 2016; Carlen *et al.,* 2018; Amundin *et al.*, 2022]. Currently, this region is a Natura 2000 site where the porpoise is the subject of protection. The SAMBAH project results indicated that porpoises were more dispersed in the south-east Baltic Sea outside the breeding season from November to April.

In the PMA, the exact status of porpoise populations is unknown, but it is estimated that the number of these animals is low [Gillespie *et al.* 2005; Koschinski 2011; SAMBAH 2016]. The SAMBAH project shows that both porpoise subpopulations appear seasonally in the Polish maritime areas, however, the population of the Baltic Proper is primarily present. The SAMBAH project data also indicate that the prevalence of animals in the Polish maritime areas is generally low, with higher values recorded mainly outside the breeding season, between November and April. As it results from the detection probability maps, such a trend applies, among others, to the area of the proposed location of the Baltic East OWF [Figure 50].

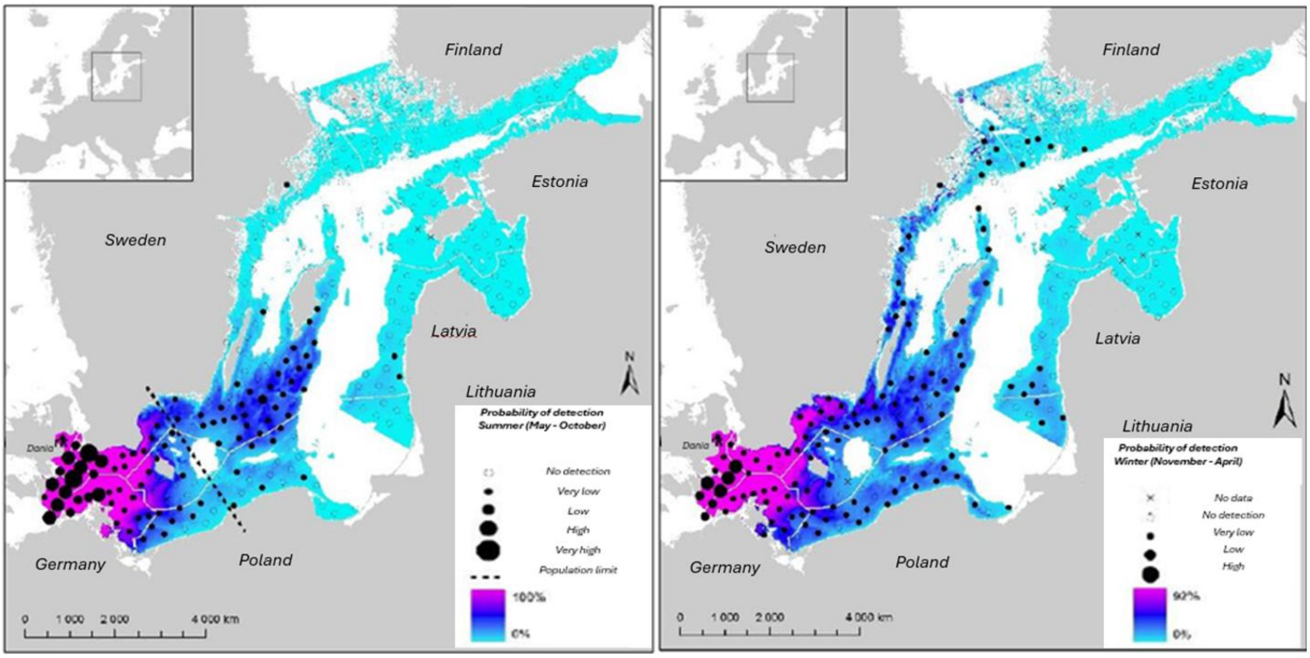

Figure 50 Probability of porpoise detection in two seasons: May–October (left) and November–April (right), demonstrated during the SAMBAH project (2011–2013) [source: SAMBAH, 2016]

Information on the presence of porpoises in the central part of the Polish maritime areas also come from the monitoring surveys carried out in years after the SAMBAH project. The surveys confirmed the low frequency of species detection and provided new, different data on the seasonal activity of animals.

As part of the State Environmental Monitoring, in 2016–2018, Passive Acoustic Monitoring of porpoises was carried out in the area of the Pomeranian Bay and Stilo Bank. The survey results showed a much more frequent occurrence of porpoises within the Pomeranian Bay area (4.6% DPD from all monitoring days) than the Stilo Bank (0.3% DPD), as well as seasonal differences in the occurrence of animals in both areas. The obtained detection levels were higher than in the case of data resulting from SAMBAH [CIEP, 2018]. During the second stage of the state monitoring program, the trends described earlier were confirmed, both regionally and seasonally [CIEP, 2022]. The Baltic East OWF Area is located north of the Stilo Bank, where according to CIEP data the number of porpoise detections is generally low. On the basis of the information from 2016–2017, animals appeared more frequently in the area in autumn and winter, andwhile in the years 2017–2018 - in spring[CIEP, 2018].

As the number of monitoring surveys for the proposed OWF increases, the availability of data on the occurrence of porpoises in the open waters of the Polish part of the Baltic Sea increases. The results of such surveys are currently available, among others, for the locations of the Bałtyk II, Bałtyk III, Baltic Power, BC-Wind and Bałtyk I OWFs. The projects located in the immediate vicinity of the Baltic

East OWF Area are the Baltic Power OWF (west) and BC-Wind OWF (east). Acoustic monitoring carried out in 2018–2019 for the Baltic Power OWF showed a rare occurrence of porpoises in the survey area. Animals were recorded on 12 out of 1945 survey days (0.6% DPD). The detections were recorded in most months, except for February, April, July and November, with the highest DPM level in the autumn season (on average 0.003% of DPM) [Opioła *et al.*, 2020]. The results of acoustic monitoring carried out in 2019–2021 in the BC-Wind OWF Area also indicated occasional occurrence of porpoises in the area analysed. The overall detection level obtained during the surveys was 0.6% DPD (17 DPD out of 2790 days of recordings), with the highest number of animal recordings in the summer season [Gajewski *et al*., 2021]. Surveys carried out at locations located westwards farther away from the Baltic East OWF Area – Bałtyk II and Bałtyk III, showed very low activity of porpoises. In both areas, single animal detections were recorded throughout the year, mostly in the spring-summer period. Detection was carried out both using the acoustic method and during visual observations from an aircraft [Plichta *et al.*, 2014, 2015]. A project proposed in the area north of the Baltic East OWF is the OWF Bałtyk I wind farm. Monitoring surveys carried out in this location in 2020–2022 showed the presence of porpoises in all seasons of the year. Animals appeared with the highest frequency during summer, followed by a decline in detections during the autumn months. In winter and spring, registration levels were the lowest and had similar values. The overall detection level recorded during the surveys was 2.9% DPD [Brocławik *et al.*, 2022].

Presence within the Baltic East OWF Area

In order to investigate the extent to which the Baltic East OWF Area is used by porpoises, Passive Acoustic Monitoring was performed using CPODs (Chelonia Ltd., online). Monitoring took place at nine survey stations (CPOD_01 – CPOD_09), located within the Baltic East OWF Area. The surveys were performed in the period from 1 July 2022 to 23 October 2023. Acoustic recordings were collected continuously and acquired during service cruises. Detailed survey results are described in Appendix No. 1 to this Report.

The results of acoustic monitoring showed that porpoises occurred in the survey area. The activity of animals varied in temporal and spatial terms. Detections were recorded mainly in the second part of the survey period, in 2023. The highest levels of detection positive days (DPD) and detection positive minutes (DPM) were recorded at station CPOD_08, as well as CPOD_03 and CPOD_09. Single DPDs were recorded at stations CPOD_02 and CPOD_04 – CPOD_07, whereas no acoustic recordings were made in location CPOD_01 [Figure 51–Figure 52]. In general, the activity of porpoises in the survey area was low, amounting to 0.4% DPD.

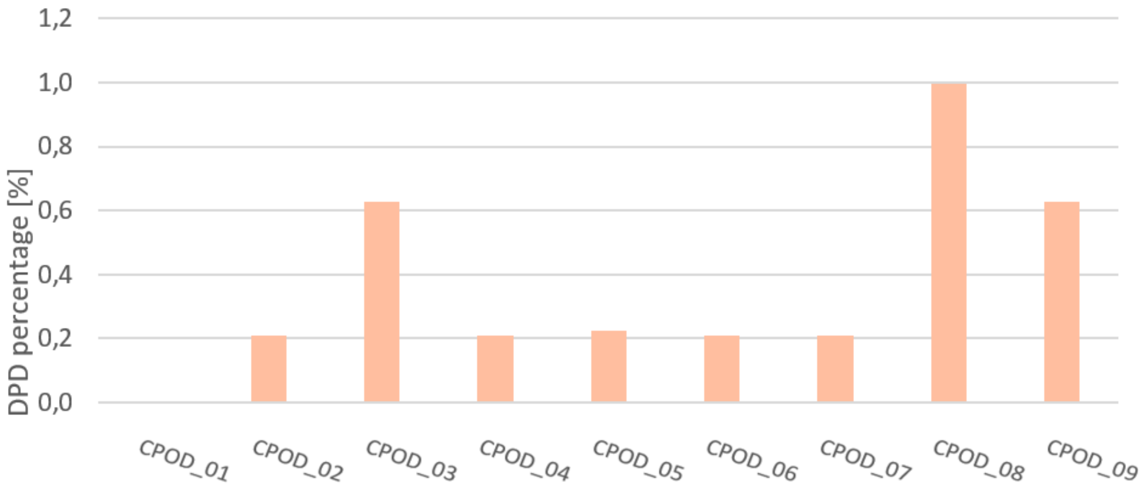

Figure 51 Porpoise activity recorded at survey stations during acoustic monitoring in the Baltic East OWF survey area from 1 July 2022 to 23 October 2023. Data is presented as a percentage of recorded DPD in relation to all days of recordings collected at a given station

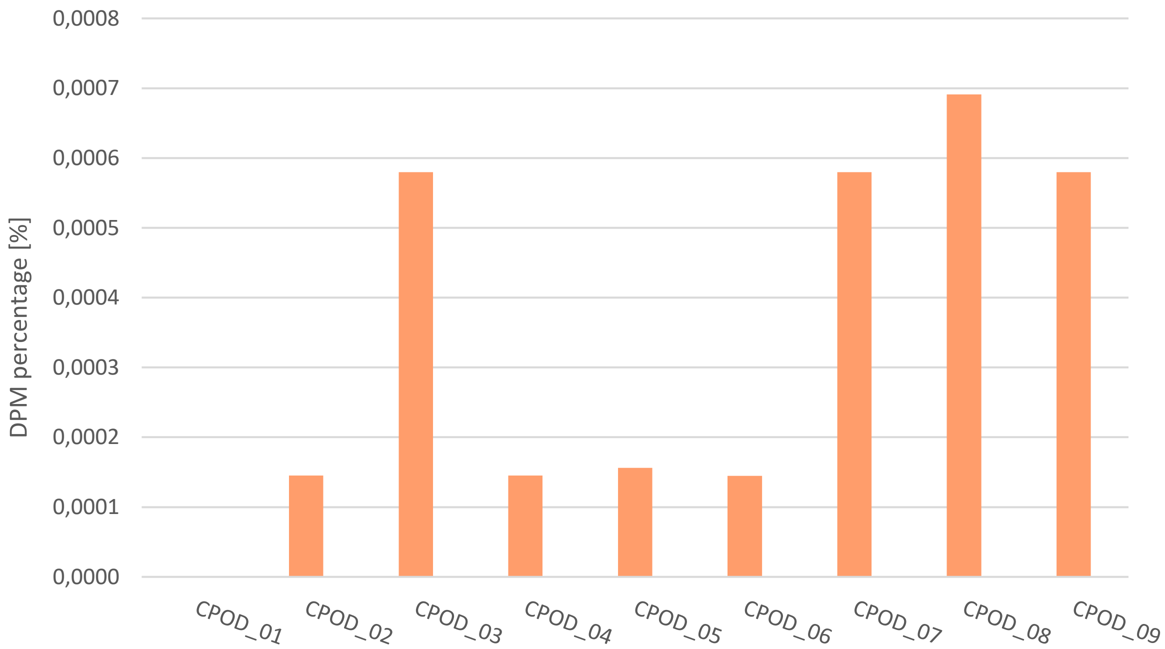

Figure 52 Porpoise activity recorded at survey stations during acoustic monitoring in the Baltic East OWF survey area from 1 July 2022 to 23 October 2023. Data is presented as a percentage of recorded DPM in relation to all minutes of recordings collected at a given station

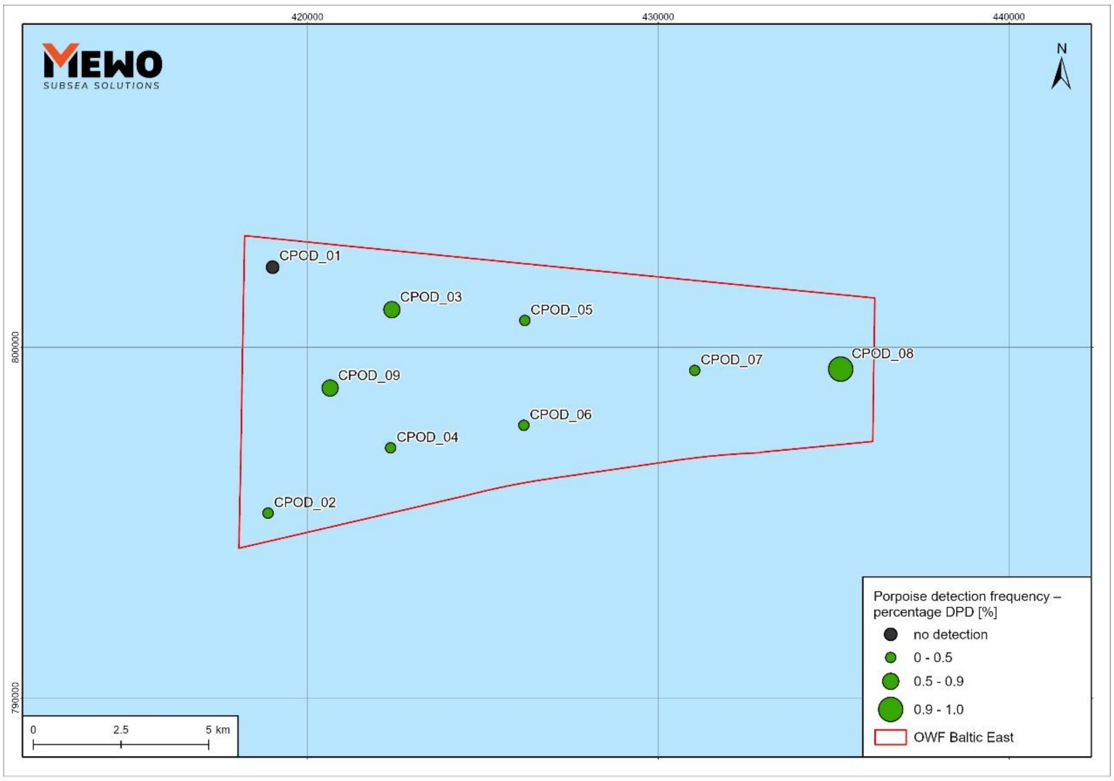

Figure 53 Porpoise activity recorded at survey stations during acoustic monitoring in the Baltic East OWF survey area from 1 July 2022 to 23 October 2023. Data is presented as a percentage of recorded DPD in relation to all days of recordings collected at a given station

The seasonal analysis showed visible changes in porpoise activity during the monitoring [Figure 54]. In the summer and autumn of 2022, no animals were found in the Baltic East OWF Area. During the winter of 2022/2023, a single detection was recorded at station CPOD_09. In the spring of 2023, the number of detections begun to increase (0.4% DPD), reaching the highest values in summer and autumn (0.9% DPD). In the summer of 2023, porpoise activity was recorded at six survey stations, while in the autumn it was recorded at three locations [Figure 54].

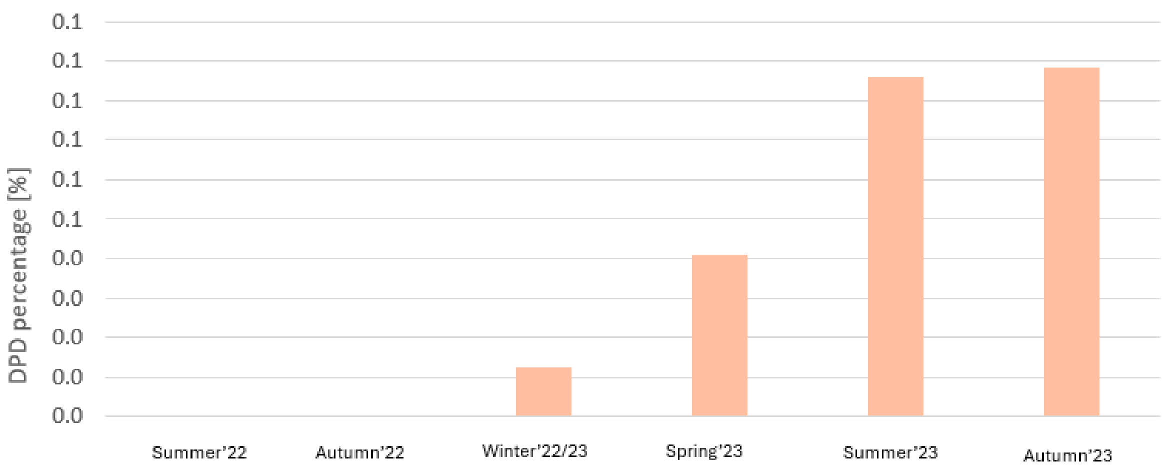

Figure 54 Porpoise activity recorded seasonally at survey stations during acoustic monitoring in the Baltic East OWF survey area from 1 July 2022 to 23 October 2023. Data is presented as a percentage of recorded DPD in relation to all days of recordings collected in a season at individual stations

Taking into account monthly trends, porpoises occurred in the survey area mainly from April to October 2023. In a single case, the animals were registered in December 2022 (station CPOD_09) [Figure 55]. The highest detection levels were recorded in August and October 2023. August was the month when registration times were the longest and porpoises appeared in the largest part of the survey area (five stations).

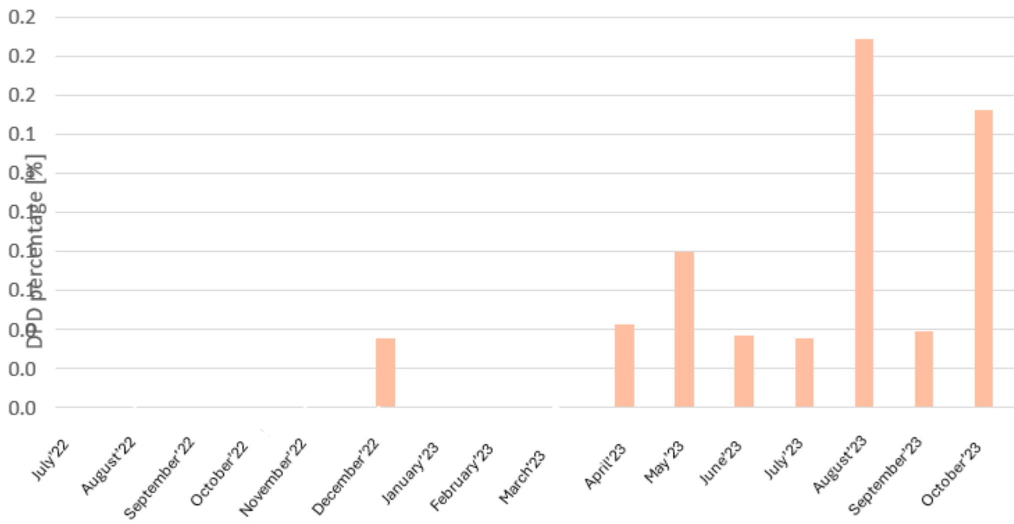

Figure 55 Porpoise activity recorded monthly at survey stations during acoustic monitoring in the Baltic East OWF survey area from 1 July 2022 to 23 October 2023. Data is presented as a percentage of recorded DPD in relation to all days of recordings collected per month at a given station

The data obtained during the monitoring carried out for the Baltic East OWF confirmed that the waters of the central part of the PMA are an area with a low-frequency of porpoises presence. The overall detection level recorded during the surveys was 0.4% DPD, which is in the range of values similar to the results obtained for the neighbouring proposed Baltic Power OWF and BC-Wind OWF (0.6% DPD) and the Stilo Bank area (0.3% DPD) [CIEP, 2018; Opioła *et al.*, 2020; Gajewski *et al.*, 2021]. In terms of seasonality of animal occurrence, the results obtained in the Baltic East OWF Project for 2023 are similar to the data from the Baltic Power and BC-Wind projects, indicating increased activity of porpoises in the summer and autumn seasons. This trend deviates from the conclusions of the SAMBAH project, which show that in the area analysed the occurrence of the species is more frequent between November and April [SAMBAH, 2016]. Compared to the northern part of the Polish maritime areas, the detection levels found in the Baltic East OWF Area are significantly lower. At the location of the Bałtyk I OWF, at the border of the Polish and Swedish Exclusive Economic Zone, the overall DPD rate was 2.9% [Brocławik *et al.*, 2022]. However, for both areas, the most frequent occurrence of porpoises was recorded in summer.

It is worth noting that as a result of the monitoring for the Baltic East OWF, different trends of porpoise occurrence were found in two consecutive summer and autumn seasons (2022, 2023). The identified lack of detection in the summer and autumn of 2022 was a phenomenon contrary to that of 2023, when animal activity increased significantly during the same period. Harbor porpoise is a mobile species moving across sea basins in search of suitable feeding grounds. It was assumed that changes observed in the occurrence of porpoises at the turn of the years may be related to environmental conditions, including, among others, the availability of food.

Seals

Occurrence in the PSA – state of the art

There are three seal species in the Baltic Sea: gray seal, harbor seal and ringed seal [Cichocki *et al.*, 2015]. Harbor seal and, in particular, ringed seal are occasionally recorded in the waters of the Southern Baltic [HELCOM 2018]. The most frequently observed species in the PMA is the gray seal [WWF 2023a; WWF 2023b]. In 2019, the population size of the species in the southern part of the Baltic Sea was estimated at approximately 2537 individuals, which corresponds to approximately 7% of the Baltic population [Galatius *et al.*, 2020].

Data on the presence of seals on the Polish coast are collected by the WWF Blue Patrol in cooperation with the Marine Station of the Institute of Oceanography of the Gdańsk University. The project report "Protection of mammals and seabirds – continuation" shows that in 2020–2023 on the Polish coast, gray seals were recorded most frequently – 1390 observations. The number of detections of other species was much lower: 40 observations of harbor seal and 8 observations of ringed seal. Gray seals were most frequently recorded east of Łeba [WWF 2023a] [Figure 56–Figure 59].

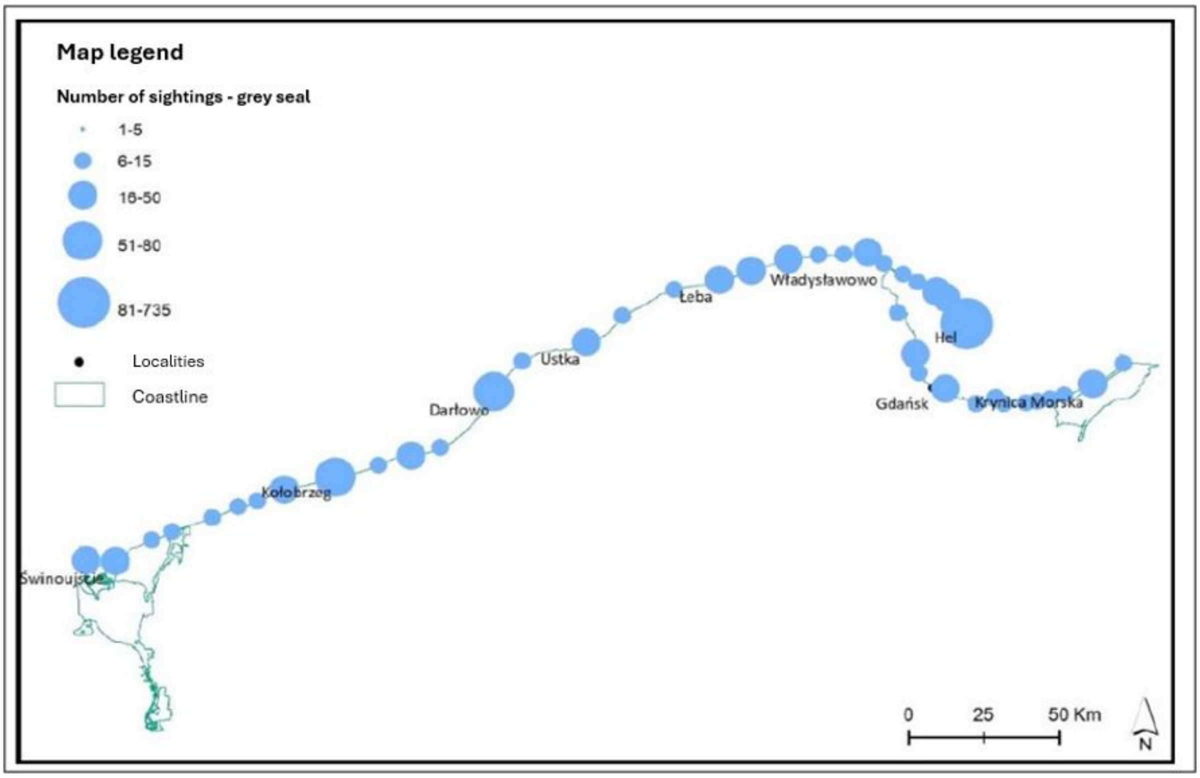

Figure 56 Grey seal observations in 2020–2023 on the Polish coast [source: WWF, 2023a]

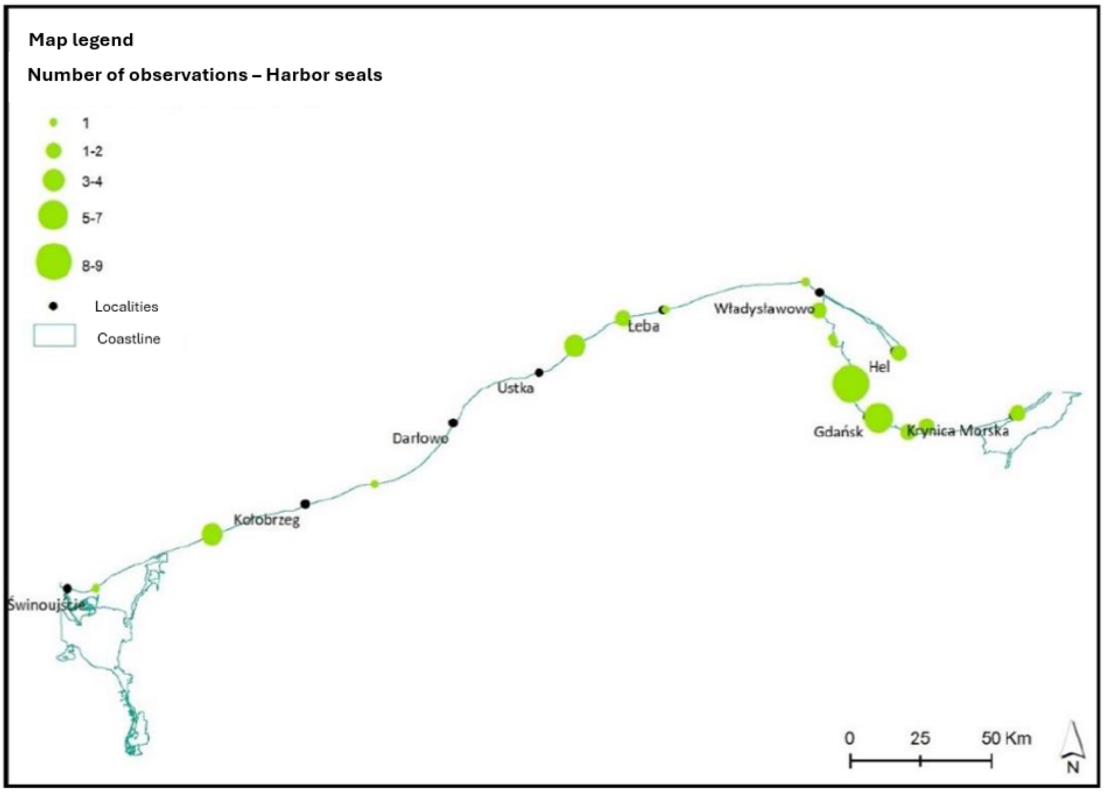

Figure 57 Observations of harbor seals in 2020–2023 on the Polish coast [source: WWF, 2023a]

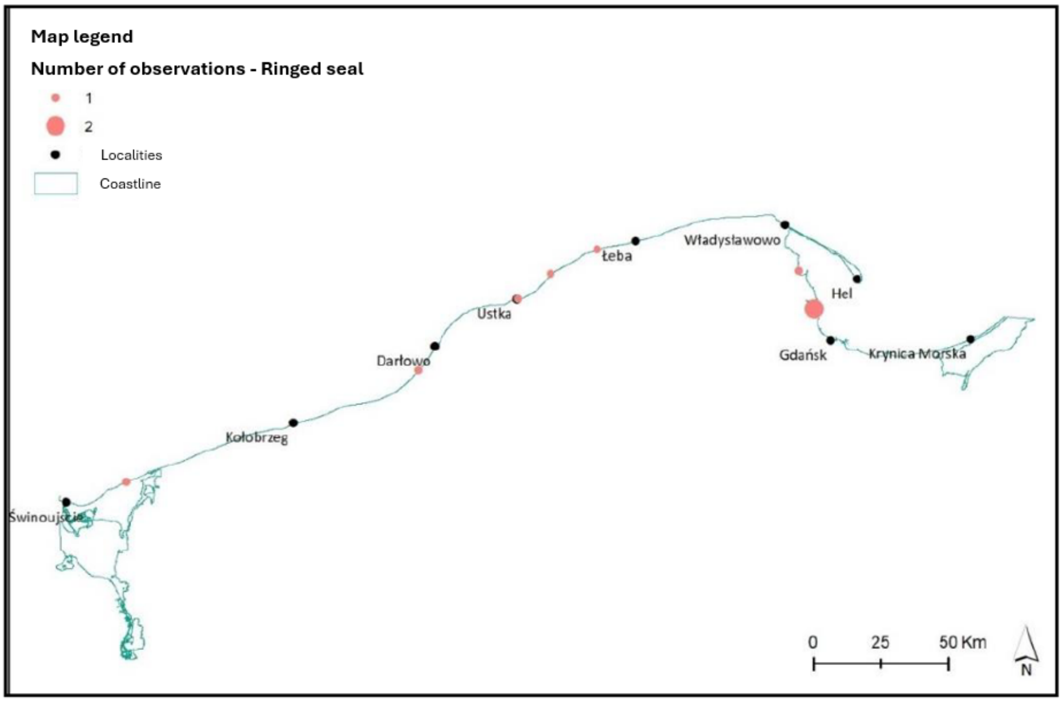

Figure 58 Ringed seal observations in 2020–2023 on the Polish coast [source: WWF, 2023a]

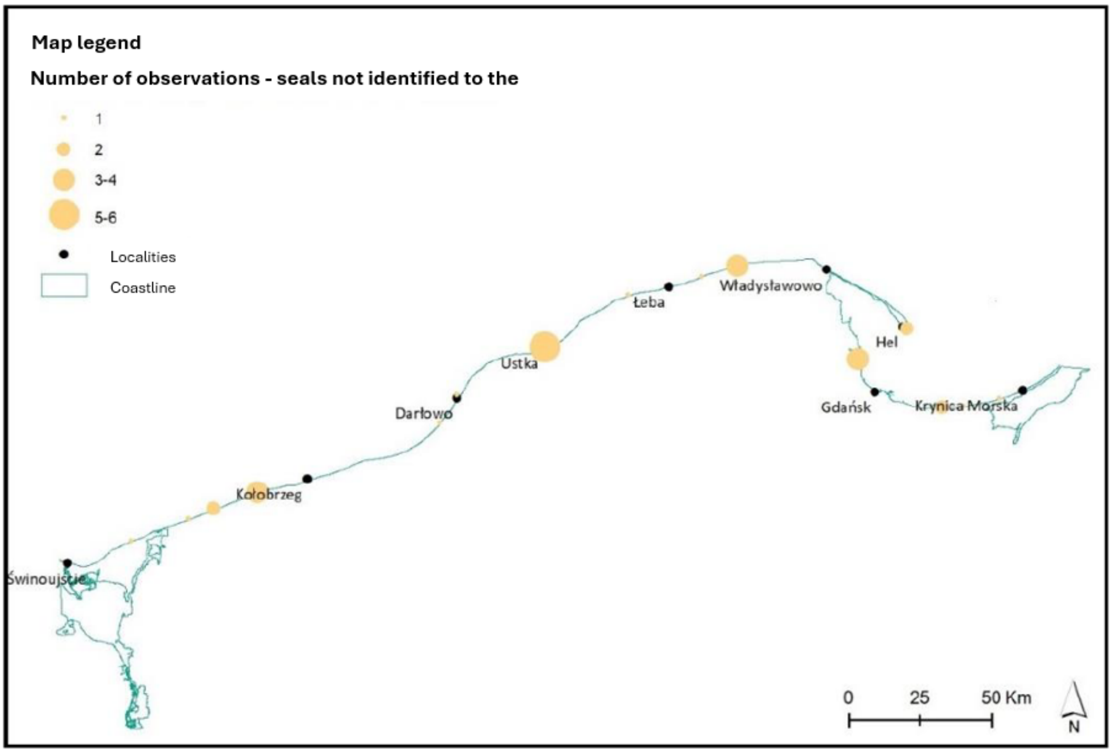

Figure 59 Observations of seals not identified to the species in 2020–2023 on the Polish coast [source: WWF, 2023a]

In open waters of the Baltic Sea, gray seals migrate to search for food, feed, explore and reproduce, traveling distances of up to 100 km per day [Sjöberg and Ball 2000; WWF 2019; WWF 2020]. Telemetric surveys indicate that these animals use the entire Polish maritime areas [WWF 2019; WWF 2020], including the area of the proposed Baltic East OWF [Figure 60].

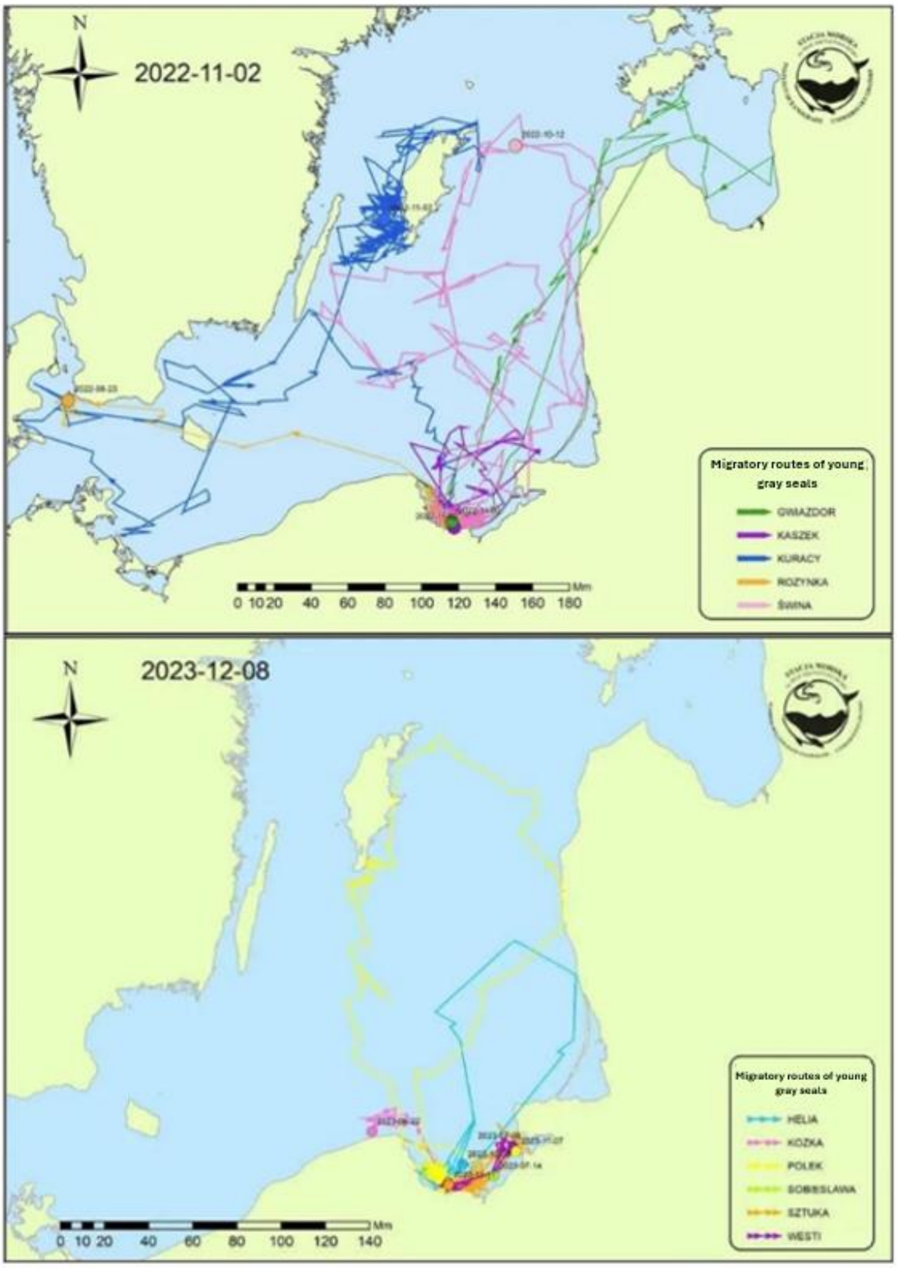

Figure 60 Migratory routes of young gray seals in 2022–2023 [source: SMIOUG press materials available on-line]

Data obtained from the project entitled "Pilot implementation of monitoring of marine species and habitats in 2015–2018" carried out as part of the State Environmental Monitoring and information gathered in the WWF Poland database shows that there is one haul-out place in the Polish Maritime Areas where animals gather to rest. The haul-out is located at the mouth of the Vistula River, *Przekop Wisły* in the Gulf of Gdańsk. On the basis of observations carried out with the use of drones in June 2022, 856 seal individuals were recorded in this area [WWF 2023a].

The available data on the occurrence of seals also come from monitoring projects carried out for other proposed wind farms, including, among others, for the location of the Bałtyk II, Bałtyk III, Baltic Power, BC-Wind and Bałtyk I OWFs. The surveys carried out for these projects show that the area of the central and northern part of the Polish waters of the Baltic Sea is used by gray seals in various seasons of the year. Harbor seals are also occasionally observed. Frequency and seasonal activity of animals vary between survey areas and years [Plichta *et al.*, 2014; 2015; Opioła *et al.*, 2020; Gajewski *et al.*, 2021; Brocławik *et al.*, 2022]. During aircraft visual monitoring carried out for the Bałtyk II OWF (2012–2013) and Bałtyk III OWF (2013–2014) (west of the Baltic East OWF), few observations of seals were recorded in the spring and autumn seasons. Gray seal, harbor seal and individuals not identified to the species were recorded [Plichta *et al.*, 2014; 2015]. During visual surveys from a vessel carried out for the neighboring Baltic Power OWF (2018–2019), seals were recorded in all seasons, ten times in total. Gray seals and individuals not identified to the species were recorded [Opioła *et al.*, 2020]. The occurrence of seals was also recorded during monitoring conducted from a vessel for the nearby BC-Wind OWF (2020–2021). At various times of the year, a total of 28 observations were made, 21 of which concerned gray seal and the other – individuals not identified to the species [Gajewski *et al.*, 2021]. In the case of the location situated in the northern part of the Exclusive Economic Zone – Bałtyk I OWF (north of the Baltic East OWF, 2020–2022), during visual surveys from a vessel, the occurrence of gray seal was recorded. A total of nine observations were recorded, mostly in autumn and to a lesser extent in summer [Brocławik *et al.* 2022].

Occurrence in the Baltic East OWF Area and adjacent waters

In order to analyse the activity of seals in the Baltic East OWF Area and adjacent waters, visual monitoring from an aircraft was carried out. The surveys were performed during six observation flights carried out in all seasons of 2023. The observations were carried out along five transects with a length of 50 km, covering the OWF area and adjacent waters, taking into account part of the Natura 2000 site *Przybrzeżne wody Bałtyku*. Detailed survey results are described in Appendix No. 1 to this Report.

The results of visual monitoring showed that seals occurred in the survey area. The presence of animals was recorded during one of the spring flights on 22 April 2023. A total of 14 observations were made, during all of which gray seal was recorded [Figure 61]. In one case, a juvenile individual was recorded, in the other cases – adult seals. Most of the observed animals were in movement, and one time one animal was observed to be resting on the water surface.

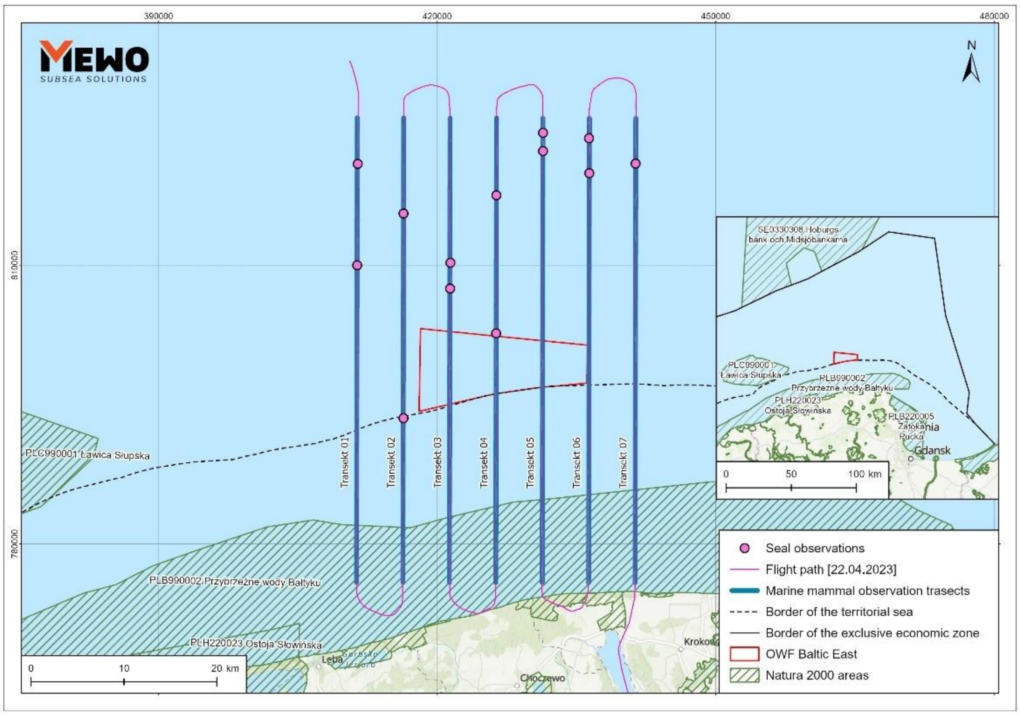

Figure 61 Flight route and observations of seals during visual monitoring from an aircraft carried out on 22 April 2023 in the Baltic East OWF survey area

Taking into account the results of visual monitoring and literature data, it can be concluded that the area of the proposed Baltic East OWF is used by gray seals and occasionally by harbor seals. Animals appear at different times of the year and their activity varies over time. The surveys carried out as part of this Project showed the occurrence of gray seals in the spring season. The information obtained for the neighbouring Baltic Power OWF and BC-Wind OWF in the preceding years (2018–2021) shows that gray seals were observed in the area analysed in all seasons [Opioła *et al.*, 2020; Gajewski *et al.*, 2021]. Previous surveys for the Bałtyk II and Bałtyk III OWF (2012–2014) showed the appearance of gray and harbor seals in the spring and autumn seasons. Seal migrations in the area analysed were also demonstrated during telemetric surveys [WWF, 2019; WWF, 2020]. Taking into account the biology of the observed species, it is assumed that seals use the Baltic East OWF Area in search of food and during migration, and the frequency of their occurrence depends on environmental conditions.

To sum up, within the area of the proposed Baltic East OWF, harbor porpoise, gray seal and occasionally harbor seal can be encountered. The activity of recorded species is generally low, changes over time, both seasonally and at the turn of years.

3.11.1.7 Bats

During field surveys – detector monitoring along transects and monitoring points – flights were recorded and three bat species were marked: common noctule *Nyctalus noctula*, Nathusius' pipistrelle *Pipistrellus nathusii* and soprano pipistrelle *Pipistrellus pygmaeus*. Detailed survey results are described in Appendix No. 1 to this Report.

All the identified bat species are strictly protected in accordance with the Regulation of the Minister of the Environment of 16 December 2016 *on the protection of animal species* (Journal of Laws of 2022, item 2380), provisions of the Convention on the protection of species of European wild flora and fauna and their habitats (Berne Convention) (Appendix III – common pipistrelle and soprano pipistrelle, Appendix II – other species), the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) and the Agreement on the Conservation of Populations of European Bats (EUROBATS) ratified by Poland, as well as Appendix IV to the Habitats Directive. The species found in the survey area are common and frequent on a national scale and have the LC (*last concern*) hazard category according to the IUCN (International Union for Conservation of Nature). Detection of these species is consistent with the data obtained from literature on the presence of chiropterofauna in offshore areas. No rare species with the highest conservation status from Appendix II to the Habitats Directive were found. Among the registered species, Nyctalus and Pipistrellus are classified as species highly exposed to collisions with wind turbines [Kepel *et al.*, 2011].

Spring migration

During spring migrations, a total of 55 bat activity units were recorded: along transects – 4 activity units of Nathusius' pipistrelle and one of common noctule, and at a monitoring point – 46 activity units of Nathusius' pipistrelle, three units of common noctule and one of soprano pipistrelle. During this period, Nathusius' pipistrelle was dominant.

Autumn migration

During autumn migrations, a total of 197 bat activity units were recorded: along transects – 4 activity units of Nathusius' pipistrelle and one of common noctule, and at a monitoring point – 163 activity units of common noctule and 9 activity units of Nathusius' pipistrelle. Common noctule was dominant.

When analysing the unit data of all controls, the activity index value reached a high level along transect T4 on 27 August 2022 (5.9 activity units/hour), and at a monitoring point on 15 and 18 August 2022 – 4.8 and 4.5 activity units/hour, respectively. The total data for the autumn and spring migration periods for the monitoring point and transects remained low, not exceeding 0.5 activity units/hour. Only in August, along transects T3 and T4, the activity index was recorded at 2.3 activity units/hour, remaining at a low level.

3.11.2 Protected areas including Natura 2000 sites

The Baltic East OWF Area is located outside the protected areas indicated in the Act of 16 April 2004 *on nature conservation* (consolidated text, Journal of Laws of 2024, item 1478), including the European ecological network Natura 2000.

The Natura 2000 site *Przybrzeżne wody Bałtyku* (PLB990002) is the site located nearest to the Baltic East OWF Area at a distance of approximately 11 km southwards. The second nearest Natura 2000 protected site is *Ławica Słupska* (PLC990001) located west of the OWF area.

At a distance of more than 20 km from the Baltic East OWF Area, the following are located:

- *Ławica Słupska* (PLC990001) offshore area;
- *Ostoja Słowińska* (PLH220023) offshore and onshore areas and 7 onshore areas, on the coast from Ustka to Hel.

Within the area of *Ostoja Słowińska* (PLH220023), the main complex of the Słowiński National Park is located, including its section located in the offshore areas.

The location of the Baltic East OWF against protected areas is presented in the figures below [Figure 62, Figure 63].

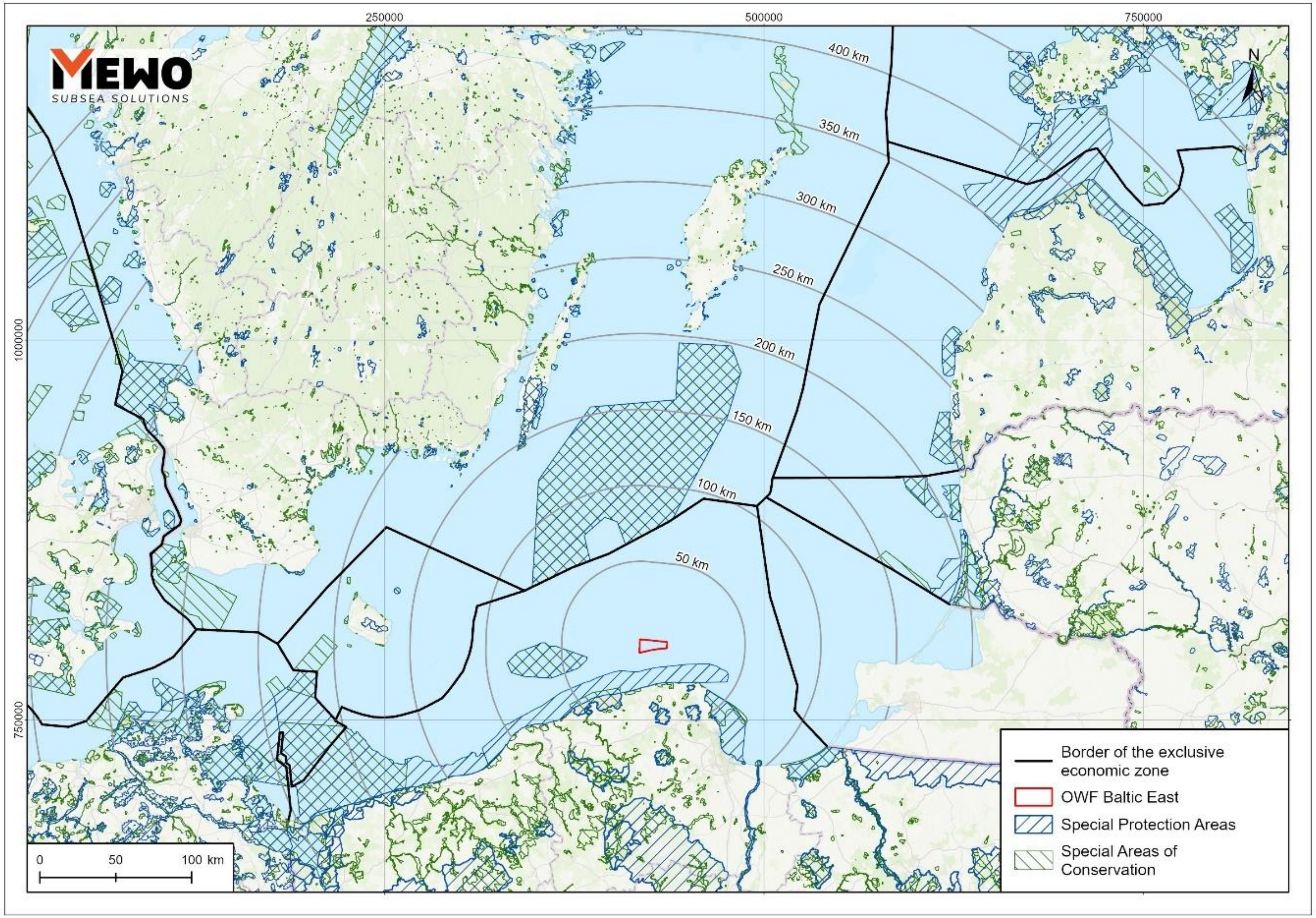

Figure 62 Baltic East OWF Area against the European ecological Network Natura 2000 sites [Source: internal materials]

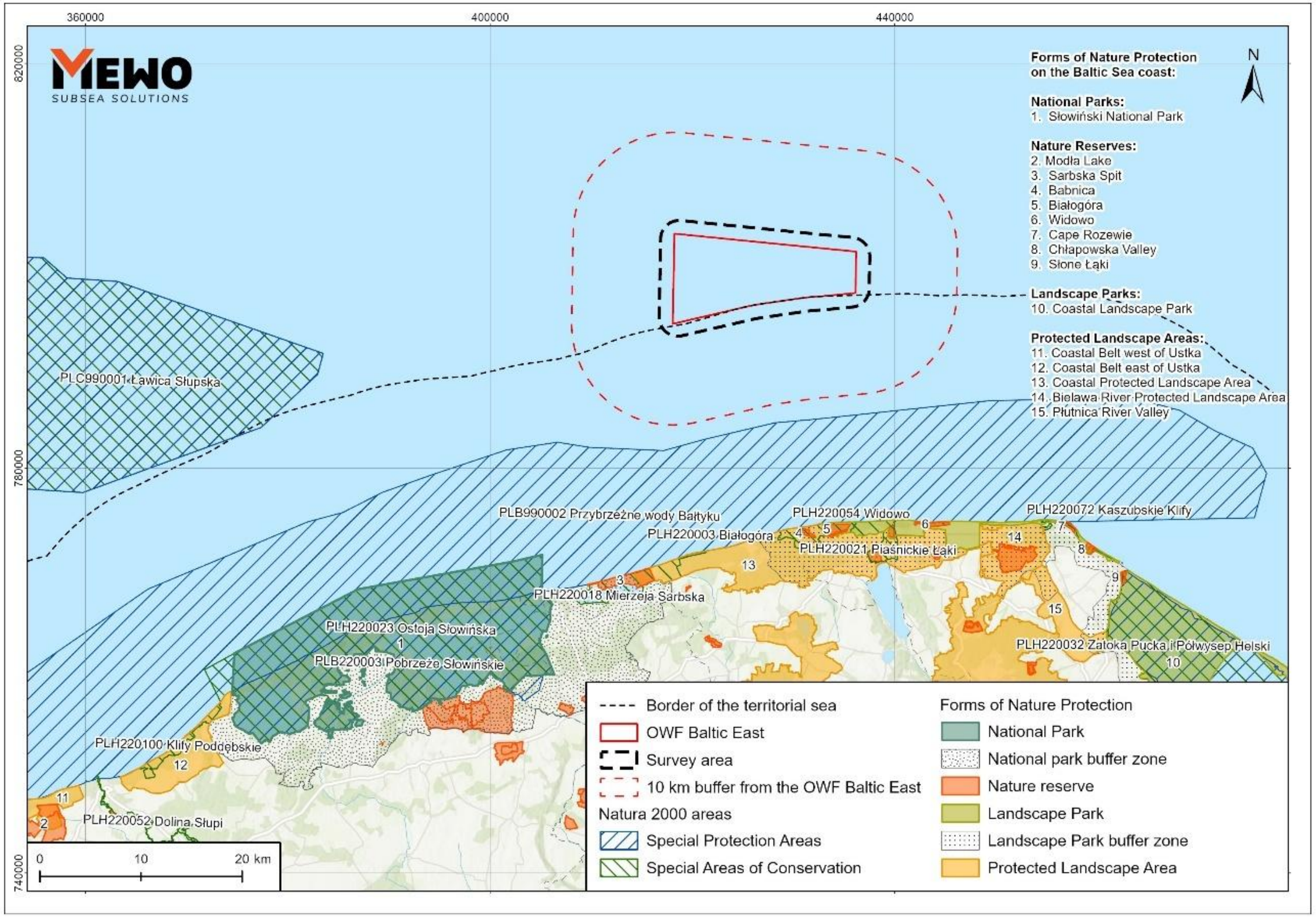

Figure 63 Baltic East OWF Area against protected areas indicated in the Act of 16 April 2004 on nature conservation and Natura 2000 sites [Source: internal materials]

Moreover, the following protected areas are located on the southern shore of the Baltic Sea:

- Coastal Protected Landscape Area;
- Nature reserves *Mierzeja Sarbska*, *Babnica* i *Białogóra*;
- Coastal Landscape Park;
- Natura 2000 sites: *Mierzeja Sarbska* (PLH220018), *Białogóra* (PLH220003).

Most national protected areas such as national parks, landscape parks, nature reserves and others overlap with the sites included in the European ecological network Natura 2000.

Due to the analyses carried out in this EIA Report, with reference to the European ecological network Natura 2000, Standard Data Forms of the above mentioned Natura 2000 sites were analysed, which showed that there were links between them and the following protected areas:

- Słowiński National Park;
- Coastal Landscape Park;
- Mierzeja Sarbska Nature Reserve;
- "Koszalin Coastal Belt" Protected Landscape Area;
- "Coastal Belt east of Ustka" Protected Landscape Area.

At a distance of more than 61 km from the Baltic Power OWF Area, there is the *Hoburgs bank och Midsjöbankarna* (SE0330308) Swedish Natura 2000 site [Figure 64].

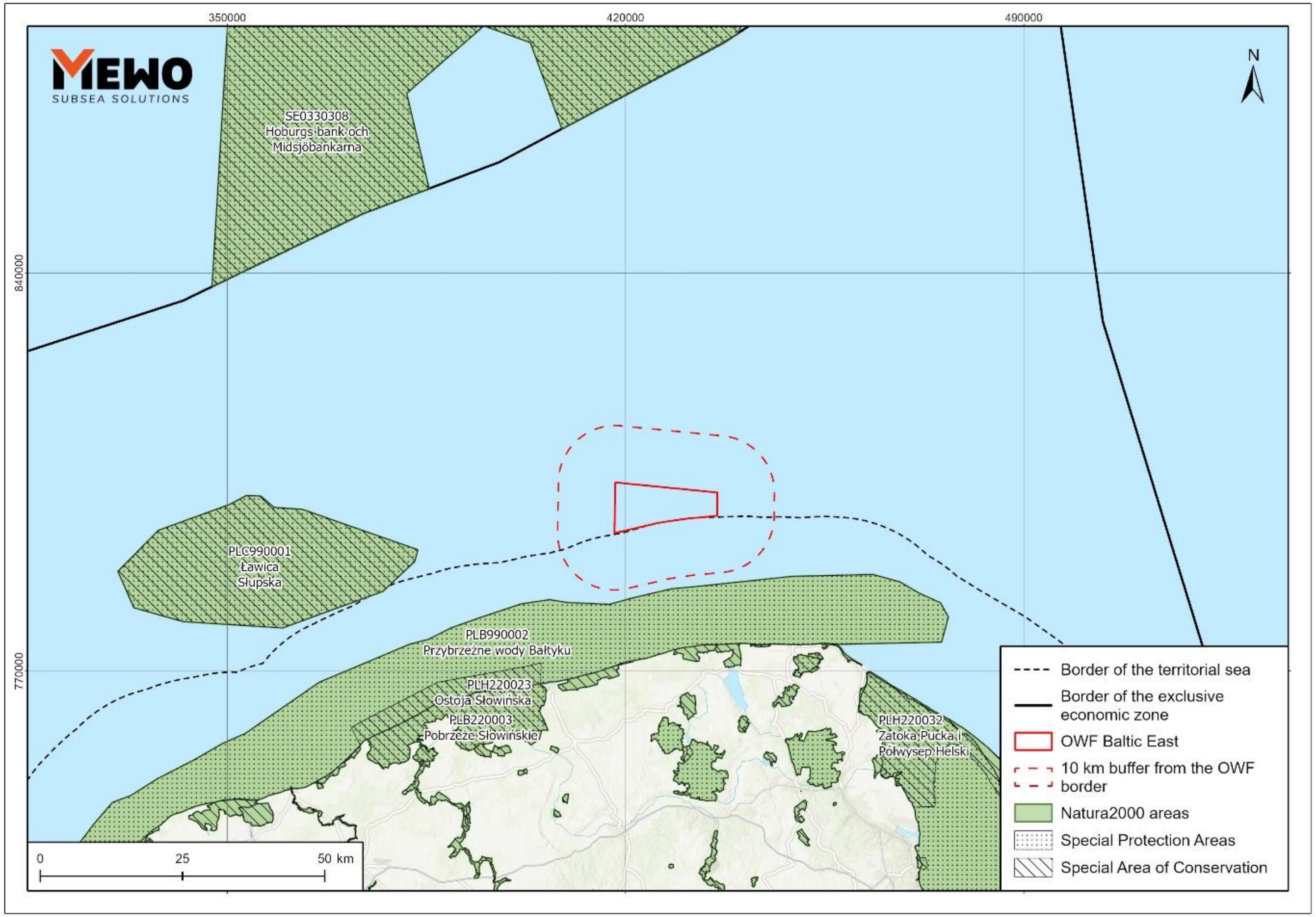

Figure 64 Location of the areas of the European ecological network Natura 2000 and the Baltic East OWF Area [Source: internal materials]

Both the Słupsk Bank and the Coastal Waters of the Baltic Sea sites are critical habitats for seabirds, especially during migration and wintering. The rich marine biodiversity and the relatively undisturbed nature of these areas provide feeding grounds, helping to maintain populations of birds migrating to the Baltic Sea in winter.

In particular, the Przybrzeżne Wody Bałtyku site is crucial for a large number of waterbirds and seabirds, and its shallow waters create ideal forging and resting conditions. The rich food resources and the protected status of these sites are essential to maintain a good condition of the water bird population. It cannot be excluded that birds observed during monitoring of migratory birds in the Baltic East OWF Area used the Natura 2000 sites *Hoburgs bank och Midsjöbankarna* SE0330308 and *Zatoka Pomorska* PLB990003.

Hoburgs bank och Midsjöbankarna is a protected habitat area where shoals and reefs as well as the harbour porpoise are the subject of protection. The bird species referred to in Article 4 of Directive 2009/147/EC and listed in Annex II of Directive 92/43/EEC are the long-tailed duck and common eider, which are diving benthivorous birds, and the black guillemot, which is a piscivorous bird.

Natura 2000 site *Zatoka Pomorska* PLB 990003, located approximately 120 km south-west of the Baltic East OWF. This area is the target wintering site of the long-tailed duck, velvet scoter, common scoter and two species of divers.

All 11 species listed in the documentation for the indicated Natura 2000 sites were observed during surveys of migratory birds in the Baltic East OWF Area, of which in the case of black guillemot only one individual was observed during radar surveys.

***Przybrzeżne Wody Bałtyku* PLB990002**

Relatively shallow waters and proximity to the coast of the *Przybrzeżne Wody Bałtyku* site contribute to the abundance of marine life, which is crucial for various bird species, in particular:

- velvet scoter *Melanitta fusca*
- long-tailed duck *Clangula hyemalis*
- red-throated diver *Gavia stellata*
- common eider *Somateria mollissima*
- black-throated diver *Gavia arctica*
- European herring gull *Larus argentatus*
- common gull *Larus canus*
- razorbill *Alca torda*
- black guillemot *Cepphus grylle*

Two bird species from Annex I to the Birds Directive: black-throated diver and red-throated diver spend winter in this site. In winter, more than 1% of the population of the black guillemot and velvet scoter migration trail are present there. Wintering populations of the long-tailed duck, velvet scoter, razorbill and European herring gull are also under protection. It is estimated that 90–120,000 individuals of the long-tailed duck, 14–20,000 individuals of the velvet scoter, 8–15,000 individuals of the European herring gull and 500–1000 individuals of the razorbill winter within the area. The wintering and migratory populations of the black guillemot are also subject to protection in the area [Table 40].

Table 40 Basic information on avifauna present in the Przybrzeżne Wody Bałtyku PLB990002 [source: internal materials based on the Natura 2000 site Standard Data Form]

SPECIES	POPULATION TYPE	SITE ASSESSMENT FOR THE POPULATION*	SIZE OF POPULATION WITHIN THE AREA [NUMBER OF INDIVIDUALS]		PROPORTION OF WINTERING POPULATION/MIGRATORY ROUTE
			MINIMUM	MAXIMUM	
Black-throated diver *Gavia arctica*	wintering	D	200	500	<1%
Red-throated diver *Gavia stellata*	wintering	D	100	500	<1%
European herring gull *Larus argentatus*	wintering	C	8,000	15,000	<1%
Common gull *Larus canus*	wintering	D	1,000	1,000	<1%
Black guillemot *Cepphus grylle*	wintering	B	1,500	1,500	At least 1%
Razorbill *Alca torda*	wintering	C	500	1,000	<1%
long-tailed duck *Clangula hyemalis*	wintering	B	90,000	120 ,000	>1%
Velvet scoter *Melanitta fusca*	wintering	C	14,000	20,000	At least 1%
Common scoter *Melanitta nigra*	wintering	C	5,000	8,000	<1%
	passing	C	3,000	3,000	<1%

*class intervals: A: 100 ≥ p > 15%, B: 15 ≥ p > 2%, C: 2 ≥ p > 0%; site assessment for the population D (the species is not subject to protection in the area)

***Ławica Słupska* PLC990001**

The area covers an undersea bank with a significantly shallow seabed in relation to the surrounding areas, and its shallow waters create ideal conditions for the feeding and resting of many bird species. The key bird species observed in *Ławica Słupska* include:

- long-tailed duck *Clangula hyemalis*

- velvet scoter *Melanitta fusca*
- black-throated diver *Gavia arctica*
- black guillemot *Cepphus grylle*
- red-throated diver *Gavia stellata*

The subjects of protection in the area are three bird species – black guillemot, long-tailed duck and velvet scoter. Due to the lowest population size rating – D, black-throated diver and red-throated diver are not subjects of protection in this area [Table 41].

Table 41 Basic information on avifauna present in the Ławica Słupska PLC990001 [source: internal materials based on the Natura 2000 site Standard Data Form]

SPECIES	POPULATION TYPE	SITE ASSESSMENT FOR THE POPULATION*	SIZE OF POPULATION WITHIN THE AREA [NUMBER OF INDIVIDUALS]		PROPORTION OF WINTERING POPULATION/MIGRATORY ROUTE
			MINIMUM	MAXIMUM	
black guillemot *Cepphus grylle*	wintering	C	98	556	0.5–2.8%
	passing	C	72	461	0.4–2.3%
long-tailed duck *Clangula hyemalis*	wintering	B	101,148	231,180	6.7–15.4%
	passing	B	76,440	214,374	5.1–14.3%
arctic diver *Gavia arctica*	wintering	D	93	173	<0.15%**
red-throated loon *Gavia stellata*	wintering	D	28	66	<0.02%**
velvet scoter Melanitta fusca	wintering	B	5,565	23,611	1.5–6.3%
	passing	C	910	1,789	0.2–0.5%

**class intervals: A: 100 ≥ p > 15%, B: 15 ≥ p > 2%, C: 2 ≥ p > 0%; site assessment for the population D (the species is not subject to protection in the area)*

***values calculated on the basis of data included in the Ławica Słupska PLC990001 Standard Data Form*

***Hoburgs bank och Midsjöbankarna* SE0330308**

The site is centrally located in the relevant part of the Baltic Sea and comprises offshore areas consisting of a mosaic of shallow shoals and reefs and deep areas with sedimentary deposits. The subjects of protection in the area include the following habitats: Sandbanks which are slightly covered by sea water all the time (1110), Rocky seabed, Reefs (1170), harbour porpoise *Phocoena phocoena and* three bird species: black guillemot *Cepphus grylle*, common eider *Somateria mollissima* and long-tailed duck *Clangula hyemalis*.

The table below presents information on bird species included in the site Standard Data Form [Table 42].

Table 42 Basic information on avifauna present in the Hoburgs bank och Midsjöbankarna SE0330308 site [source: internal materials based on the Natura 2000 site Standard Data Form]

SPECIES	POPULATION TYPE	SITE ASSESSMENT FOR THE POPULATION*	SIZE OF POPULATION WITHIN THE AREA [NUMBER OF INDIVIDUALS]		PROPORTION OF WINTERING POPULATION/MIGRATORY ROUTE
			MINIMUM	MAXIMUM	
black guillemot *Cepphus grylle*	wintering	C	1,000	5,000	5.1–25.5%
long-tailed duck *Clangula hyemalis*	wintering	A	200,000	1,000,000	13.3–66.7%
common eider *Somateria mollissima*	passing	C	5,000	50,000	0.005–5%

**class intervals: A: 100 ≥ p > 15%, B: 15 ≥ p > 2%, C: 2 ≥ p > 0%; site assessment for the population D (the species is not subject to protection in the area)*

***Pobrzeże Słowińskie* PLB220003**

Onshore area of 21,819.43 ha, with morphological forms found in the Gardnieńsko-Łebska Spit, including unique coastal barchan dunes and the two largest brackish water lakes, Łebsko and Gardno, together with adjacent meadows, peatlands, forests and coniferous forests. In the area of *Pobrzeże Słowińskie* PLB220003, which is included in the list of Ramsar Convention sites, at least 28 bird species are listed in Annex I to the Birds Directive, but they are mostly related to terrestrial habitats [Table 43]. At least 1% of the population of the migratory route of three species of water birds is found there during the migration period: smew *Mergus albellus*, bean goose *Anser faballis* and common merganser *Mergus merganser*. The great cormorant *Phalacrocorax carbo*, white-fronted goose *Anser albiforns* and Eurasian wigeon *Mareca Penelope* can be found in relatively large numbers. A large population of the European herring gull also nests there. The subjects of protection of this site are the migratory populations of the greater white-fronted goose, the bean goose, the common pochard *Aythya ferina*, the common merganser and the cormorant, as well as the breeding population of the European herring gull.

Table 43 Basic information on avifauna present in the Pobrzeże Słowińskie PLB220003 [source: internal materials based on the Natura 2000 site Standard Data Form]

SPECIES	POPULATION TYPE	SITE ASSESSMENT FOR THE POPULATION*	SIZE OF POPULATION WITHIN THE AREA [NUMBER OF INDIVIDUALS]	
			MINIMUM	MAXIMUM
Boreal owl *Aegolius funereus*	sedentary	D	1	1
Eurasian wigeon *Mareca penelope*	passing	D	1	3,000
Mallard *Anas platyrhynchos*	passing	D	1	6,500

SPECIES	POPULATION TYPE	SITE ASSESSMENT FOR THE POPULATION*	SIZE OF POPULATION WITHIN THE AREA [NUMBER OF INDIVIDUALS]	
			MINIMUM	MAXIMUM
Greater white-fronted goose *Anser albifrons*	passing	C	1,000	6,200
Taiga bean goose *sensu lato* *Anser fabalis*	passing	A	3,200	4,500
Golden eagle *Aquila chrysaetos*	Producing offspring	B	-	1
Lesser spotted eagle *Aquila pomarina*	Producing offspring	D	-	1
Short-eared owl *Asio flammeus*	Migratory	D	-	21
Common pochard *Aythya ferina*	Migratory	C	1	1,500
Eurasian bittern *Botaurus stellaris*	Producing offspring	D	2	4
Eagle owl *Bubo bubo*	Settled	B	5	5
Dunlin *Calidris alpina*	Producing offspring	D	-	-
	Migratory	D	140	140
European nightjar *Caprimulgus europaeus*	Producing offspring	D	30	30
Common ringed plover *Charadrius hiaticula*	Producing offspring	C	10	10
White stork *Ciconia ciconia*	Producing offspring	D	15	25
Black stork *Ciconia nigra*	Producing offspring	D	-	1
Western marsh-harrier *Circus aeruginosus*	Producing offspring	D	7	9
Hen harrier *Circus cyaneus*	Producing offspring	D	-	-
Montagu's harrier *Circus pygargus*	Producing offspring	D	4	5
Corncrake *Crex crex*	Producing offspring	C	200	250
Whopper swan *Cygnus cygnus*	Migratory	B	560	560
Crane *Grus grus*	Migratory	C	7,000	7,000
White-tailed eagle *Haliaeetus albicilla*	Producing offspring	D	4	4
	Migratory	D	10	30
European herring gull *Larus argentatus*	Producing offspring	B	400	400
Lesser black-backed gull *Larus fuscus*	Producing offspring	D	2	2
Smew *Mergus albellus*	Migratory	B	1,700	1,700
Common merganser *Mergus merganser*	Migratory	C	1	2,100
Black kite	Producing offspring	D	-	1

SPECIES	POPULATION TYPE	SITE ASSESSMENT FOR THE POPULATION*	SIZE OF POPULATION WITHIN THE AREA [NUMBER OF INDIVIDUALS]	
			MINIMUM	MAXIMUM
Milvus migrans				
Red kite *Milvus milvus*	Producing offspring	C	7	8
Western osprey *Pandion haliaetus*	Producing offspring	D	-	1
Honey buzzard *Pernis apivorus*	Producing offspring	D	1	1
Great cormorant *Phalacrocorax carbo*	Producing offspring	C	200	200
Ruff *Philomachus pugnax*	Migratory	D	380	380
Spotted crake *Porzana porzana*	Producing offspring	D	-	4
Little tern *Sternula albifrons*	Producing offspring	D	-	3
Common tern *Sterna hirundo*	Producing offspring	D	-	15

**class intervals: A: 100 ≥ p > 15%, B: 15 ≥ p > 2%, C: 2 ≥ p > 0%; site assessment for the population D (the species is not subject to protection in the area)*

3.11.3 Wildlife corridors

A wildlife corridor, in accordance with the Act of 16 April 2004 *on nature conservation* (consolidated text: Journal of Laws 2024, item 1478) is an area enabling the migration of plants, animals or fungi. More specifically, these are interconnected and interpenetrating areas that ensure free migration of species to maintain their spatial range and spread of their populations. Wildlife corridors may constitute a system of areas subject to poor anthropogenic pressure and high naturality, but also highly urbanised areas, which, however, enable the movement of species. The basic criterion of a wildlife corridor is the passability of migration routes. Bird migration areas are a separate issue of marine corridors. In this case, the offshore area, or rather the airspace above its surface, forms part of the pathway that birds travel from breeding sites to wintering sites in autumn and *vice versa* in spring. As evidenced by the bird flight surveys carried out for the offshore wind farms in the Baltic Sea, migrations generally take place from the north-east to the south-west in the autumn migration period and *vice versa* in the spring migration period. Flight routes are the shortest possible sections between onshore landmarks. According to the general classification of the migration system of wetland birds in Eurasia, Poland with its offshore areas is located within two large migration corridors: East Atlantic and Mediterranean – Black Sea corridors. The migration strategy and migration corridors of seabirds in the Baltic Sea area are very poorly studied. In summer, in July and August, sea ducks (mainly male common scoters) are observed flying from the Gulf of Finland toward the moulting areas located in the Danish Straits. They are accompanied by common eiders and velvet scoters, but the abundance of both species is much lower than that of common scoters. Those birds only exceptionally stop in sea basins in the Southern Baltic. The autumn migration period of seabirds extends over a very long time. Already in August, a number of waterbird species can be found within Polish maritime areas. Some of them only fly through and do not stay for winter (e.g. terns of the *Sterna* and *Chlidonias* genera), while others are observed throughout their migration and wintering period (sea ducks, razorbills, loons, grebes). In spring, large flocks of sea ducks (long-tailed ducks, velvet scoters, common scoters) are observed, which, while moving towards breeding sites, stop in the Polish Baltic Sea zone [Sikora *et al.*, 2011].

For other animals, including marine mammals found in the Southern Baltic, no areas can be identified that can meet the criteria for ecological corridors. Both seals and porpoises go after food, without preferring specific routes.

3.11.4 Biodiversity

3.11.4.1 Phytobenthos

The surveys carried out in the area of the proposed Baltic East OWF showed no underwater vegetation.

3.11.4.2 Macrozoobenthos

Following to the macrozoobenthos inventory survey results, the Baltic East OWF area was dominated by taxa typical of shallow and medium deep seabed (up to approximately 40 m below sea level) of the Southern Baltic open waters. The presence of rare and protected species was not confirmed.

On the soft seabed, 22 macrozoobenthos taxa belonging to the phyla Priapulida and Nemertea and 7 classes were found: hydrozoans Hydrozoa, polychaetes Polychaeta, clitellates Clitellata, Thecostraca, malacostracans Malacostraca, gastropods Gastropoda and bivalves Bivalvia. The dominant species in the population size of the soft-seabed association was the small, sand-lumpy polychaete *Pygospio elegans*, recognized as an indicator of the clean or medium clean seabed, consisting of sediment with a small admixture of organic matter, whereas the biomass of the soft seabed was dominated by one bivalve species – *Macoma balthica*, which feeds many species of ducks (e.g. common scoter or common eider) and fish (e.g. European flounder or eel). Moreover, the most common were opportunistic taxa with low sensitivity, characteristic of the seabed contaminated with an excessive load of organic matter: *Marenzelleria* spp., *Bylgides sarsi*, *Macoma balthica* and Oligochaeta.

However, on the hard seabed, the periphyton and accompanying fauna community was formed by 20 macrozoobenthos taxa belonging to 8 classes: hydrozoans Hydrozoa, polychaetes Polychaeta, clitellates Clitellata, Thecostraca, arachnids Arachnida, malacostracans Malacostraca, gastropods

Gastropoda and bivalves Bivalvia. The abundance and biomass of benthic fauna, in boulder areas and on rocks, was dominated by clams, bay mussels *Mytilus trossulus* forming aggregations, as well as taxa characteristic for this community, i.e. bay mussels *Mytilus trossulus*, Bryzoa *Einhornia crustulenta*, Balanus *Amphibalanus improvisus* amphipods of the genus *Gammarus*. Bay mussels *Mytilus trossulus* are an important food component of fish and birds – diving benthivorous birds (e.g. long-tailed ducks and velvet scoters) and play a habitat-forming role in the environment.

The taxa found are typical and common representatives of invertebrate macrofauna in open waters of the southern Baltic Sea. The list of results of macrozoobenthos surveys carried out as part of neighbouring projects (BC-Wind OWF, Baltic Power OWF), in the period 2019–2022, indicate that macrozoobenthos in any of the indicated, neighboring PMA regions was not distinguished in terms of composition features and taxonomic diversity of soft-seabed macrozoobenthos, and the range of taxa on the stations surveyed and the most frequently recorded taxa are comparable.

3.11.4.3 Ichthyofauna

The analysis of the results of catches and catch efficiency of an association of fish living within the Baltic East OWF area shows that the area is typical for the Southern Baltic in terms of species diversity, with a clear predominance of codfish and European flounder in demersal catches and herring and sprat in pelagic catches.

In total, 144 fish species were recorded in the Baltic Sea, including 97 marine species, 7 migratory species and 40 freshwater species [Thiel *et al.* 1996]. The predominant fish species in deeper waters of the western Baltic Sea are cod and flounder in the demersal zone and herring and sprat in the pelagic zone [Aro 2000; Kloppmann *et al.* 2003; Winkler *et al.* 2003].

According to the Chief Inspectorate of Environmental Protection (CIEP) (2013), a maximum of 44 fish species live in the open sea area, taking into account temporarily appearing species, found in coastal and transitional waters.

A total of 22 taxa were observed during the surveys in the Baltic East OWF area. In the case of ichthyoplankton, eggs of two fish species and larvae belonging to 13 taxa were caught.

Sprat (62.0%) and gobies (23.0%) were by far the most important in the total number of fish larvae (converted to 10 m^2 of water surfaces) throughout the survey period. European flounder (12.5%) and ammodytids (1.5%) were next on the list. The total proportion of larvae of the remaining 9 species (cod, European plaice, fourbeard rockling, herring, shorthorn sculpin, common seasnail, rock gunnel, long-spined bullhead and straightnose pipefish) in the total larvae represented only 1%.

During pelagic catches, 8 fish species were caught, of which 99% were sprat and herring. Individuals of great sand eel, salmon, river lamprey, European anchovy, European flounder and lumpfish were also found.

During demersal catches, fish belonging to 15 taxa were recorded. European flounder and cod dominated. Other species constituted small by-catches (great sand eel, European plaice, shorthorn sculpin, pogge, Atlantic mackerel, fourbeard rockling, turbot, sprat, herring, lumpfish, vivaparous eelpout, whiting, and salmon).

3.11.4.4 Seabirds

The species diversity of seabird associations recorded in the Baltic East OWF area varied depending on the seasons in which the observations were performed.

In summer, only 3 species of seabirds and waterbirds rarely encountered at sea away from the coast were recorded in the Baltic East OWF area. The common guillemot (64.8% of the group) and the European herring gull (34.1%) were the most abundant.

During the autumn migration period, the presence of 14 species in the OWF area was confirmed, with the most abundant being the long-tailed duck constituting 30.8% of all the birds observed. Three other species had a proportion of at least 10% in the entire bird group, namely: the razorbill (27.3%), the common guillemot (16.7%), and the European herring gull (10.8%). The remaining species were much less abundant and their total number recorded during all nine controls did not reach 100 birds. During that period, 15 ducks were also found, which could not be assigned to a species.

In winter, 14 species were recorded. The most abundant species wintering in this sea basin was the long-tailed duck, which constitutes 62.1% of the entire group of birds. The razorbill was also abundant, reaching 24.5%.

During the spring migration period, 15 species of seabirds were found within the OWF area, of which the long-tailed duck was the most abundant, accounting for 61.5% of all birds found. The razorbill (17.8%) and the European herring gull (7.0%) were also abundant. The remaining species did not exceed 5% of the group proportion. During that period, 7 divers were also found, which could not be assigned to a species [Table 44].

Table 44 Number of species and most abundant species of seabirds found in the Baltic East OWF area in individual phenological periods

PARAMETER	SUMMER PERIOD	AUTUMN MIGRATION PERIOD	WINTER PERIOD	SPRING MIGRATION PERIOD
Number of species	3	14	14	15
Most abundant species (up to 10% in the group)	common guillemot, European herring gull	long-tailed duck, razorbill, common guillemot, European herring gull	long-tailed duck, razorbill	long-tailed duck, razorbill

3.11.4.5 Migratory birds

Given that migratory birds are the subject of this report, it cannot be excluded that birds observed during monitoring of migratory birds in the Baltic East OWF area used the Natura 2000 sites *Hoburgs bank och Midsjöbankarna* SE0330308 and *Zatoka Pomorska* [Pomeranian Bay] PLB990003.

NATURA 2000 sites located nearest to the Baltic East OWF are: *Przybrzeżne wody Bałtyku* [Coastal Waters of the Baltic Sea] PLB990002 and *Ławica Słupska* [Słupsk Bank] PLC990001. The *Zatoka Pomorska* [Pomeranian Bay] site is more than 120 km away from the Project area, and the Swedish *Hoburgs bank och Midsjöbankarna* SE0330308 site is more than 70 km away. Moreover, the southern part of the South Middle Bank located in the Swedish *Hoburgs bank och Midsjöbankarna* site has been an Important Bird Area (IBA) since 2016.

Both the Słupsk Bank and the Coastal Waters of the Baltic Sea sites are critical habitats for seabirds, especially during migration and wintering. The rich marine biodiversity and the relatively undisturbed nature of these areas provide feeding grounds, helping to maintain populations of birds migrating to the Baltic Sea in winter.

In particular, the Przybrzeżne Wody Bałtyku site is crucial for a large number of waterbirds and seabirds, and its shallow waters create ideal forging and resting conditions. The rich food resources and the protected status of these sites are essential to maintain a good condition of the water bird population.

The key bird species observed in *Ławica Słupska* [Słupsk Bay] PLC990001 include:

- long-tailed duck *Clangula hyemalis*
- velvet scoter *Melanitta fusca*
- black-throated diver *Gavia arctica*
- black guillemot *Cepphus grylle*
- red-throated diver *Gavia stellata*

Relatively shallow waters and proximity to the coast of the *Przybrzeżne Wody Bałtyku* [Coastal Waters of the Baltic Sea] (PLB990002) site contribute to the abundance of marine life, which is crucial for various bird species, in particular:

- velvet scoter *Melanitta fusca*
- long-tailed duck *Clangula hyemalis*
- red-throated diver *Gavia stellata*
- common eider *Somateria mollissima*
- black-throated diver *Gavia arctica*
- European herring gull *Larus argentatus*
- common gull *Larus canus*
- razorbill *Alca torda*
- black guillemot *Cepphus grylle*

Hoburgs bank och Midsjöbankarna is a protected habitat area where shoals and reefs are the subject of protection. Bird species referred to in Article 4 of Directive of the European Parliament and of the Council 2009/147/EC of 30 November 2009 *on the conservation of wild birds* (consolidated version) (OJ EU. L. of 2010 No 20, p. 7 as amended) and listed in Annex II of Directive 92/43/EEC of 21 May 1992 on the *conservation of natural habitats and of wild fauna and flora* (OJ EU. L. of 1992 No. 206, p. 7 as amended), these are the long-tailed duck and common eider which are diving benthivorous birds, and the black guillemot, which is a piscivorous bird.

The Natura 2000 site *Zatoka Pomorska* [Pomeranian Bay] PLB 990003, located at a distance of approximately 120 km south-west of the Baltic East OWF is the target wintering site of the long-tailed duck, velvet scoter, common scoter and two species of divers.

During the monitoring of migratory birds within the Baltic East OWF area, all 11 species listed in the documentation of the above Natura 2000 sites were recorded, of which in the case of black guillemot only one individual was observed during radar surveys.

Twenty one of the species recorded are listed in Annex I to Directive of the European Parliament and of the Council 2009/147/EC of 30 November 2009 *on the conservation of wild birds* (consolidated version) (OJ L of 2010, No. 20, p. 7, as amended). On the basis of the International Union for Conservation of Nature (IUCN) classification, common eider is recognized at European level as endangered (EN). The following are considered vulnerable (VU): velvet scoter *Melanitta fusca*, northern pintail *Anas acuta*, tundra swan *Cygnus columbianus*, rook *Corvus frugilegus*, common snipe *Gallinago gallinago* and northern lapwing *Vanellus vanellus*, wheras the following are considered near threatened (NT): hen harrier *Circus cyaneus*, Eurasian curlew *Numenius arquata*, red-footed falcon *Falco vespertinus*, tufted duck *Aythya fuligula*, red-breasted merganser *Mergus serrator*, common swift *Apus apus* and horned grebe *Podiceps auritus*. According to the HELCOM threat category, wintering populations of both species of divers are critically endangered (CR), whereas wintering populations of horned grebe *Podiceps auritus*, common eider *Somateria* *mollissima*, velvet scoter *Melanitta fusca*, common scoter *Melanitta nigra*, taiga bean goose *Anser fabalis*, long-tailed duck *Clangula hyemalis* and the breeding population of dunlin *Calidris alpina schinzii*. Breeding populations of horned grebe *Podiceps auritus*, common eider *Somateria mollissima* and velvet scoter *Melanitta fusca*, the entire population of lesser black-backed gull *Larus fuscus*, greater scaup *Aythya marila*, Caspian tern *Hydroprogne caspia* and red-breasted merganser *Mergus serrator* were identified as vulnerable. The little gull *Larus minutus*, Temminck's stint *Calidris temminckii*, northern wheatear *Oenanthe oenanthe*, tufted duck *Ayhthya fuligula* and northern lapwing *Vanellus vanellus* are listed as near-threatened (NT) [Table 45].

Among the listed species, very few (up to 10 individuals) were observed: horned grebe *Podiceps aur*itus, common eider *Somateria mollissima*, Caspian tern *Hydroprogne caspia*, northern wheatear *Oenanthe oenanthe*, Temminck's stint *Calidris temminckii,* common snipe *Gallinago gallinago*, sandwich tern *Thalasseus sandvicensis*, dunlin *Calidris alipca schinzii*, rook *Corvus frugilegus*, black guillemot *Cepphus grylle* and northern lapwing *Vanellus vanellus*. Among the particularly abundant species observed based on the visual and radar observations in total are the long-tailed duck *Clangula hyemalis* (almost 2000 individuals in total), razorbill *Alca torda* (more than 1400), velvet scoter *Melanitta fusca* (more than 1200), Eurasian skylark *Alauda arvensis* (almost 1200), Eurasian wigeon *Mareca penelope* (more than 1000), common scoter *Melanitta nigra* (more than 900), taiga bean goose *Anser fabalis* and greater white-fronted goose *Anser albifrons* (both species more than 800), great cormorant *Phalacrocorax carbo* (more than 800), little gull *Larus minutus* (more than 600), common murre *Uria aalgae*, whooper swan *Cygnus cygnus* (both species more than 400 individuals).

Table 45 Conservation status of migratory birds recorded during the migratory bird surveys in the Baltic East OWF surveyed area (data include visual and radar observations) [source: internal materials]

Item	ENGLISH NAME	LATIN NAME	SPECIES PROTECTION IN POLAND[1]	ANNEX I TO THE BIRDS DIRECTIVE	IUCN[2]	CAT. HELCOM THREAT CATEGORY[3]	NATURA 2000[4]
1	Long-tailed duck	*Clangula hyemalis*	SP	No	LC/VU	EN (wp)	1, 2, 3, 4
2	Razorbill	*Alca torda*	SP	No	LC	-	2
3	Velvet scoter	*Melanitta fusca*	SP	No	VU	VU (bp) EN (wp)	1, 2, 4
4	Eurasian skylark	*Alauda arvensis*	SP	No	LC	-	-
5	Eurasian wigeon	*Anas penelope*	SP	No	LC	-	-
6	Common scoter	*Melanitta nigra*	SP	No	LC	EN (wp)	4
7	Grayleg goose	*Anser anser*	G	No	LC	-	-
8	Great cormorant	*Phalacrocorax carbo*	PP	No	LC	-	-
9	Greater white-fronted goose	*Anser albifrons*	G	No	LC	-	-
10	Little gull	*Larus minutus*	SP	Yes	LC	NT	-

Item	ENGLISH NAME	LATIN NAME	SPECIES PROTECTION IN POLAND[1]	ANNEX I TO THE BIRDS DIRECTIVE	IUCN[2]	CAT. HELCOM THREAT CATEGORY[3]	NATURA 2000[4]
11	Common guillemot	*Uria aalge*	SP	No	LC	-	-
12	Whopper swan	*Cygnus cygnus*	SP	Yes	LC	-	-
13	Chaffinch	*Fringilla coelebs*	SP	No	LC	-	-
14	Tufted duck	*Aythya fuligula*	G	No	NT/LC	NT	-
15	Common teal	*Anas crecca*	G	No	LC	-	-
16	Black-throated diver	*Gavia arctica*	SP	Yes	LC	CR (wp)	1, 2, 4
17	Lesser black-backed gull	*Larus fuscus*	SP	No	LC	VU	-
18	Mallard	*Anas platyrhynchos*	G	No	LC	-	-
19	Greater scaup	*Aythya marila*	SP	No	LC	VU	-
20	Northern shoveler	*Anas clypeata*	SP	No	LC	-	-
21	Siskin	*Carduelis spinus*	SP	No	LC	-	-
22	Taiga bean goose	*Anser fabalis*	G	No	LC	EN (wp)	-
23	Common starling	*Sturnus vulgaris*	SP	No	LC	-	-
24	White wagtail	*Motacilla alba*	SP	No	LC	-	-
25	Black tern	*Chlidonias niger*	SP	Yes	LC	-	-
26	Common gull	*Larus canus*	SP	No	LC	-	2
27	Black-headed gull	*Larus ridibundus*	SP	No	LC	-	-
28	European herring gull	*Larus argentatus*	PP	No	LC	-	-
29	Common merganser	*Mergus merganser*	SP	No	LC	-	-
30	Northern pintail	*Anas acuta*	SP	No	VU/LC	-	-
31	Barn swallow	*Hirundo rustica*	SP	No	LC	-	-
32	Red-throated diver	*Gavia stellata*	SP	Yes	LC	CR (wp)	-
33	Crane	*Grus grus*	SP	Yes	LC	-	-
34	Eurasian curlew	*Numenius arquata*	SP	No	NT	-	-
35	European golden plover	*Pluvialis apricaria*	SP	Yes	LC	-	-
36	Red-breasted merganser	*Mergus serrator*	SP	No	NT/LC	VU	-
37	Common swift	*Apus apus*	SP	No	NT/LC	-	-
38	Meadow pipit	*Anthus pratensis*	SP	No	LC	-	-
39	Mute swan	*Cygnus olor*	SP	No	LC	-	-
40	Great egret	*Egretta alba*	SP	Yes	LC	-	-
41	Common goldeneye	*Bucephala clangula*	SP	No	LC	-	-
42	Parasitic jaeger	*Stercorarius parasiticus*	SP	No	LC	-	-
43	Yellow wagtail	*Motacilla flava*	SP	No	LC	-	-

Item	ENGLISH NAME	LATIN NAME	SPECIES PROTECTION IN POLAND[1]	ANNEX I TO THE BIRDS DIRECTIVE	IUCN[2]	CAT. HELCOM THREAT CATEGORY[3]	NATURA 2000[4]
44	Common wood pigeon	*Columba palumbus*	G	No	LC	-	-
45	Gadwall	*Anas strepera*	SP	No	LC	-	-
46	Common tern	*Sterna hirundo*	SP	Yes	LC	-	-
47	Tundra swan	*Cygnus columbianus*	SP	No	VU/LC	-	-
48	Blue tit	*Parus caeruleus*	SP	No	LC	-	-
49	European goldfinch	*Carduelis carduelis*	SP	No	LC	-	-
50	Great black-backed gull	*Larus marinus*	SP	No	LC	-	-
51	Eurasian wren	*Troglodytes troglodytes*	SP	No	LC	-	-
52	Kestrel	*Falco tinnunculus*	SP	No	LC	-	-
53	Robin	*Erithacus rubecula*	SP	No	LC	-	-
54	Lapwing	*Vanellus vanellus*	SP	No	VU/NT	NT	-
55	Grey heron	*Ardea cinerea*	PP	No	LC	-	-
56	Brambling	*Fringilla montifringilla*	SP	No	LC	-	-
57	Sandwich stern	*Sterna sandvicensis*	SP	Yes	LC	LC	-
58	Short-eared owl	*Asio flammeus*	SP	Yes	LC	-	-
59	Eurasian whimbrel	*Numenius phaeopus*	SP	No	LC	-	-
60	Common blackbird	*Turdus merula*	SP	No	LC	-	-
61	Eurasian sparrowhawk	*Accipiter nisus*	SP	No	LC	-	-
62	Song thrush	*Turdus philomelos*	SP	No	LC	-	-
63	Rook	*Corvus frugilegus*	PP	No	VU/LC	-	-
64	Canada goose	*Branta canadensis*	SP	No	LC	-	-
65	Red-footed falcon	*Falco vespertinus*	SP	No	NT	-	-
66	Jackdaw	*Corvus monedula*	SP	No	LC	-	-
67	Common redpoll	*Carduelis flammea*	SP	No	LC	-	-
68	Tree pipit	*Anthus trivialis*	SP	No	LC	-	-
69	Twite	*Carduelis flavirostris*	SP	No	LC	-	-
70	Woodlark	*Lullula arborea*	SP	Yes	LC	-	-
71	Long-eared owl	*Asio otus*	SP	No	LC	-	-
72	Arctic tern	*Sterna paradisaea*	SP	Yes	LC	-	-
73	Caspian tern	*Sterna caspia*	SP	No	LC	VU	-
74	Common snipe	*Gallinago gallinago*	SP	No	VU/LC	-	-
75	Goldcrest	*Regulus regulus*	SP	No	LC	-	-
76	House martin	*Delichon urbicum*	SP	No	LC	-	-
77	Common sandpiper	*Actitis hypoleucos*	SP	No	LC	-	-
78	Garden warbler	*Sylvia borin*	SP	No	LC	-	-

Item	ENGLISH NAME	LATIN NAME	SPECIES PROTECTION IN POLAND[1]	ANNEX I TO THE BIRDS DIRECTIVE	IUCN[2]	CAT. HELCOM THREAT CATEGORY[3]	NATURA 2000[4]
79	Peregrine falcon	*Falco peregrinus*	SP	Yes	LC	-	-
80	Common redstart	*Phoenicurus phoenicurus*	SP	No	LC	-	-
81	Great crested grebe	*Podiceps cristatus*	SP	No	LC	-	-
82	Sand martin	*Riparia riparia*	SP	No	LC	-	-
83	Snow bunting	*Plectrophenax nivalis*	SP	No	LC	-	-
84	Black redstart	*Phoenicurus ochruros*	SP	No	LC	-	-
85	Citrine wagtail	*Motacilla citreola*	SP	No	LC	-	-
86	Hawk	*Accipiter gentilis*	SP	No	LC	-	-
87	Temminck's stint	*Calidris temminckii*	SP	No	LC	NT	-
88	Whinchat	*Saxicola rubetra*	SP	No	LC	-	-
89	Caspian gull	*Larus cachinnans*	SP	No	LC	-	-
90	Common eider	*Somateria mollissima*	SP	No	EN/NT	VU (bp) EN (wp)	1,2,3
91	Horned grebe	*Podiceps auritus*	SP	Yes	NT/VU	VU (bp) NT (wp)	-
92	Lesser whitethroat	*Sylvia curruca*	SP	No	LC	-	-
93	Red knot	*Calidris canutus*	SP	No	LC/NT	-	-
94	Spotted flycatcher	*Muscicapa striata*	SP	No	LC	-	-
95	Stock dove	*Columba oenas*	SP	No	LC	-	-
96	Western marsh-harrier	*Circus aeruginosus*	SP	Yes	LC	-	-
97	Yellowhammer	*Emberiza citrinella*	SP	No	LC	-	-
98	Cuckoo	*Cuculus canorus*	SP	No	LC	-	-
99	Eurasian hobby	*Falco subbuteo*	SP	No	LC	-	-
100	Honey buzzard	*Pernis apivorus*	SP	Yes	LC	-	-
101	Pigeon hawk	*Falco columbarius*	SP	Yes	LC	-	-
102	Hen harrier	*Circus cyaneus*	SP	Yes	NT	-	-
103	Barnacle goose	*Branta leucopsis*	SP	Yes	LC	-	-
104	Black guillemot	*Cepphus grylle*	SP	No	LC	-	1,2,3
105	Reed bunting	*Emberiza schoeniclus*	SP	No	LC	-	-
106	Dunlin	*Calidris alpina*	SP	No	LC	EN (schinzii)	-
107	Dunnock	*Prunella modularis*	SP	No	LC	-	-
108	Eurasian blackcap	*Sylvia atricapilla*	SP	No	LC	-	-
109	Fieldfare	*Turdus pilaris*	SP	No	LC	-	-
110	Northern wheatear	*Oenanthe oenanthe*	SP	No	LC	NT	-
111	Wood sandpiper	*Tringa glareola*	SP	Yes	LC	-	-

[1]Regulation of the Minister of the Environment of December 16, 2016 on the protection of animal species; Regulation of the Minister of the Environment of March 11, 2005 on establishing a list of game species: SP – strict species protection, PP – partial species protection, G – game species

[2]IUCN: EN – endangered, VU – vulnerable, NT – near threatened, LC – least concern; the first value refers to the European population, the second to the world population

[3]HELCOM: CR – critically endangered; EN – endangered; VU – vulnerable, NT – near threatened, LC – last concern; WP – wintering population, BP – breeding population

[4]NATURA 2000: species referred to in Article 4 of Directive 2009/147/EC and listed in Annex II of Directive 92/43/EEC for the site: 1) Ławica Słupska [Słupsk Bank], 2) Przybrzeżne Wody Bałtyku [Coastal Waters of the Baltic Sea], 3) Hoburgs bank och Midsjöbankarna, 4) Zatoka Pomorska [Pomeranian Bay]

3.11.4.6 Marine mammals

Within the area of the proposed Baltic East OWF, harbor porpoise, gray seal and occasionally harbor seal can be encountered.

3.11.4.7 Bats

In Poland, chiropterofauna is represented by 28 bat species, 18 of which are present in Gdańsk Pomerania.

The occurrence of bats at a significant distance from the shore is not a result of searching for feeding grounds [Ahlen *et al.*, 2007; Ahlen *et al.*, 2009; Poerink B.J., 2013]. Currently, quite a number of surveys for offshore projects confirm that the Baltic Sea region plays an important role during the migration period of European bats [Gaultier *et al.*, 2020].

The bat species identified are classified as long-distance migrants, especially the Nathusius' pipistrelle traveling over two thousand kilometers during migrations [Peterson 1990, Huttere *et al.*, 2005], which is usually the most frequently recorded species [Rydell, 2014].

3.11.5 Nature assessment of the sea basin

Appropriate abiotic conditions affecting the nature of the habitat (type of seabed, quality of bottom sediments, depth, photic conditions) directly affect the organisms inhabiting them, permanently living in such conditions or temporarily using a given area.

The results of comprehensive environmental surveys performed for the purposes of the EIA Report indicate that the Baltic East OWF area is in most cases homogeneous in terms of abiotic conditions. Therefore, the area is characterized by quite homogeneous natural values.

3.11.5.1 Phytobenthos

No underwater vegetation was found in the surveyed area, therefore the area does not meet any of the four criteria determining its value [Brzeska-Roszczyk and Kruk-Dowgiałło, 2018].

3.11.5.2 Macrozoobenthos

Multimetric indicator B [Osowiecki *et al.* 2012] was used to assess the ecological quality status of macrozoobenthos communities on the soft seabed, whereas on the hard seabed – the typical species occurrence indicator – OGT [CIEP 2018], using a five-stage scale.

The surface distribution of the ecological quality status determined on the basis of macrozoobenthos within the boundaries of the Baltic East OWF area is mosaic in nature. This area is inhabited by macrozoobenthos, indicating mainly poor and moderate quality status [Figure 65]. The average value of indicator B was 2.76±0.31, which on average indicates a moderate quality status of the soft-seabed demersal fauna community inhabiting the described area and corresponds to water quality class 3 according to the Regulation of the Minister of Infrastructure of June 25, 2021 *on the classification of ecological status, ecological potential, chemical status and the method of classifying the status of surface water bodies as well as environmental quality standards for priority substances* (Journal of Laws of 2021, item 1475). However, the average value of indicator OGT at the hard-seabed stations surveyed was 3.67±0.52, which classifies the quality status of macrozoobenthos communities of this seabed type as "very good". The detailed surface distribution of the ecological quality status in the Baltic East OWF area shows that benthic habitats of higher value (good status) occur mainly in the north-western part of the surveyed area, both on the soft seabed and hard seabed. Moreover, the assessment conducted in the places of occurrence of the remaining seabed with cover of boulders and stones, covering the central and eastern part of the surveyed area, indicates that this is the most valuable habitat area, as the quality status of the macrozoobenthos association inhabiting these seabed fragments was characterized by a very good ecological quality status.

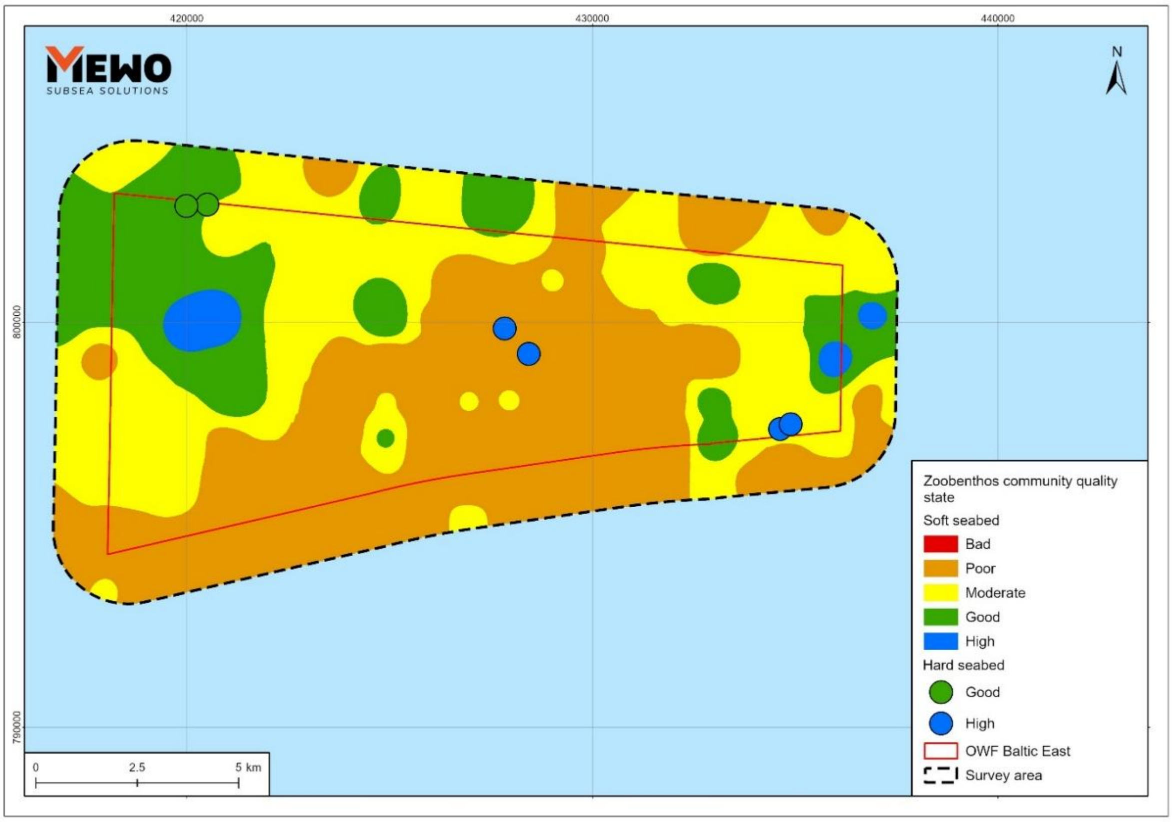

Figure 65 Distribution of ecological status in the Baltic East OWF area based on the assessment of the macrozoobenthos quality status

Comparison of the ecological quality status of the Baltic East OWF area with the survey results in the area of neighbouring proposed projects: the BC-Wind OWF area adjacent to the surveyed area from the north-east (EIA Report for the BC-Wind 2021 OWF) and the Baltic Power OWF area (1 NM) located west of the surveyed area (EIA Report for the Baltic Power 2022 OWF) indicate that the ecological quality status of the soft seabed in the area covering the three proposed projects was determined as moderate. However, in the case of the hard seabed, the boulder area within the Baltic East OWF area was inhabited by periphyton and accompanying fauna of high value (very good status) compared to a slightly lower ecological quality status of this type of seabed in the neighbouring locations (good status in the Baltic Power OWF area and the BC-Wind OWF area) [Table 46].

Table 46 Ecological quality status of the Baltic East OWF area in 2022 and 2023 against the results of macrozoobenthos surveys of the Baltic Power OWF area of 2019 and BC-Wind OWF of 2020

PARAMETER	SURVEY AREA	BALTIC POWER OWF AREA (1 NM)	BC-WIND OWF AREA
Ecological quality status (soft and hard seabed)	Moderate (soft bottom), Very good (hard seabed)	Moderate (soft bottom), Good (hard bottom)	Moderate (soft bottom), Good (hard bottom)

3.11.5.3 Ichthyofauna

The analysis of the results of catches and catch efficiency of an association of fish living within the Baltic East OWF area shows that the area is typical n terms of species diversity, with a clear predominance of codfish and European flounder in demersal catches and herring and sprat in pelagic catches, which is typical of the waters of the Southern Baltic.

On the basis of the results of ichthyoplankton surveys and literature information, it can be assumed that late spring and summer sprat spawning takes place in July within the surveyed area. Due to a relatively high depth and lack of appropriate substrate, the surveyed area does not constitute a significant spawning ground for herring. The results of the surveys on the abundance of cod and European flounder carried out in individual survey seasons indicate that these fish occur abundantly within the surveyed area on an annual basis. Therefore, the above survey results may indicate that the area of the proposed Project is an important habitat for these fish species, regardless of the season, but it is not a place for their reproduction.

3.11.5.4 Seabirds

Seabird surveys carried out in the Baltic East OWF area during all four phenological periods indicate that this sea basin is not a place of very high avifauna concentrations. This is mainly caused by the large depths present there, too great for diving benthivorous birds which obtain food from the seabed. In the surveyed area, there was no clear common relation between the depth of the sea basin and the abundance of birds. This may indicate small bay mussel resources – the main food component of this morpho-ecological group of seabirds most abundant in the Baltic Sea outside the breeding season.

The number of seabird groups in the Baltic East OWF area was highly variable. The highest abundances were observed during one survey campaign in winter and two campaigns during the spring migration period. Higher concentrations of birds therefore appear irregularly in this sea basin, which is probably the result of bird movements related to migrations and local movements in winter. In both cases, bird flocks stay there for a short time.

The most abundant species found from autumn to spring in the Baltic East OWF area was the long-tailed duck. It is a species with an elevated conservation status, dominating in numbers throughout the Baltic Sea outside the breeding season. However, its abundance and average density compared to other areas in the Polish Baltic Sea zone and part of the sea basins intended for the construction of offshore wind farms were low. The number of other species was significantly lower. However, within the surveyed area, the razorbill was recorded in great numbers as for this species. It is a piscivorous bird and feeds mainly on pelagic fish. Significant fluctuations in its abundance that of the closely related common guillemot are due to the movements of fish stocks, as these birds concentrate in places of their abundance. In summer, common guillemots appeared there in greater numbers. After the end of breeding, they concentrate in places of fish abundance together with juveniles, where young individuals learn to obtain food independently.

Bird flights over the Baltic East OWF area during the day were not very abundant and the vast majority of them took place low above water. However, it should be remembered that the vast majority of flights in the Baltic Sea take place at night and the results obtained during seabird observations may only be of an auxiliary nature. The assessment of birds in flight, including flight intensity and altitudes, must be based on the results of radar surveys.

3.11.5.5 Migratory birds

The main objective of nature assessment is to identify the most valuable areas and determine their functions against the background of biotic elements species diversity. The methodological assumptions of the surveys based on migratory bird counting and observations at a survey point allow to collect complete and reliable data for the purpose of conducting the EIA, however, they cannot constitute the basis for carrying out the environmental assessment of the area, precisely due to their local nature. Additionally, migration through the Baltic Sea takes place over a broad front and its intensity depends to a large extent on regional and local weather conditions (e.g. wind strength and direction, precipitation, cloud cover, and visibility), which means that there are no open waters of the Baltic Sea with constant, repeatable annual flight intensity that could be indicated as the most valuable for migratory avifauna. The only element of the environment differentiating the Baltic East OWF area that can be used for its assessment is the depth of the sea basin. Shallower fragments may therefore constitute a more attractive area for some species of resting and feeding seabirds (long-tailed duck, velvet scoter, and common scoter). This is due to the fact that in sea basins with a lower depth, they can acquire food with lower energy expenditure, which is more beneficial for them.

3.11.5.6 Marine mammals

The area of the proposed Baltic East OWF is a region with low presence of marine mammals.

3.11.5.7 Bats

Nathusius' pipistrelle and soprano pipistrelle are species not threatened, abundant, or moderately abundant in Poland and Gdańsk Pomerania. These resources can be considered insignificant. The common noctule recorded in greatest numbers is also a species that is not threatened and abundant in Pomerania, its resources should be considered insignificant.

4 DESCRIPTION OF THE ENVIRONMENTAL IMPACTS PREDICTED IN THE CASE THE PROJECT IS NOT IMPLEMENTED, TAKING INTO ACCOUNT THE AVAILABLE INFORMATION ON THE ENVIRONMENT AND SCIENTIFIC KNOWLEDGE

The possibility of failure to implement the Baltic East Offshore Project could take place in two scenarios, i.e.:

- the abandonment of offshore wind energy development in the PSA in its entirety;
- the abandonment by the Applicant of the Baltic East OWF with a maximum capacity of 966 MW while maintaining the implementation of other OWFs in the PSA.

The above scenarios for abandoning the Project are fundamentally different in terms of the scale, type and extent of environmental impacts. Both of the above scenarios will ensure that the predicted impacts on environmental components that will be subject to existing or new/different impacts resulting from pressures occurring in the marine environment will not occur, to various scales and scopes.

The abandonment of the Project may influence the failure to achieve the environmental objectives adopted in the strategic documents (Section 1.5). On a long-term national scale, the first scenario is to forego the use of an alternative source of electricity with significant capacity (e.g. the Baltic East OWF alone would cover around 4% of the average annual national power demand (value for 2023 from: NPS Report 2023). Such a case would require action to offset energy production from, for example, conventional sources of similar output or an equivalent alternative source, which in terms of anticipated environmental impacts would involve gaseous and particulate emissions from the combustion of fossil fuels (hard coal or lignite) and the generation of waste from the combustion of these fuels. Apart from nuclear power, it is impossible to realise such power on land from alternative energy sources. At the same time, the abandonment of the Project in scenario one would indirectly cause environmental impacts at fossil fuel extraction sites and energy production sites.

The local benefits of abandoning the Project along with other offshore wind farms (in scenario one), relate to the development issues of maritime areas. The lack of investment in offshore wind energy (wind turbines, power cables, substations) will mean that there will be no negative impacts associated with the Project phases (implementation, operation and decommissioning) over several decades. There will be no restrictions regarding the accessibility of the planned Baltic East OWF area for the users i.e. shipping, fishing, tourism.

At the same time, the abandonment of offshore wind energy (OWE) would negatively affect the huge regional economic development potential associated with the implementation and operation of offshore wind farms.

The predicted impact of offshore wind energy projects in the first phase of the investment in the PSA was assessed or environmental impact assessment proceedings are underway. The cumulative impacts of the projects are taken into consideration.

The abandonment of the Project in the second scenario would mean the development of offshore wind farms in other areas and the abandonment of the Baltic East OWF only.

The second scenario, taking into account the abandonment of the Baltic East OWF itself, will also significantly affect the amount of energy produced and the level of atmospheric emissions avoided. With a conservative assumption of 40% of power utilisation and 55 years of OWF operation, the Baltic East OWF with a maximum capacity of 966 MW can produce 186.17 TWh/670.21 PJ of electricity, which would help prevent the emission of over 66.37 million Mg CO_2, over 911 thousand Mg SO_2, over 121 thousand Mg of nitrogen oxides and nearly 2.21 million Mg of particulate matter from lignite-fired power plants [EEA 2008].

This scenario, compared to the first, is still environmentally preferable, as it reduces the impacts of domestic fossil fuel extraction and the burning of these fuels in conventional power plants. Thus, it does not detract from the possibility of achieving, at national level, the objectives and trends in the development of the European energy sector, such as reducing the share of conventional power generation in electricity production or deepening the integration of Poland's national extra-high voltage transmission systems with Germany, Denmark, Sweden and Lithuania.

The abandonment of the Baltic East OWF Project would entail the underutilisation of the energy potential of the PSA, especially as the current MSPPSA indicates a limited number of sea areas with a primary function of renewable energy generation.

The predicted environmental consequences of abandoning the Baltic East OWF Project are a direct rationale for its development.

5 PROJECT ENVIRONMENTAL IMPACT ASSESSMENT

This section contains the Project expected environmental impact assessment and a description of the proposed Project expected significant environmental impacts, including direct, indirect, secondary, cumulative, short -, medium - and long-term, permanent and temporary environmental impacts resulting from: (a) the existence of the Project, (b) the use of environmental resources, (c) emissions.

5.1 Determination of the Project expected environmental impact and description of the expected significant environmental impacts of the Applicant Proposed Variant (APV)

5.1.1 Implementation phase

5.1.1.1 Impact on geological structure, seabed topography and availability of raw materials and deposits

The activities described in Section 2 of this study carried out during the implementation phase of the proposed Project may cause the following **types of impacts on** the seabed (geological structure, seabed topography and availability of raw materials and deposits):

- local, point changes in the seabed structure if it is necessary to replace/reinforce the soil at the location of wind turbines and substations (some types of foundations or support structures require constructing scour protection layers around their bases; rock crushed stone, stones and boulders are most commonly used for this purpose; these actions change the substrate composition of bottom sediments); in accordance with the adopted definitions of impact characteristics[Table 3], these will be direct, local, temporary and irreversible impacts;
- point disturbance of geological structure by introducing elements of foundations or support structures of wind turbines and substations (drilling or driving of foundations or support structures, erection of support structures, laying or possible burying of cables, dredging works); direct, local, temporary and irreversible impact;
- changes in the shape of the seabed due to: preparing the seabed for the foundation or support structure, laying of cables, levelling of seabed unevenness along the cable route; changes in the seabed morphology will also occur as a result of the possible storage of rock material excavated to prepare the seabed for foundations or support structures; in accordance with the adopted definitions of impact characteristics, these will be direct, local, temporary and reversible impacts;
- seabed level changes due to the settlement of rock material disturbed and moved during preparatory and construction works (from suspended solids); in accordance with the

adopted definitions of impact characteristics, these will be direct, local, temporary and reversible impacts;

- depressions created in the seabed at the anchoring locations of vessels installing elements of the OWF infrastructure; in accordance with the adopted definitions of impact characteristics, these will be direct, local, temporary and reversible impacts;
- the disturbance and sedimentation of suspended solids – during preparatory and construction works, suspended solids will be locally resuspended, as a result of which water will become turbid. The time of suspended solids sinking to the seabed, created as a result of sediment disturbance during dredging works, will depend on the dynamics of the waters in the area. The disturbed sediment will move mainly within Baltic East OWF area and up to a maximum of several kilometres from its boundaries (in trace quantities), which is comparable to the amount of suspended solids sinking to the seabed as a result of natural processes throughout the year; in accordance with the adopted definitions of impact characteristics, these will be indirect, local, temporary and reversible impacts.

An important part of the assessment of the Project impact on the processes taking place at the seabed and on the seabed itself is to determine the scale of impact intensity and the impact range. The impact is considered significant if the change to the nature of the surface and the structure of the seabed is greater than the size of geomorphological forms occurring at the seabed. The impact range determined as local, in geological and geomorphological terms, refers to spot changes (foundations) or linear changes (laying of cables) to the topography and structure of the seabed and is no larger than the dimensions of forms created in a given area. The local range also applies to changes in the direct vicinity of the activity related to the Project.

In geological terms, taking into account the nature of deposits forming the seabed surface of the Baltic East OWF area, no significant changes in the nature of deposits are expected. Possible changes can occur only very locally where it is necessary to replace weak soil with soil of appropriate parameters, but this will depend on the technology selected. When considering the following types of foundations: monopiles or multi-support (jacket), changes in the sediment nature should be expected in the case of soil replacement for the indicated foundations. In the vicinity of individual locations of the wind turbines and substations, the nature of surface sediments will change and, locally, where foundations or support structures are inserted into the seabed, sediments forming the seabed will change.

The total surface area of the Baltic East OWF is 111.7 km ^{2}. Changes in the nature of the seabed topography and surface sediments will apply to the seabed for the preparation, protection and foundation of up to 64 wind turbines, two substations and 150 km of the cable line strip, which constitutes up to approximately 5% of the development area.

The **sensitivity**, i.e. the response of the seabed topography and structure, is assessed on a five-step scale in accordance with the data from table [Table 47].

Table 47 Sensitivity of the geological structure and seabed topography to impacts resulting from activities related to the Baltic East OWF implementation [source: internal materials]

SENSITIVITY	DESCRIPTION
Insignificant	No changes to the topography and structure of the seabed or changes similar to the ones observed during natural processes
Low	Changes noticeable, but not altering the nature of the topography and structure of the seabed
Moderate	Changes noticeable, modifying the nature of the topography and structure of the seabed to a degree not affecting the general nature of the area
High	Changes affecting the topography and structure of the seabed, changing its character and affecting processes taking place on the seabed; local range, limited to the project area, possible small impact on the nature of the topography of adjacent areas
Very high	Changes significantly affecting the topography and structure of the seabed in the analysed area, which may significantly affect geological and geomorphological processes of the Project area and adjacent areas

Depending on its structure, the seabed may exhibit different **sensitivity** to the Project impact during its implementation phase. A till seabed bottom and a till seabed with a stony cover are difficult to wash out and change their morphology. A sandy, sandy and silty, and silty seabed are more susceptible to scour and material displacing over it, e.g. in the form of sandy waves. Thus, elements of the OWF infrastructure may be uncovered or covered both as a result of natural processes displacing rock material along the seabed and as a result of this transport being disturbed by OWF infrastructure components.

The assessment of the scale of the identified impact, sensitivity of the receptor and assessment of the significance of the impact on the geological structure and the seabed topography, as well as the availability of raw materials and deposits during the Baltic East OWF implementation phase are included in Table [Table 48].

Table 48 *Assessment of the significance of impacts on the geological structure and seabed topography during the Baltic East OWF implementation phase [source: internal materials]*

Impact	Scale of impact	Receptor sensitivity	Impact significance
Local, point changes in the seabed structure	Low	Low	Negligible (N)
Point disturbance of the geological structure	Low	Low	Negligible (N)
Changes in the seabed topography	Low	Low	Negligible (N)
Seabed level changes due to sedimentation	Low	Low	Negligible (N)
Disturbance of the seabed as a result of vessel anchoring	Low	Low	Negligible (N)
Deposition of suspended solids	Insignificant	Insignificant	Negligible (N)

The overall impact of the Project at the implementation stage on the geological structure, seabed topography and surface sediments was assessed as negligible – the changes will be small, on a small seabed surface, spot (foundations or support structures of wind turbines and substations) or linear (within the strip along the cable route).

Because no mineral deposit and mining area [igs.pgi.gov.pl; geolog.pgi.gov.pl] were recorded within the boundaries of the Baltic East OWF and in its immediate vicinity, the impact of the Project regarding this issue during the implementation phase was not analysed.

Given the impact assessment results and possible technologies during Project implementation, it is not indicated that measures minimising the negative impact of the Baltic East OWF on the geological structure and seabed topography, as well as the availability of raw materials and deposits are necessary.

5.1.1.2 Impact on the quality of sea waters and seabed sediments

Sea water and bottom sediments as receptors that may be affected by the Project in terms of physical and chemical interactions were considered jointly.

This section identifies, characterizes and evaluates the impact of the implementation of the Baltic East OWF on the quality of sea waters and bottom sediments.

It is planned to use single-support (monopile) or jacket foundations. In the case of monopiles, the pile structure is driven or drilled into the substrate up to half its length [Górski *et al.* 2019], in this case, it is 30–60 m. In case of jacket foundations, the wind turbine is based on jack-up legs placed on driven piles. The process of embedding the structure into the substrate leads to disturbance of the seabed structure, including local disturbance of sedimentation structures and tearing off of some bottom sediments. Where clays and silts are present in the substrate, vibrations caused by the piling process may cause local liquefaction of cohesive sediments, local deformations of surface sediments as well as introduction of fine sediments (<63 µm) into the suspended solids. Construction of foundations/support structures requires seabed preparation, which may involve removal/relocation of boulders deposited in or on the seabed, both in the cable area and around the foundations. However, disturbance of the sediment during these preliminary works is small and its impact is negligible.

An example calculation of the amount of disturbed sediment for a large diameter pile with a diameter of 12 m is presented below. Assuming that piles of such diameter will be driven several dozen meters into the seabed, it can be assumed that sediments approximately 1 m deep within a radius of approximately 4.2 m around the pile will be disturbed. The sediments around the piles driven will liquefy as a result of vibrations caused by the operation of the pneumatic hammer. The volume of sediment disturbed during pile driving into the seabed was calculated using the following formula:

$$V_a = V_{tr\ cone} – V_{cyll.\ I},$$

where:

V_a – volume of the sediment layer disturbed during pile driving into the seabed,

$V_{tr\ cone}$ – volume of the truncated cone (volume of the truncated cone with 12 m bases,

$V_{cyll.\ I}$ – cylinder volume I (pile volume).

After inserting the data into the formula, the volume of sediment to be disturbed during the driving of one pile into the seabed amounts to approximately 98 m^3 of sediment per one foundation with a diameter of 12 m, and in the case of a jacket support structure with four piles with a diameter of 4 m it amounts to approximately 44 m^3. The above indicates that during the erection of 66 monopile foundations with a diameter of 12 m for 64 wind turbines and 2 offshore substations (OSS) (in the APV), approximately 6500 m^3 of bottom sediment will be disturbed. In the case of jacket support structures with four piles with a diameter of 4 m each, approximately 3000 m^3 of bottom sediment will be disturbed. All calculated volumes of disturbed sediment are theoretical and maximum values resulting from the modelling of the distribution of suspended solids included in Appendix No. 2 to the EIA Report).

If the pile foundation installation is hindered due to the presence of hard rocks in the substrate, it may be necessary to conduct drilling. Drilling may take place inside the pile or inside a casing pipe. Assuming the need to drill the entire pile volume, the volume of disturbed sediment will amount to approximately 6000 m^3 per monopile with a diameter of 12 m and a drilling depth of 50 m. If it is necessary to perform drilling in 50% of the location, this will result in a total of approximately 198 000 m^3.

During installation of the foundation, the sediment disturbed as a result of drilling will be distributed at the location of the performed works up to a height of 2 m.

The sediment will also be disturbed during cable laying. The burial of the power cable in the seabed can be performed using two basic technologies:

- SLB – simultaneous lay and burial of the cable in the bottom sediment;
- PLB – post lay burial of the cable.

In the worst-case scenario, the PLB technology and the self-propelled remotely controlled equipment for preparatory and construction works will be used, which operate in the water jetting, ploughing and mechanical cutting technologies. In the case of this technology, the volume of disturbed sediment will be higher than in the SLB technology.

During cable laying, the bottom sediment will be disturbed. The width of the seabed strip covered by the construction works for one cable line will be maximum 20 m, which corresponds to the maximum spacing of caterpillars of the equipment taking part in the construction of the cable line.

In the case of PLB, the material is extracted using a plough to the sides of the trench and is not significantly disturbed. Often, the cable is simultaneously embedded and backfilled. The trench shape is similar to a triangle with a base area equal to its width and a height equal to its depth. The sediment will be disturbed to an average depth of 3 m and width of 9 m. Thus, the maximum volume of disturbed sediment during cable laying with the ploughing technology will amount to 13.5 m^3 of sediment per 1 running metre of the cable, and at a length of 150 km in the APV, it will amount to 2 025 000 m^3 of disturbed sediment.

If the method of constructing a trench using jet nozzles (SLB) is used, a trench width of a maximum of 6 m and a depth of 3 m were assumed for simultaneous trench construction and cable burial. It is assumed that this method has the greatest potential for generating suspended solids. The volume of disturbed sediment during cable laying with the use of the ploughing technology will amount to 9 m^3 of sediment per 1 running metre of the cable, and at a length of 150 km in the APV, it will amount to 1 350 000 m^3 of disturbed sediment.

During the implementation stage, when founding and installing support structures, disturbance of the bottom sediments will be observed due to anchoring of vessels. The anchoring process itself is short-term, affects a small area (spot) to a depth of approximately 3 m, so the volume of disturbed sediment will be negligible.

It was found that actions taken during the Baltic East OWF implementation phase may cause various **types of impacts on** the discussed receptors (water and bottom sediment), these are:

- release of pollutants and biogenic compounds from sediment into water,
- contamination of water and seabed sediments with petroleum products,
- contamination of water and seabed sediments with anti-fouling agents,
- contamination of water and seabed sediments with accidentally released waste or wastewater,
- contamination of water and bottom sediments with accidentally released chemicals.

The water column and the bottom sediments constitute very important elements of the Baltic Sea water ecosystem, which is a shallow, small sea with limited water exchange through narrow and shallow Danish Straits. The surface of the sea is approximately 4 times smaller than of its catchment. Approximately 85 million people live in this area. Such conditions make each interference with the marine environment – e.g. fishery, navigation, municipal and industrial sewage discharge, surface runoff from industrialized and agricultural areas, activities related to the extraction from and management of the seabed – affect the delicate ecological balance of the sea [Uścinowicz, 2011]. Water and sediments in water reservoirs are closely connected. There is a kind of balance between the various components of the marine environment, and in particular between the water and bottom sediments. A change to one component (e.g. sediments) causes changes in the other (in water) and vice versa.

For the quality of sea waters and sediments, it was assumed that the local range of impact covers the immediate vicinity of the activity related to the proposed Project at a distance of up to 2 NM (approximately 3.7 km) from the boundaries of the proposed Project.

Most pollutants (heavy metals and toxic organic compounds with low solubility and difficult to degrade) released into the environment as a result of human activity and reaching surface waters are retained in sediments [Bojakowska, 2001]. Sediments are a place where persistent and toxic pollutants released into the environment are deposited, and also where many aquatic organisms live, feed, multiply and grow. Contaminated sediments pose high risks to the biosphere, since a part of the harmful components contained in the sediments may pass into the water as a result of chemical and biochemical processes and be accessible to living organisms [Fröstner 1980; Bourg and Loch, 1995].

- **Release of pollutants and biogenic compounds from sediments into water**

Disturbance of the bottom sediment related to the construction of support structures for the OWF facilities, anchoring of vessels and burying of the cable is a process which favors the transfer of pollutants from the sediments to the water [Uścinowicz, 2011; Bojakowska, 2001; Fröstner 1980; Bourg and Loch 1995; Dembska 2003]. During construction works, substances including labile metal forms, persistent organic pollutants (POPs), i.e. polycyclic aromatic hydrocarbons (PAHs) and PCBs, biogenic substances (nitrogen and phosphorus compounds) will pass into the water.

The identified spatial diversity of the analysed physical and chemical properties of bottom sediments does not create any limitations for the location of facilities, i.e.: support structures and internal power system.

The most important parameters affecting the **scale of impact** are: the dimensions and number of support structures, the length of cable sections and the width and depth of the cable trench, the types and amount of pollutants accumulated in the bottom sediments and the type of rock material forming the seabed.

The passage of pollutants from sediments into water (and thus a change in water quality) and the formation of long-lasting suspended matter depend on the type of sediment. The largest amount of pollutants and biogenic substances will be transferred to water from sediments with an increased organic matter content (e.g. silty, clayey sediments with a higher concentration of metals and POPs). These sediments will also contribute to the formation of an increased amount of suspended solids which will remain in the water for a long time. Intensive resuspension may cause the release of biogenic substances immobilized in the sediment and contribute to eutrophication. In case of sandy sediments with low organic matter content (e.g. coarse sandy sediments), the described processes will be less intensive. These sediments are generally characterized by a small amount of fine-grained fractions and POPs [Cefas 2011]. Therefore, it is estimated that the processes related to the release of biogenic substances and POPs will occur at low intensity within the entire Baltic East OWF area.

Processes related to the construction of support structures, anchoring of vessels, and cable burial may result in better oxygenation of sediments and, consequently, increased intensity of nitrification processes and repeated release of nitrates to waters. This may also affect the general pattern of nitrogen circulation by reducing the intensity of anaerobic denitrification processes consisting in the conversion of nitrates into molecular nitrogen [O'Neil, 1998; Trzeciak, 1995]. The amount of nitrogen that could migrate from sediment to the water column during preparatory and construction works would be negligible compared to approximately 136 000 tons of total nitrogen introduced annually into the Baltic Sea with river waters [Statistics Poland 2023].

It should be emphasized that substances released from the sediment will pass into water. However, within approximately 1 year from the end of the construction activities, these substances will move back into sediments after reaching an equilibrium.

On the basis of the above assumptions and concentrations of pollutants and biogenic substances found in the Baltic East OWF area (see Subsection.3.2.2), their release into water in the APV was estimated.

The calculations assume an average sediment volumetric density of 1.6 $g \cdot cm^{-3}$ (1600 $kg \cdot m^{-3}$) and an average sediment moisture content of 20.42 %. For the calculations, the cubic volume of sediments necessary to be removed/disturbed in order to correctly install the support structure, i.e. for a monopile with a diameter of 12 m – 98 m^3 and jackets with a maximum of four piles with a diameter of 4 m – 44 m^3 was assumed.

The estimate of the amount of heavy metals, pollutants and biogenic substances that may be released in the APV during the Baltic East OWF Project implementation is presented in tables [Table 49].

Envelope calculations were also conducted in the case of the seabed preparation prior to the installation of jack-up vessels. This will involve the replacement of surface sediment with rock aggregate bedding. Such replacement will be necessary for each of the four to six supports of the jack-up vessel, if in a given location of the wind turbine or OSS, the bearing capacity of soils will not be sufficient for the foundation of the supports on the seabed. For each leg, sediments of a volume of 14 000 m^3 will be agitated.

It was assumed that potentially approx. 25% of all wind turbine locations will require the removal (replacement) of the seabed. Below, calculations can be found which take into account the volume of sediment disturbed both for monopile foundations and substations for the APV (construction phase), including the disturbance of the seabed for the jack-up vessel [Table 51].

In the case of indicators whose concentration during the conducted environmental surveys was below the lower limit of quantification (LOQ) of the test methods used for load calculations (for reference purposes), the values of this limit were assumed (in the table marked with the sign "<"). For comparative purposes, the tables also contain the loads transported annually to the Baltic Sea with the rivers of Poland and with atmospheric precipitation [Uścinowicz 2011; Statistics Poland 2023]. The results of the State Environmental Monitoring carried out by Chief Inspectorate of Environmental Protection in 2003–2012 were also used. Estimates of remobilization of individual indicators were shown to be insignificant.

Table 49 Comparison of the weight of pollutants and biogenic substances that may be released into water during sediment disturbance, during the installation of foundations for wind turbines and OSSs in the APV (implementation phase) with the load introduced into the Baltic Sea with rivers and wet precipitation [source: internal materials]

Parameter	Unit	One 12 m diameter monopile foundation	APV (64 monopile foundations + 2 OSS foundations)	One jacket foundation 4 x 4 m diameter pile	APV (64 jacket foundations +2 OSS foundations)	Annual load brought by rivers into the Baltic Sea	Annual load brought by wet precipitation into the Baltic Sea
Volume of disturbed sediment	m^3	98	6,444	44	2,904	No data available	No data available
Weight of disturbed sediment	Mg	124	8,205	56	3,698	No data available	No data available
Dry weight of disturbed sediment	Mg	99	6,530	45	2,943	No data available	No data available
Lead (Pb)	kg	0.18	17.77	0.08	5.41	12,700	200,000
Copper (Cu)	kg	0.05	4.93	0.0	1.50	112,000	No data available
Chromium (Cr)	kg	0.06	6.09	0.03	1.85	No data available	No data available
Zinc (Zn)	kg	0.34	33.04	0.15	10.06	122,000	No data available
Nickel (Ni)	kg	0.08	7.63	0.04	2.32	84,900	No data available
Cadmium (Cd)	kg	<0.005	<0.48	<0.002	<0.15	300	7,100
Mercury (Hg)	kg	<0.001	<0.10	<0.0004	<0.03	400	3,400
Arsenic (As)	kg	<0.124	<12.08	<0.06	<3.68	No data available	No data available
Congeners representing PCBs	g	0.0001	0.01	0.00004	0.003	260,000	715,000
Analytes representing PAHs	g	0.31	30.43	0.14	1,430	No data available	No data available
Available phosphorus (P)	kg	8.3	808	3.73	9.27	6,400,000 (P tot.)	163,000,000
Nitrogen (N)	kg	<1.9	<193	<0.89	<0.08	136,000,000 (N tot.)	5,700,000

Table 50 Comparison of the weight of pollutants and biogenic substances that may be released into water during sediment disturbance, during the construction of cable lines in the APV (implementation phase) with the load introduced into the Baltic Sea with rivers and wet precipitation [source: internal materials]

Parameter	Unit	1 km of cable (burial using the jet trenching method, jetting) PLB	APV Cable route length (150 km)	1 km of cable (burial using the SLB ploughing method)	APV Cable route length (150 km)	Annual load brought by rivers into the Baltic Sea	Annual load brought by wet precipitation into the Baltic Sea
Volume of disturbed sediment	m^3	9,000	1,620,000	13,500	2,430,000	No data available	No data available
Weight of disturbed sediment	Mg	11,460	2,062,714	17,189	3,094,070	No data available	No data available
Dry weight of disturbed sediment	Mg	9,119	1,641,507	13,679	2,462,261	No data available	No data available
Lead (Pb)	kg	16.8	3,020	25.2	4,531	12,700	200,000
Copper (Cu)	kg	4.7	837	7.0	1,256	112,000	No data available
Chromium (Cr)	kg	5.7	1,034	8.6	1,551	No data available	No data available
Zinc (Zn)	kg	31	5,614	46.8	8,421	122,000	No data available
Nickel (Ni)	kg	7.2	1,297	10.8	1,945	84,900	No data available
Cadmium (Cd)	kg	<0.5	<82	<0.4	<123	300	7,100
Mercury (Hg)	kg	<0.09	<16	0.07	<24.6	400	3,400
Arsenic (As)	kg	<11.4	<2,054	<8.8	< 3,078	No data available	No data available
Congeners representing PCBs	g	0.009	1.64	<0.004	2.46	260,000	715,000
Analytes representing PAHs	g	28.7	5,171	8.1	7,756	No data available	No data available
Available phosphorus (P)	kg	762	137,230	623.2	205,845	6 400 000 kg (total P)	163,000,000

Parameter	Unit	1 km of cable (burial using the jet trenching method, jetting) PLB	APV Cable route length (150 km)	1 km of cable (burial using the SLB ploughing method)	APV Cable route length (150 km)	Annual load brought by rivers into the Baltic Sea	Annual load brought by wet precipitation into the Baltic Sea
Nitrogen (N)	kg	<182	<232,830	<141	<49,245	136 000 000 kg (total N)	5,700,000

Table 51 Comparison of the weight of pollutants and biogenic substances that may be released into the water when disturbing bottom sediments during the installation of wind turbine and OSS foundations, construction of cable lines, taking into account the disturbance of sediment during the removal of the bottom sediment in the place of installation of jack-up vessels in the APV with the load introduced into the Baltic Sea with rivers and wet precipitation [source: internal materials]

Parameter	Unit	APV (foundations of 64 wind turbines and 2 OSSs, construction of cable lines and replacement of the bottom sediment before installation of jack-up vessels)	Annual load brought by rivers into the Baltic Sea	Annual load brought by wet precipitation into the Baltic Sea
Volume of disturbed sediment	m^3	2,686,500	No data available	No data
Weight of disturbed sediment	Mg	3,420,667	No data available	No data
Dry weight of disturbed sediment	Mg	2,755,167	No data available	No data
Lead (Pb)	kg	5,009	12,700	200,000
Copper (Cu)	kg	1,388	112,000	No data
Chromium (Cr)	kg	1,715	No data available	No data
Zinc (Zn)	kg	9,310	122,000	No data
Nickel (Ni)	kg	2,151	84,900	No data
Cadmium (Cd)	kg	<136	300	7,100
Mercury (Hg)	kg	<27	400	3,400
Arsenic (As)	kg	<3,403	No data available	No data
Congeners representing PCBs	g	2.72	260,000	715,000
Analytes representing PAHs	g	8,575	No data available	No data
Available phosphorus (P)	kg	22,7573	6 400 000 (P tot.)	163,000,000
Nitrogen (N)	kg	<54,443	136 000 000 (N tot.)	5,700,000

It was assumed that all sediments removed from the construction sites of support structures during the seabed preparation and construction stage (i.e. during the implementation phase) will be left in the Baltic East OWF area.

At the same time, it should be added that the bottom sediment disturbance processes may slightly improve their quality (increase in oxygenation and decrease in the amount of pollutants and nitrogen compounds in the sediment due to their transfer to water). Better oxygenation of sediments may, in turn, reduce phosphorus transfer from the sediment to the water, as this process takes place under anaerobic (reducing) conditions [Alloway and Ayres, 1999].

The **sensitivity** of sea waters to the release of pollutants and biogenic substances was determined as moderate and of the bottom sediments as low.

Release of pollutants and biogenic substances from the bottom sediments during the construction phase is a direct, short-term, negative impact of local range.

The **significance** of this **impact** during the implementation phase in the APV was assessed to be of low importance for sea waters and negligible for bottom sediments.

- **Pollution of water and bottom sediments with oil derivatives during normal operation of vessels during construction and during their failure or collision**

The presence of numerous construction vessels within and around the Baltic East OWF construction area poses a risk of pollution as a result of leakages or accidental spills of lubricants, diesel oils and gasoline carried on board those vessels that get into the water and deposit on the seabed. No more than 3 vessels are expected to operate simultaneously during the implementation phase. The total offshore construction and installation period for wind turbines, OSSs and cables can take up to two years. Any situation in which there is a vessel present within the Project implementation area involves a certain risk of accidental release of liquids and harmful substances into the environment. This risk involves the possibility of the quality of sea waters and bottom sediments deteriorating.

Pollutants entering water during normal operation of vessels form the second largest source of oil pollution of seas. This source comprises approximately 33% of oil entering the environment – mainly due to the increased vessel traffic in the Baltic Sea area [Kaptur, 1999]. In comparison, approximately 37% of oil entering the sea flows with rivers from land, and tanker disasters only rank third (12%).

During the implementation phase, vessels (ships, barges, etc.) will be used, from which small leaks of petroleum products (lubricating oil, fuel oil, petrol, etc.) into water may occur during normal operation. They may contribute to a minor extent to the deterioration of water quality.

If there is an accidental leakage, it is expected to be very small, up to 2 m^3. Therefore, it is assumed that there will be no pollution of sea waters and seabed within an area of more than 2 ha [Fabisiak, 2008], and thus this leakage will not meet the criteria for serious failures (Regulation of the Minister of the Environment of December 30, 2002 on major incidents, which should be notified to the Chief Inspector of Environmental Protection, consolidated text: Journal of Laws of 2021, item 1555).

In the worst-case scenario, it should be assumed that these will be small (class I) spills, up to 20 m^3. Visible traces of such pollutants in favorable conditions may disappear spontaneously as a result of evaporation and dispersion in water. The size of these spills will be virtually limited to the Baltic East OWF area.

The **sensitivity** of sea waters and bottom sediments to small leakages of petroleum products occurring during the normal operation of vessels was assessed as insignificant.

Contamination of sea waters or seabed sediments with petroleum products released during normal operation of vessels constitute a direct, negative impact of local range, temporary or short-term.

The significance of this impact during the implementation phase in the APV was assessed as negligible for sea waters and seabed sediments.

Leakage of oil derivatives which will pollute water and bottom sediments may also occur in emergencies (as a result of a failure or a collision of vessels, a construction disaster of one of the Baltic East OWF facilities, as well as during maintenance works). Such events may contribute to the deterioration of water quality – even coastal waters if the spill reaches the shore. In the event of a collision of vessels, a 3rd degree spill, i.e. one above 50 m^3 and up to approximately 200 m^3, can be expected.

A visible effect of an oil spill is an oil slick which, under the influence of gravity and surface tension, spreads at a speed depending on the type of oil and ambient conditions. The influence of factors such as oil volume, density, viscosity, temperature, wind speed and time determine the size of the spill. The estimated speed of oil slick movement in large water regions is approximately 2–3% of wind speed. It was found that a spill of 1.6 t (1.8 m^3) of oil spreading over the surface of 1 km^2 during one day causes a film 2 µm thick and dark in color to form. On the other hand, 40 kg of oil causes the spillage on the surface of 1 km^2 with a film thickness of 0.05 µm [Gutteter-Grudziński, 2012].

Oil film formed on the water surface may cause:

- impeded exchange of gases, especially of oxygen, between water and the atmosphere;
- a 5–10% decrease in light intensity under the water surface (mainly due to the presence of heavy fractions of oil and sulfur) limiting photosynthesis;

- an increase in the temperature of water during the day as a result of light absorption by the oil layer.

While an oil slick is spreading, other degradation processes are progressing leading to the lowering of the concentration of hydrocarbons on the water surface (e.g. the release of low molecular weight hydrocarbons). Heavier oil fractions may undergo sorption on the surface of organic and mineral suspensions, which may increase their specific gravity and gradually make them sink to the bottom. Thus, heavier oil fractions may be bound by the bottom sediments, contaminating them. The susceptibility of bottom sediments to contamination depends on the grain size of the sediment and its packing. Loose sandy sediments are more susceptible to pollution absorption. Compact loamy sediments inhibit the penetration of pollutants into the sediment. However, due to the type of sediments in the Baltic East OWF area (small amount of organic matter and low content of fine fractions), oil spills will not cause a noticeable deterioration of the sediment quality.

The probability of a failure or a collision of vessels in the Baltic Sea is low. Approximately 2000 vessels sail the Baltic Sea every day (including 200 tankers transporting oil and other liquids), and the number of collisions and failures in recent years has remained roughly constant (with a slight increase), i.e. approximately 120–190 sea accidents every year. The majority of accidents in the Baltic Sea cause no pollution. The number of accidents with pollution spilling into water is up to 21 per year. Even one large-scale accident can seriously endanger the marine environment. In 2017, 139 vessel accidents occurred in the Baltic Sea area, 21 of which resulted in pollution. None of the accidents that resulted in water pollution and required clean up occurred in the Polish Exclusive Economic Zone [HELCOM 2018]. In 2017, there occurred 8 confirmed oil spills less than 1 m^3 in volume, one with a volume in the range of 1–10 m^3 and one larger accident with a volume of 200 m^3 [*ibidem*].

For the area of the south-eastern Baltic Sea where the analysed Baltic East OWF area lies, the risk of a collision with a spill of over 5,000 tons was estimated to be 1 in 1,060 years, whereas the areas under the greatest threat are around the Wolin and Rüggen Islands and the Hel Peninsula [www.brisk.helcom.fi].

During the implementation phase, vessels sail at low speeds, and then the risk of damage to the fuel tank is very low. A vessel generally holds fuel in several tanks, which reduces the risk of a major leak in the case of a collision. Vessels used in the construction works of the Baltic East OWF may have fuel tanks with the total capacity of approximately 5000 m^3 (cable-laying vessels). Assuming a failure or a collision of the largest vessels used in the Baltic East OWF implementation phase (during inspections, maintenance and emergency repairs) and the destruction of the largest tanks of one vessel, no more than 200 m^3 of fuel oil, 15 m^3 of machine oil and approximately 2.5 m^3 of hydraulic oil may escape from one vessel (in the worst-case scenario) [Veldhuizen *et al.* 2014].

In the event of a construction disaster at the OWF (a wind turbine falling over or a vessel colliding with the wind turbine or a substation), a leak of fuel oil (up to 100 m^3), machine oil (up to 15 m^3), hydraulic oil (up to 2.2 m^3) or transformer oil (up to 80 m^3) may occur.

However, the probability of a collision or construction disaster is low. The most important parameters affecting the **scale of impact** are: type and amount of released petroleum products, weather conditions and the type of rock material forming the seabed.

The **sensitivity** of both receptors may be high in case of emergency or collision situations.

Moreover, for the Baltic East OWF, a plan for combating hazards and pollution will be developed for the offshore wind farm and a set of equipment approved by the Director of Maritime Office competent for the location of the offshore wind farm. This plan shall specify the potential area under threat for various failure and disaster scenarios, as well as determine the methods of preventing and eliminating oil spills.

The pollution of water or bottom sediments with petroleum products released during an emergency forms a direct negative impact of regional range.

The **significance** of this **impact** during the implementation phase in the APV due to the random and sporadic nature of failures and collisions was assessed to have low significance for sea waters and bottom sediments.

- **Accidental pollution of water and bottom sediments with anti-fouling agents containing organic tin compounds (e.g. TBT)**

Hulls of vessels are protected against fouling with biocides, which may contain e.g. copper, mercury and organotin compounds (e.g. TBT). These substances may pass into the water and eventually be kept in the sediment. It should be assumed that releases of those compounds will be limited by their dilution in the water. Of the substances listed, organotin compounds are the most harmful (toxic) to aquatic organisms. The use of TBT (the most harmful substance) in anti-fouling paints is now prohibited, but the presence of those compounds in older vessels cannot be ruled out. The **sensitivity** of sea waters and bottom sediments to biocidal substances released from hulls was assessed as moderate.

Vessels (ships, barges, etc.) will be used in the Project implementation phase and their hulls may release certain amounts of anti-fouling substances into the water during normal operation. They can then contaminate sediments. To avoid this, it is recommended, in each implementation phase, to use vessels whose hulls have not been coated with anti-fouling paint containing TBT. This will eliminate this most harmful impact on aquatic organisms.

The most important parameters affecting the **scale** of **impact** are: type and amount of anti-fouling substances released, type of rock material forming the seabed.

Pollution of water and/or bottom sediments with anti-fouling substances during the implementation phase is a direct, short-term negative impact of local or regional range.

The **significance** of this **impact** during the implementation phase in the APV was assessed as low for sea waters and bottom sediments.

- **Contamination of water and seabed sediments by an accidental release of nutrients together with waste or (raw) wastewater**

Waste as well as sewage not directly related to the Project implementation will be generated on vessels and in the ports handling the Project implementation. The presence of numerous vessels used for the construction of offshore wind farms poses a risk of sewage leaks and accidental discharge of waste generated and transported on board these vessels. Waste may be released into the water column and part of the material and particles will fall and be deposited on the seabed, contaminating sediments. It is expected that at the implementation stage several vessels may be present at the same time within the construction area. The total offshore construction period for wind turbines, OSSs and cables can take two years. Each vessel presence within the Project implementation area involves a certain risk of accidental release of waste and sewage to the environment, e.g. during collection from vessels by another vessel and in the event of a failure, causing a local increase in the concentration of biogenic substances and deterioration in the quality of water and sediments, resulting in potential facilitation of the eutrophication process. An increase in the concentration of nutrients in sea waters and sediments may lead to excessive concentrations of macronutrients in the surveyed area, such as nitrogen and phosphorus. The nutrient load may potentially cause increased growth of algae, increased eutrophication phenomena, and reduced oxygen level in water, with the possibility of creating anaerobic zones in the water depth, leading in particular to deterioration of the quality of sea waters.

However, the pollutants should be dispersed quickly, and thus would not contribute to a permanent deterioration of the environment in the Project area.

The most important parameters affecting the **scale of this impact** are: type and quantity of released waste or sewage, weather conditions and type of rock material forming the seabed.

The **sensitivity** of sea waters and bottom sediments to this type of impact is assessed as negligible.

Pollution of water and/or bottom sediments with waste or sewage is a direct, temporary, negative impact of local range.

The significance of this impact during the implementation phase in the APV was assessed as negligible for sea waters and seabed sediments.

- **Contamination of water and seabed sediments with accidentally released chemicals**

During the OWF implementation, waste directly related to the OWF implementation process will be generated on vessels, in ports handling the implementation of the Project and at the Project implementation site. These may include, among others, damaged parts of OWF components, cement, joint grouts, mortars, machine fluids and other chemical substances used or replaced during construction works. They may be accidentally released into the sea.

The waste is mainly generated during the implementation and decommissioning phases (most often from group 17 of the Annex to the Regulation of the Minister of Climate of January 2, 2020 on the waste catalog (Journal of Laws of 2020, item 10)). Waste produced during the implementation phase will include e.g. cable scrap, flammable waste, oil and chemical waste, as well as construction waste. Waste should be neutralized in accordance with the applicable regulations concerning industrial waste.

The most important parameters affecting the **scale of impact** are: type and amount of chemicals released, weather conditions and the type of rock material forming the seabed.

Loose cement, grouts, mortars and other binders often contain hazardous substances. For example, epoxy (two-component) binders contain various proportions of: epoxy resin, alkyl-glycidyl ethers and polyaminoamides. When released into water, these substances sink and deposit on the seabed due to their high density (approximately 1.3 g cm^{-1}). They are considered a serious hazard because they cannot be easily removed from the seabed and are toxic to marine organisms.

For the Baltic East OWF, a plan for combating hazards and pollution will be prepared for the offshore wind farm and the set of equipment generated during the implementation, operation and decommissioning of the OWF, which will specify mitigation measures and the procedure in case of such events.

The **sensitivity** of both receptors in case of contamination of water and bottom sediments with accidentally released chemicals is moderate.

Sensitivity, i.e. the response of the receptor, which is the quality of sea waters and bottom sediments, is described in a five-stage scale in accordance with the data presented in table [Table 52].

Table 52 Sensitivity of sea waters and bottom sediments to a change in their quality resulting from activities during the Baltic East OWF implementation [source: internal materials]

SENSITIVITY	DESCRIPTION
Insignificant	No noticeable impact on the receptor resulting from the project implementation
Low	Insignificant impact, in practice no measurable (noticeable) effects on the receptor resulting from the project implementation, natural and quick return to the initial condition
Moderate	Noticeable impact, causing measurable effects on the receptor resulting from the project implementation, possible return to the initial condition
High	Significant impact causing a fundamental change of the receptor resulting from the project implementation, full return to the initial condition not possible
Very high	Severe impact, resulting in exhaustion of receptor absorptivity, adaptation or return to the initial condition not possible

Pollution of water and/or bottom sediments related to the Baltic East OWF implementation is a direct, negative impact of local range, short-term or temporary, non-reversible, repeatable during the construction period, and of low intensity.

The impact significance resulting from accidental release of chemicals during the implementation phase in the APV was determined as negligible for the quality of sea waters and as insignificant for bottom sediments.

The characteristics of the impacts identified, their scale and the assessment of the impact significance on the quality of waters and bottom sediments during the Baltic East OWF implementation phase are presented in tables [Table 53, Table 54].

Table 53 Impacts on the quality of waters and bottom sediments during the Baltic East OWF implementation phase [source: internal materials]

IMPACTS	Type of impact			Spatial range			Duration					Type	
	Direct	Indirect	Secondary	Transboundary	Regional	Local	Long-term	Medium-term	Short-term	Temporary	Permanent	Positive	Negative
Release of pollutants and biogenic substances from sediments into water – for water	x				x				x				X
Release of pollutants and biogenic substances from sediments into water	x				x				x			x	
Contamination of water and seabed sediments with petroleum products during normal operation of vessels	x					X			x				x

IMPACTS	Type of impact			Spatial range			Duration					Type	
	Direct	Indirect	Secondary	Transboundary	Regional	Local	Long-term	Medium-term	Short-term	Temporary	Permanent	Positive	Negative
Contamination of water and seabed sediments with petroleum products in the case of emergency situations and collisions	x				x			x					x
Contamination of water and seabed sediments with anti-fouling agents	x					X			x				x
Contamination of water and seabed sediments by an accidental release of nutrients together with waste or (raw) wastewater	x					X				x			x
Contamination of water and seabed sediments with accidentally released chemicals	x					X				x			x

Table 54 Assessment of the significance of impacts on the quality of waters and bottom sediments during the Baltic East OWF implementation phase [source: internal materials]

Impact	Scale of impact	Receptor sensitivity	Impact significance
Release of pollutants and biogenic substances from sediments into water – for water	Moderate	Moderate	Low (N)
Release of pollutants and biogenic substances from sediments into water	Low	Low	Negligible (P)
Contamination of water and seabed sediments with petroleum products (during normal operation of vessels)	Low	Insignificant	Negligible (N)
Contamination of water and seabed sediments with petroleum products (emergency situations and collisions)	High	Moderate	Moderate (N)
Contamination of water and seabed sediments with anti-fouling agents	Moderate	Moderate	Low (N)
Contamination of water and seabed sediments by an accidental release of nutrients together with waste or (raw) wastewater	Low	Insignificant	Negligible (N)
Contamination of water and seabed sediments with accidentally released chemicals	Low	Moderate	Low (N)

Impact significance on the quality of sea waters and bottom sediments is negligible or insignificant. Only in case of emergency situations or collisions, the oil spill may become an impact of moderate significance.

Given the results of the impact assessment, the limited area of the Project and the possible technologies of its implementation, there is no indication that it is necessary to apply measures minimising the negative impact of the Baltic East OWF on the quality of sea waters and bottom sediments.

5.1.1.3 Impact on ambient air quality, including climate and greenhouse gas emissions

As part of the Project **impact identification**, the current meteorological parameters obtained from the series of measurements taken at sea at the location of the planned farm were determined, respectively, for: wind, pressure, humidity and air temperature. Moreover, the available information from air quality measurements in the coastal zone closest to the proposed Project as well as general climatic conditions for the southern Baltic Sea were taken into account.

During the Baltic East OWF implementation phase, an increased load of pollutants introduced into the atmosphere should be expected, mainly from flue gas emissions from vessels, systems, or equipment, including dust and greenhouse gases. This will be related to significantly increased traffic of vessels involved in the Project implementation. As of the date of the EIA Report submission, it is not possible to calculate the planned fuel consumption, as the number and type of specialized vessels as well as the duration of their use will be determined only in the detailed design. Therefore, it is currently not possible to assess the actual emission of pollutants into the atmospheric air at all stages of the Baltic East OWF life.

All vessels participating in the entire project shall meet the requirements and comply with the regulations resulting from the provisions of the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78), including in particular the procedures included in the "Plans for Combating hazards and pollution" prepared in accordance with the Regulation of the Minister of Infrastructure of December 15, 2021 *on the rescue plan and the plan for combating hazards and pollution for an offshore wind farm and a set of equipment* (Journal of Laws, item 2391).

It should also be taken into account that in the light of the latest findings [e.g. Mello 2020], the largest proportion of CO_2 emissions concerning OWFs is generated in connection with the production of wind turbine components (approx. 90% of total emissions), and then with transport and offshore construction – approx. 5.6%, and only approx. 3.5% is generated during the farm operation. In conclusion, most emissions will not be directly related to the marine environment.

According to the findings of the GP WIND project [2012], electricity yield from Offshore Wind Energy involves emission of 6 to 34 kg of CO_2 per 1 MWh in all phases of the OWF life. The higher of the quoted values refers to the case when a gravity-base foundation with the high proportion of cement was used. Taking into account the assumed total capacity of the Baltic East OWF – 966 MW, this results in annual energy yield of 8.46 TWh (which is the maximum value assuming that the full installed capacity of the turbine will be used – this is usually not the case due to wind conditions, operating conditions, etc., moreover, it refers to the implementation period). Therefore, taking into account the above-mentioned CO_2 emissions per 1 MWh, it is possible to estimate the maximum expected annual emissions within the range of 50.8–287.7 mln Mg CO_2. In the light of more recent findings, these figures appear to be overestimated. For example, Xie [2020] assumes the OWF CO_2 emissions at a level of 3.9 kg per 1 Mwh of power for the entire OWF operation cycle, which, when converted to the conditions of the Baltic East OWF, gives the emission value amounting to 33 mln Mg of CO_2. The quoted values should be considered the baseline, as they will be lower in operational practice.

It should also be taken into account that the impact on air quality during the proposed Project implementation phase will **be direct, negative, local and will disappear quickly after the works cease**, as in an open maritime area without terrain obstacles, the concentration of pollutants will quickly decrease (dilution). Therefore, the significance of this impact will be negligible.

The scale of impact of the Baltic East OWF on meteorological conditions, climate and air quality is described in a five-stage scale according to the data included in table [Table 55].

Table 55 Scale of impact of the Baltic East OWF on meteorological conditions, climate and air quality [source: internal materials]

SCALE OF IMPACT	DESCRIPTION
Insignificant	No noticeable changes
Low	Changes are limited only to the nearest vicinity of wind turbines and substations
Moderate	Changes with a range greater than the closest vicinity of wind turbines and substations, but covering less than half of the OWF area
High	Changes cover more than half of the OWF area
Very high	The changes cover the entire OWF area and/or more

The significance of impact of the Baltic East OWF implementation phase on meteorological conditions, climate, and air quality in the Baltic East OWF area is presented in table [Table 56].

Table 56 Assessment of the significance of impacts on the quality of atmospheric air, including on the climate and emission of greenhouse gases during the Baltic East OWF implementation phase [source: internal materials]

Impact	Scale of impact	Receptor sensitivity	Impact significance
Impact on meteorological (weather) conditions	Insignificant	Low	Negligible (N)
Impact on climatic conditions	Insignificant	Insignificant	Negligible (P/N)
Impact on air quality (air emissions)	Low	Low	Negligible (N)

It can be assumed that during the implementation phase, the significance of impact of the proposed Project resulting from greenhouse gas emissions will be negligible, as no significant presence of factors that could have a noticeable impact on their increased generation is expected.

5.1.1.4 Impact on systems using EMF

Prior to obtaining the building permit, the Applicant shall prepare expert opinions on the impact of the Baltic East OWF on systems using EMF (see Section 2.7.6). If the expert opinions identify the possibility of impacts on systems using EMF during the Project implementation phase, the Applicant shall implement appropriate actions or install appropriate devices to mitigate such impact.

The key **activities** during the Project implementation phase that may have an impact on systems using EMF include:

- at the stage of the Project preparation: traffic of large vessels operating in the sea basin or new structures,
- in the Project construction phase:
  - traffic of large vessels in the sea basin,
  - transport of large structures for the construction of foundations, wind turbines, substations,
  - facilities within the OWF area completed and not yet handed over for operation.

Impacts may consist in creating obstacles or barriers to the transmission of communication signals. These may be direct and cumulative impacts with other obstructions present in the sea basin. The impact range may be regional as the communication equipment is located outside the Baltic East OWF area, these may be short-term or long-term impacts, both temporary as well as permanent ones. The nature of the impact will be negative.

The **sensitivity** of communication systems to potential impacts during the Project implementation phase can be assessed as very high.

Due to the need to ensure uninterrupted communication of the operating systems of various operators, the **scale of impact** should be considered very large.

Impact significance in accordance with the adopted methodology of the EIA Report preparation will be significant. It is assumed that in accordance with the applicable legal requirements, possible impacts will be identified and the Applicant will apply the measures indicated in the expert opinions and arrangements with administrative authorities aimed at avoiding, preventing, mitigating or compensating possible negative impacts on systems using EMF.

The scope of the assessment of the OWF impact on defense systems, including determination of methods and means of compensation for the negative impact of the OWF and the set of equipment on these systems, shall be developed in detail by the Investor in accordance with the requirements of the Regulation of the Minister of National Defense of October 10, 2022 *on the detailed scope of technical expert opinions in the scope of assessing the impact of the offshore wind farm and the set of power output equipment on national defense systems and on the system of state border protection at sea (*Journal of Laws of 2022, item 2115).

To sum up, the table below defines the significance of the impact on systems using EMF using mitigation or compensatory measures indicated in the required expert opinions and arrangements with administrative authorities [Table 57].

Table 57 Assessment of the significance of the impact on systems using EMF at the Baltic East OWF implementation stage using mitigation or compensatory measures [source: internal materials]

IMPACT	SCALE OF IMPACT	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
Obstacles or barriers to the transmission of communication signals	Insignificant	Very high	Low (N)

As a result of the analysis conducted, the Project impact on the systems using EMF at the Project implementation phase was determined to be of low **importance**, provided that mitigation or compensatory measures are applied if they result from the prepared expert opinions or arrangements with competent administrative authorities.

5.1.1.5 Impact on cultural values, monuments and archaeological sites and facilities

The assessment of the impact of the Baltic East OWF implementation phase was carried out using the results of the investigation in the scope of cultural goods both found in literature and from the conducted geological and geophysical surveys of the seabed included in **Appendix No. 1** to the EIA Report, as well as the scope of the proposed Project.

Among the **factors** affecting cultural heritage facilities, the following can be distinguished:

- location of archaeological facilities in relation to the installed OWF components and cable routes;
- type of material forming the top layer of sediments;

- type of rock material forming the seabed;
- intensity of vessel traffic and travel routes;
- dimensions and number of foundations and length of cables to be laid;
- type and amount of released waste, chemicals or petroleum products;
- weather conditions.

What will be most exposed to negative impact are the facilities discovered during geophysical surveys (wrecks with ID: SSS-033 and SSS-049). The discovered wrecks are located at a distance of 67 m and 113 m east of the Baltic East OWF boundary.

The Applicant assumes that the activity related to the disturbance of the seabed (systems, anchoring, foundations) will be limited at a distance specified in the Permit for erection and use of artificial islands, structures and devices for the Baltic East OWF, i.e. up to 25 m from the reported wrecks.

During the preparation for the Project implementation and engineering, previously identified facilities of potential cultural importance will be taken into account, and an archaeological inventory survey will be carried out in accordance with the requirements of the Permit for erection and use of artificial islands, structures and devices. All activities of the Applicant shall be carried out in accordance with the collected data and in agreement with the Pomorskie Voivodship Heritage Conservation Officer, and further handling of monuments shall be carried out in accordance with the conservation requirements.

The probability of remnants from former periods occurring in the area of the proposed Project was taken into account. The implementation of the Baltic East OWF – both preparatory and construction works – may cause the following **types of impacts** on facilities unrecognized so far, which may be discovered and identified during the performance of works and which may be important for the protection of cultural heritage:

- uncovering potential monuments or archaeological relics, including a positive impact consisting in the discovery of new facilities,
- damage to or complete destruction of potential monuments or archaeological relics in connection with the implementation of the Project:
    - by accelerating erosion processes of uncovered facilities,
- by vessel anchors or other structures stabilizing vessels (e.g. jack-up),
    - during preparation of the seabed for the Project implementation and reinforcement of the seabed around the structures constructed,
    - when installing pile foundations to support the elements of the Project,

- during trench preparation and cable laying,
- as a result of soil subsidence,
- as a result of the previously agitated sediment settling on the seabed.

During preparatory and construction works (related to piling, installation of foundations and cables on the seabed) – new archaeological facilities, unidentified sites, facilities or archaeological artifacts may be discovered. The discovery of cultural heritage facilities is both positive due to the identification of new facilities of archaeological value and negative – due to their uncovering they may be damaged.

In accordance with the precautionary principle, the Applicant carried out environmental surveys, including identification of facilities on the seabed, for the purposes of this EIA Report (geological, geophysical) and is also obliged in the Permit for erection and use of artificial islands, structures and devices to carry out an archaeological inventory survey and to report to the competent authorities all identified facilities of cultural value, as well as to protect them until appropriate consents are obtained as to further procedure. Taking into account the above, the impact of the Baltic East OWF implementation on cultural values, monuments, and archaeological sites and facilities is local, short-term, direct, and the significance of the impact was determined to be negligible.

5.1.1.6 Impact on the use and management of the sea basin and tangible property

The Baltic East OWF implementation will cause impacts on the use and development of the sea basin (sea transport and navigation, fishery, aviation, defense and other development) and on tangible assets:

Activities at the Project preparation and construction stages include:

- traffic of large vessels navigating the sea basin,
- exclusion of the sea basin area from navigation, fishery, research and tourist cruises,
- limitation of the presence of vessels to only those related to the Project implementation,
- new structures being built within the sea basin.

The **impacts** expected during the implementation of the Baltic East OWF include:

- change of the sea basin development;
- hindrance to sea transport (navigation);
- changes in the organization and availability of flight routes for aircraft and other low-altitude facilities;
- hindrance and restrictions on fishery, as well as the need to extend routes to fishery grounds (Section 5.1.1.8);

The above impacts may be direct and cumulated with other projects implemented within the sea basin or in its area.

Navigation

The Project implementation will affect navigation safety by causing new hazards related to the construction and operation of the Baltic East OWF.

Each phase of the Project will involve the traffic of additional vessels and the presence of vessels with limited maneuverability and certain restrictions in the navigation of other vessels related, e.g., to the designation of safety zones, speed limitation, prohibition of anchoring and underwater works.

The hazards will be mainly related to the construction stage, i.e. installation of foundations, structures of wind turbines and substations and laying of inner array cables. The hazard analysis for other projects of this type shows that the probability of events, provided that appropriate risk reduction measures are taken, is rare.

Unlike the hazards associated with the connection infrastructure, for which the risk of events is extremely rare during the operation phase, for the Baltic East OWF, part of the hazards will remain permanently during the operation phase, throughout its lifetime. This is due to the fact that the wind farm structures will become significant navigation obstacles affecting navigation conditions and safety.

Hazard identification, risk assessment related to these hazards and possible necessity to apply preventive measures shall be the subject of further preparatory works, in particular a navigation expert opinion.

The expert assessment will be a follow-up to the survey works, which means that experts receive information on:

- technical data defining the scope of the project;
- vessel traffic intensity analysis;
- statistical data on maritime accidents;
- data on weather and hydrological conditions;
- results of desk study concerning the impact of the offshore wind farm on communication, navigation radars;
- results of model tests related to probability and effects of navigation events; mainly collision and contact.

The main hazards related to the Project implementation are collisions and contact.

Collision – a crash of vessels or a vessel hit by another vessel, regardless of whether it is en route, anchored or moored, but excluding a collision with an underwater wreck. With regard to collisions, the following scenarios should be considered:

a) Collision of a merchant vessel en route with another vessel – in the vicinity of the Project;

b) Collision of a fishing vessel with another vessel within the area or in the vicinity of the Project;

c) The presence of a fishing vessel results in the collision of two other vessels;

d) The presence of a pleasure craft results in the collision of two other vessels;

e) Collision of the vessel with an anchored vessel located in the vicinity or within the Project area;

f) The presence of an anchored vessel results in the collision of two other vessels;

g) The presence of a vessel performing installation works or service works results in the collision of two other vessels;

h) Collision of two vessels performing installation works or service works;

i) Collision of a vessel sailing by with two operationally connected vessels performing installation works within the area or surroundings of the Project;

j) The presence of operationally connected installation vessels results in the collision of other vessels;

Contact (allision) – sudden contact between a vessel and a permanent structure/a vessel hitting an external object or an external object, neither a vessel nor the seabed, hitting a vessel. Likely scenarios:

a) Vessel (by type and class including small single-person craft) en route comes into contact with a permanently fixed structure;

b) Installation vessel or service vessel comes into contact with the OWF structure;

c) A vessel without control over its movements (drifting) comes into contact with a vessel or a group of vessels of reduced maneuverability;

d) Failure of an installation vessel stabilization system causes its drift, contact with the OWF structure or tipping over;

e) Failure of the lifting equipment on the installation vessel results in the fall of a structural component of the OWF – damage to the vessel or an accompanying vessel located in the vicinity;

f) Failure of the OWF structure causes its components to fall onto the deck of a vessel.

The most important factor with respect to the location of hazards and the degree of impact on navigation, will be the reanalysis of navigation resulting from new conditions of maritime spatial planning. Construction of offshore wind farms planned at stage I will result in changes in the organization of vessel traffic.

The expected vessel traffic related to the construction of wind farms is described using a navigation model assuming that vessels engaged in regular navigation will avoid appropriately marked hazardous areas. An example of such a model is presented on the map below [Figure 66].

In the presented model, the route of some of the navigation routes marked in red will have to be changed. Changes (marked in green) may consist in removal of the route and relocation of traffic to neighboring routes or change of their route allowing to avoid navigation obstacles.

It should be noted that the new routes largely corresponds to the rules resulting from the PZPPOM.

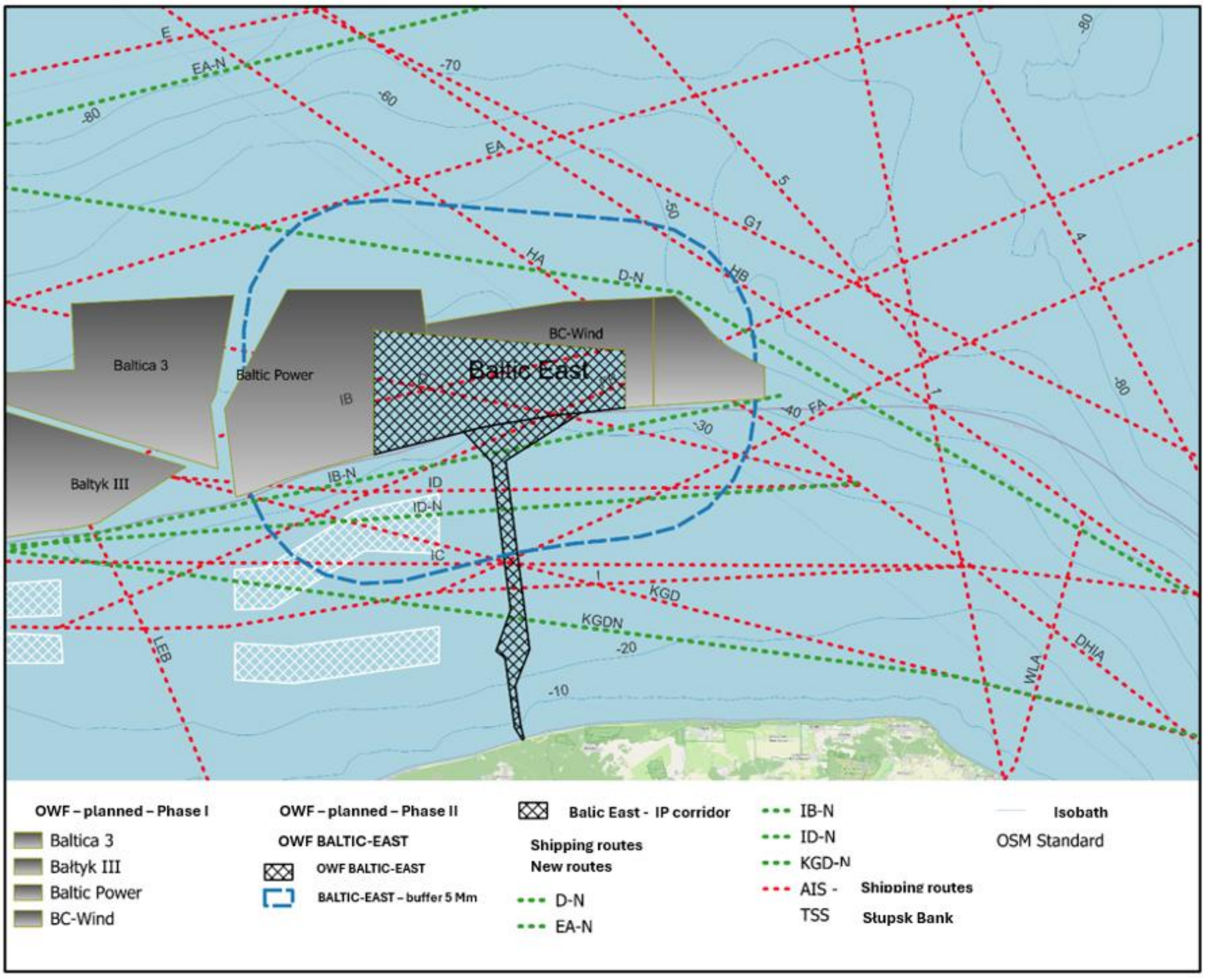

Figure 66 Vessel traffic model in the vicinity of offshore wind energy projects [Source: internal materials]

During the implementation phase of the Baltic East OWF, this area will be gradually excluded from navigation, fishing, research and tourist cruises due to safety reasons. Only the presence of vessels related to the project implementation will be allowed. The construction of the Baltic East OWF will not interfere with the use of Polish Navy military training grounds. The elements of cultural heritage identified during the research should be protected by establishing zones excluded from construction works at a distance of at least 25 m. Increased traffic of vessels serving the construction of the OWF may mean difficulties in the vessel traffic on the route located south of the OWF. The spatial range of impacts will be local, and the duration of the impact will be short-term at the preparation stage and medium-term at the construction stage. The impacts will be temporary and permanent. The nature of impacts will be negative.

Fishery is potentially the most vulnerable **receptor**. However, considering that the Baltic East OWF area has been used little so far for fishing activity and that it is not a leading function of the sea basin, fishery may be carried out in other sea basins. It should be assumed that the impact significance of the Baltic East OWF on fishery will be insignificant.

Sensitivity of receptors to possible impacts is high.

The **assessment of the scale** of the impact identified and the assessment of the significance of impact on the use and development of the sea basin and tangible assets during the operation phase of the Baltic East OWF is included in table [Table 58].

Table 58 Assessment of the significance of impacts on the use and development of the sea basin and tangible assets during the Baltic East OWF implementation phase [source: internal materials]

IMPACT	SCALE OF IMPACT	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
Change in the sea basin development by the introduction of the OWF development	Low	Moderate	Low (N)
Hindrance to sea transport (navigation)	Low	High	Low (N)
Changes in the organization and availability of flight routes for aircraft and other low-altitude facilities	Low	High	Low (N)
Hindrance and restrictions on fishery and the need to extend routes to fishery grounds;	Low	High	Low (N)

As a result of the analysis conducted, the impact **significance** of the Project on the use and development of the sea basin and tangible property during the implementation phase was determined to be insignificant.

In the case of sea transport and aviation, the Project implementation will require, in accordance with the Permit for erection and use of artificial islands, structures and devices, the preparation of expert opinions and obtaining approvals of competent administrative authorities.

5.1.1.7 Impact on landscape, including the cultural landscape

During the Baltic East OWF implementation phase the following expected Project **impacts** on the landscape, including the cultural landscape, were identified:

- change of the landscape perceived from land and sea from natural to industrial – subsequent offshore structures of wind turbines and substations,
- illumination of the Project implementation area;
- traffic of vessels, mainly the vessels of contractors of construction works, as well as surveys, supervision and other works;
- traffic of vessels related to transport of the OWF structural components, including large-size ones.
- The impact of the OWF on the landscape during the implementation phase depends on:
- intensity of vessel traffic related to the construction and the size of the structures transported;
- the size of the structure, diameter of the rotor and its position in relation to the viewer;
- number and location of the OWF and substations;

- meteorological conditions and the sea state;
- the location where the landscape observer is located and individual visual perception characteristics of the observer,
- the observer's perception of landscape changes (aesthetic preferences).

The impact on the landscape will be subjective, depending on the individual characteristics of the perceiver – changes may be perceived as both negative, positive or neutral.

The OWF implementation will be best visible to persons who are directly temporarily present at sea in the vicinity of the implementation area (i.e. employees of the OWF construction vessels, employees on vessels, passengers of tourist ferries and deep-sea fishermen and anglers, tourists on recreational vessels, participants in search and rescue operations, flying above the sea in aircraft, scientists and others). The impacts on the landscape for these groups will be short-term or temporary, local.

Within the range of the Baltic East OWF potential landscape impact zone, there is an onshore area along the section from Ustka to Władysławowo to the east; the visualization of the view from two lookout points on the beach is presented in **Appendix No. 5** to the EIA Report. Due to the diversified topography of the coastal zone, the Baltic East OWF may be visible from the beaches along this section, whereas at a distance from the beaches, the view of the OWF and the sea is obscured by landforms: dune banks or high cliff banks overgrown with forest.

Along the land section discussed, under special meteorological conditions (of very good visibility), the Baltic East OWF will be potentially visible from the lookout points located higher: Czołpino lighthouse, dunes in the Słowiński National Park, Stilo lighthouse and the towns of Ustka, Rowy, Łeba and Jastrzębia Góra. The visibility of vessels related to the implementation and structures from the beach will be very limited due to the long distance of the Baltic East OWF area from the shore. For onshore observers, the scale of impact will be much smaller than for offshore observers traveling in the immediate vicinity of the OWF.

Landscape perception may also change as a result of changes in the physical condition of the atmosphere and daytime (day/night). The impact will vary mainly depending on the weather conditions and distance of the observer from the OWF and the characteristics of the observer (eye sight condition and aesthetic preferences). In the open sea, the landscape is not resistant to disturbance; from a short distance, very few people and for a short period of time will be exposed to landscape change. However, due to the size of the structure, the Baltic East OWF will be visible from a distance of several dozen kilometres – from the beaches it will be visible to a much lesser extent, along the section from Ustka to Hel, it will also be visible from higher and unshielded places onshore.

The spatial range of the impact will decrease with the distance of the observer from the OWF, and it will increase as the altitude of the lookout point increases. At night, the landscape seen from land towards the sea, during the implementation of the OWF, will be changed by lighting used on vessels and structures. This **impact** may have both positive and negative significance depending on the individual perception (preferences) of the receptor.

Sensitivity for all impacts depends on individual characteristics of the receptor and therefore may be from insignificant to high, depending, among others, on the distance of the observer from the OWF and their individual aesthetic preferences.

Table 59 Assessment of the significance of impacts on the landscape, including cultural landscape, during the Baltic East OWF construction phase [source: internal materials]

Impact	Scale of impact	Receptor sensitivity	Impact significance
Traffic of vessels, mainly the vessels of contractors of construction works and transport vessels, as well as surveys, supervision and other works	Moderate	Negligible to high	Low (N)
Illumination of the construction site and offshore structures	Moderate		Moderate (P/N)
Change in the natural landscape observed from the sea and from land	High		Moderate (P/N)

As a result of the analysis conducted, it was determined that the impact of the Project implementation phase on the landscape, including the cultural landscape, will be moderate or insignificant, of a positive or negative nature. The impact at the project implementation stage on the landscape will be direct, regional, and long-term.

5.1.1.8 Impact on population, health and living conditions of people

During the Baltic East OWF implementation phase, the population will be affected at various intensity levels in the onshore and offshore areas, as a result of the following **activities**:

- A number of works related to seabed preparation, transport of structural components and people as well as construction and installation will be carried out in the Baltic East OWF area;
- Structural components of wind turbines will be stored and installed in port and shipyard areas;

Substations and other components ensuring proper functioning of the Baltic East OWF will be constructed in plants and ports. They will be produced for several years using various technologies, and then transported by vessels to their target location.

The construction phase of the proposed Project will result in jobs created for many people in the shipbuilding, power, power engineering and sea transport industries. Large plants and ports from Świnoujście, Gdańsk, Gdynia and other cities, where structures and equipment of the Baltic East OWF will be manufactured, may be involved in the production and forwarding of wind turbine components for the needs of the Baltic East OWF. Moreover, they may serve as transshipment ports of components or elements transported from other locations. In these workplaces, impacts on the health and living conditions of the employed and those in their immediate vicinity will occur, such as noise emission, air pollution, sewage and waste. These impacts are identified in separate administrative procedures for projects in port and other areas. Impacts are minimized by ensuring appropriate working conditions – application of applicable standards and legally required occupational health and safety measures.

At the current stage of development of the Baltic East Project, the installation and transshipment ports taken into consideration are the ports in Świnoujście, Gdańsk, Gdynia, Władysławowo, Łeba, and Rønne, Aalborg. The Port of Rønne in Denmark (on the island of Bornholm) is the closest port with complete infrastructure used for the purposes of offshore wind energy activities. In these ports, there will be similar impacts on the health and living conditions of the employed related to noise emission, air pollution, sewage and waste, however, on a much smaller scale.

In the offshore areas, at least two years of the Baltic East OWF construction will cause significant changes to navigation routes in its vicinity and significant disturbances in the navigation of all sea-going vessels because the areas overlap with the main navigation routes of the southern Baltic Sea. It will increase the risk for the safety of navigation of all types of vessels, including recreational crafts, and for the functioning of the fishing industry in this region of the sea. The construction of an offshore wind farm of the size of Baltic East OWF may require approximately 360 passages per year of vessels of various sizes between the Baltic East OWF and the port in Świnoujście and Gdańsk or Gdynia and the ports in Łeba and Władysławowo. It will have a significant impact on the safety of navigation. During the construction period, the fishing industry will have to abandon fishing in some of the fishing squares: O8 and P8 in the sea basins affected by construction works.

In offshore areas, the potential impact on health and living conditions of people will be related to the transport and erection of individual wind turbine structures, cables and substations, and possible collisions of vessels with the OWF structures [Table 60].

Table 60 Assessment of the significance of impacts on the population, health and living conditions of people during the Baltic East OWF implementation phase [source: internal materials]

Impact	Scale of impact	Receptor sensitivity	Impact significance
Increase in employment in onshore plants and ports	Moderate	High	Moderate (P)
Increase in employment of contractors at sea	Moderate	High	Moderate (P)
Disturbances in navigation of marine vessels as a result of increased vessel traffic to the OWF area	Moderate	High	Moderate (N)
Disturbances in fishing in the area of fishing rectangles	Low	High	Low (N)

The impact at the Project implementation stage will be regional, positive, medium-term, direct and indirect in terms of employment of employees in the production of Baltic East OWF components and elements in onshore plants and ports and people working at sea during the project implementation, including transport. There will be negative, direct or indirect, medium-term impacts of a local and regional scale related to changes in navigation and fishery, as well as possible emergency and hazardous situations during the Baltic East OWF implementation and during transportation. As a result of the analysis conducted, it was determined that the impact of the Project on the population, health and living conditions of people during the implementation phase will be moderate.

5.1.1.9 Impact on biotic components in the offshore area

5.1.1.9.1 Impact on phytobenthos

Inventory surveys showed that there is no phytobenthos in the area of the Project. Therefore, there will be no impact on this element of the marine environment during the implementation phase.

5.1.1.9.2 Impact on macrozoobenthos

Works carried out on the seabed during the Baltic East OWF implementation phase, which will cover both preparatory and construction works, in the Applicant Proposed Variant (APV), will cause the following **impacts** affecting the condition of macrozoobenthos inhabiting this area:

- seabed interference – disturbance of the bottom sediment structure;
- agitation of sediments – increase in the concentration of suspended solids in the water depth;
- sediment redeposition – sedimentation of suspended solids on the seabed;
- redistribution of pollutants from the sediment into the water depth.

The most important technical parameters of the Baltic East OWF, which are important from the point of view of the assessment of the project impact on macrozoobenthos during the implementation phase, are:

- surface area of the Baltic East OWF footprint on the seabed;
  - foundations of wind turbines and offshore substations – type and number of foundations with the largest footprint seabed area;
  - cable lines – cable length and seabed area disturbed during cable laying;
  - other technical parameters of the Project, which may affect the disturbance of the seabed and destruction of benthic habitats, related to the preparation of the seabed for installation of wind turbines foundations or its protection in relation to the technology selected.

Details are given in the table below [Table 61].

Table 61 List of the most important technical parameters of the Baltic East OWF for the APV for the assessment of the macrozoobenthos impact during the implementation phase

Parameter	Value for the APV
Baltic East OWF Area	111.7 km^2
Maximum number of wind turbines	64
Maximum number of offshore substations (OSS)	2
Maximum seabed surface occupied by 66 monopile and 12 m diameter offshore substation support structures	7463.94 m^2
Maximum seabed surface occupied by 66 tripod support structures and offshore substation on 3 pile 4 m diameter pile supports	2487.98 m^2
Maximum surface area of seabed scour protection for all foundations	120,000 m^2
Maximum gravel bed/rip-rap footprint	300,000 m^2
Seabed surface area covered by removed primary material/seabed replacement material	120,000 m^2
Seabed surface covered and flattened by the sediment generated when drilling under monopiles	93,300 m^2
Maximum length of cable routes of the systems inside the OWF	150 km
Maximum width of the seabed strip covered by works related to the construction of a single cable line	20 m
Maximum seabed surface destroyed during the laying of power cables	3,000,000 m^2
Laying gravel embankments for spudcan	12,000 m^2
Surface area of rip-raps for the inner array cables (IAC)	380,000 m^2
Removal/relocation of rocks and boulders deposited on the seabed, removal of unexploded ordnance from the seabed and other potentially hazardous materials deposited on the seabed	8 km^2

The assessment of individual impacts in the Baltic East OWF area during the implementation phase was carried out separately for:

- soft seabed macrozoobenthos association;
- hard seabed macrozoobenthos association.

A separate assessment of the Project impact on macrozoobenthos results from the fact that these two associations of benthic fauna (soft and hard seabed) differ in taxonomic composition, population size and biomass of the taxa forming them. Therefore, they differ in importance and sensitivity in the context of different types of impact. The assessment of the scale of impact (type, range, duration, durability) affects the assessment of the impact characteristics. Taking into account the magnitude of the impact and sensitivity of the receptor, i.e. the assessed group of organisms (soft and hard seabed macrozoobenthos associations), the significance of a given impact on the receptor was determined.

The **sensitivity** of macrozoobenthos depends on the impact characteristics and preferences resulting from the biology of the species concerned. On the one hand, it is the ability of the population to adapt to various changes occurring in the environment as a result of the implementation of the Project and, on the other hand, the ability of an association of organisms to reconstruct the quantitative structure after the impact factor ceases to exist. The sensitivity of macrozoobenthos will differ in subsequent phases of the Project. Table [Table 62] presents definitions of macrozoobenthos sensitivity on a five-stage scale.

Table 62 Macrozoobenthos sensitivity to the impacts of the Baltic East OWF [source: internal materials based on Hiscock and Tyler-Walters 2006; Birklund 2007 and 2009]

SENSITIVITY	DESCRIPTION
Insignificant	Stressor impact has a very small impact on changes in the structure and functioning of the association of organisms
Low	Survival of some benthic species may be limited; the ability to restore benthic association and return to its original condition after the impact factor ceases will occur within one year
Moderate	Part of the species in benthic association will be destroyed and survivability of the rest may be limited; once the influencing factor has ceased, the ability to restore the quantitative structure of the longest living species in this association may take up to several years
High	Most species in the benthic association will be destroyed and survival of the remainder may be limited; after many years after the disappearance of the influencing factor, the ability to restore the benthic association is possible, which may have a different quality structure from the one before the period in which changes in the environment occurred as a result of the Project implementation
Very high	Benthic association will be destroyed under the influence of stressor and its return to its original condition will not be possible

The soft seabed macrozoobenthos association covers an accumulation platform (approximately 30% of the surveyed area) made of sandy sediments (sands and gravels), located in the central, southern, south-eastern and eastern part of the Baltic East OWF area (Appendix No. 1). This association is of low importance, as it is formed by common and characteristic soft seabed taxa of shallow and medium deep open waters of the southern Baltic Sea, characterized by moderate ecological quality.

Moreover, in the structure of this macrozoobenthos association there are numerous opportunistic taxa tolerant to environmental degradation.

The hard seabed macrozoobenthos association inhabits the surface of boulders and stones within the area of the abrasion and accumulation platform, which has a discontinuous cover of sands and gravels with local accumulations of gravels and boulders of an abrasive pavement character, mainly in the north-western, central and eastern part of the Baltic East OWF area. This type of seabed occupies approximately 70% of the Baltic East OWF surface area (Appendix No. 1 to the EIA Report). The quality status of the hard seabed macrozoobenthos association inhabiting was characterized by a very good ecological quality status. This group of benthic fauna was assessed as significant, as this association covers a large area of the Baltic East OWF area seabed; numerous boulders located at a depth of 25–35 m, but not forming a very dense boulder area, are overgrown by habitat-forming bivalves, including bay mussels *Mytilus sp.*, which play an important food role in the trophic chain.

- **Seabed interference leading to the disturbance of the bottom sediment structure**

Interference with the seabed leading to the disturbance of the bottom sediment structure is the most important, in terms of negative nature, type of impact on macrozoobenthos from among all occurring during the OWF implementation phase.

Preparatory work activities lead to physical (mechanical) destruction of natural macrozoobenthos communities. To a lesser extent, macrozoobenthos mortality occurs when invertebrates are brought onto the sediment surface, as a result of which they are subject to physical elimination or pressure from predators, mainly fish [Köller *et al.* 2006; Zucco *et al.* 2006]. Disturbance of the bottom sediment structure has the strongest impact on macrozoobenthos species inhabiting the sediment surface and organisms living in its upper 4–5 cm layer, but some may be buried up to a depth of 35 cm, which results from the biology of individual species [Brakelmann 2005; Braeckman 2010]. As a result of this impact, the soft seabed macrozoobenthos, which plays an important role in bioturbation and bioirrigation and thus transport of oxygen and organic matter into the sediment, which is important for microbiological decomposition and mineralization processes, may be eliminated [Braeckman 2010]. Mobile macrozoobenthos species, i.e. crustaceans, will avoid adverse environmental conditions by escaping [Macnaughton *et al.* 2014]. Destruction of the hard seabed macrozoobenthos species may lead to depletion of the food base for fish and diving benthivorous birds, e.g. long-tailed ducks and velvet scoters – birds feeding mainly on bay mussels.

Disturbance of the bottom sediment structure is a negative and direct impact, its most important feature being spatial range. In the OPA, physical destruction or burying of macrozoobenthos and its high mortality will occur from the moment of works preparing the seabed for installation of the turbine foundations or stabilization of the seabed around the foundations and protection of inner array cables (description of activities in section**2.4.2**). Among these works, the most unfavorable for macrozoobenthos will be the construction of cable lines, which will cover 3 km^2, and then the seabed preparatory and stabilizing works, as they will destroy macrozoobenthos on the surface of 1.81 km^2, taking into account the values of parameters from the table [Table 61]. The installation of foundations alone will, in comparison to the above works, have a negative impact on an area of 0.01 km^2 of the seabed, in relation to monopiles which, among the types of foundations selected for the Project, will cover the largest area of the seabed occupied. In total, macrozoobenthos destruction will cover up to 5% of the Baltic East OWF area. Although it is a local impact, it will cover a relatively large seabed area where long-term changes in the macrozoobenthos population structure will take place.

The **sensitivity** of the soft seabed macrozoobenthos association in the Baltic East OWF area to this impact is moderate. Although the population structure of this association of organisms is dominated by the polychaetes *Pygospio elegans* which have a relatively fast ability to restore their population after the physical disturbance of the seabed ceases [Bolam 2005], the ability to restore the entire association and its return to its original condition after the cessation of the impact factor will take place within a period from one to several years, as the restoration of the quantitative structure of the longest living species in this association, mainly the biomass-dominant species in this association, which is the Baltic cornea *Macoma balthica*, as well as other species of bivalve molluscs *Mya arenaria*, *Cerastoderma glaucum* and *Mytilus trossulus,* will last that long [Willmann 1989; Żmudziński 1990; Piechocki and Wawrzyniak-Wydrowska 2016]. This applies to areas where permanent mechanical destruction of benthos will not occur under the surface of wind turbine foundations and gravel, stone or rock rip-rap and the 2-meter surface of leveled sediment excavated for the purposes of the monopiles foundation.

Similarly, the sensitivity of the hard seabed macrozoobenthos association, in which bay mussels *Mytilus trossulus* are a group of absolutely permanent taxa and taxa dominating in terms of abundance and biomass, the sensitivity to disturbance of bottom sediments will be moderate.

The significance of the impact involving the interference with the seabed – disturbance of the bottom sediment structure was assessed as negligible for the soft seabed macrozoobenthos association and as insignificant for the hard seabed macrozoobenthos association.

- **Sediment disturbance**

Disturbance of sediments will result in an increase in the concentration of suspended solids and its distribution in water [Leonhard 2006; Zucco *et al.*, 2006]. Higher concentration of suspended solids and longer exposure time of mineral and organic particles in water cause adverse impacts on the condition of benthic fauna [Newcombe and MacDonald 1991; Hiscock *et al.* 2002]. In organisms filtering or feeding on suspended solids and organic matter deposited in sediments, including bay mussels, at excessive concentrations of suspended solids in water, the feeding efficiency may be reduced after exceeding the threshold for concentration of suspended solids particles in water, appropriate for a given species. In some of the most vulnerable individuals, such as *Mytilus trossulus*, reduction in the function of the filter apparatus (clogging) may take place and thus the survival of organisms may be affected. On the other hand, macroinvertebrates are naturally adapted to high concentration of suspended solids, which occurs, among others, during storms and can survive a month under conditions of very high concentration of suspended solids reaching up to 100 $mg \cdot dm^{-3}$ [Miller *et al.* 2002; Birklund 2009]. However, clams from the Baltic Sea are physiologically less suited to filtering suspended solids at high concentrations because they are not adapted to life in conditions of strong currents or tides [Essink 1999; Coates *et al.* 2014].

The conducted numerical modeling of suspended solids propagation in the Baltic East OWF area shows that the works causing suspended solids propagation from cohesive soils will be the least favorable for macrozoobenthos, and in particular for the hard seabed association with mussel predominance. This type of sediment, together with a thin, discontinuous sandy cover and erosive pavement with single boulders on the surface, constitutes the predominant part of the seabed surface of the Baltic East OWF area. Negative impacts will be caused mainly by works in cohesive soils related to the replacement of soil under the vessel spudcans together with the discharge of the collected soil in the area of the offshore wind farm, then the burial of the cable of the inter-array transmission infrastructure using the jetting method and clearing the seabed of stones and boulders (Appendix No. 2 to the EIA Report). The highest momentary suspended solids concentrations at a distance of 150 m from the works site related to the replacement of cohesive soils may reach 732 $mg \cdot l^{-3}$, but at a distance of 500 m and 1000 m may reach 256 $mg \cdot l^{-3}$ and 140 $mg \cdot l^{-3}$., respectively. Soil replacement will make a high-concentration suspended solids cloud of 100 $mg \cdot l^{-3}$ to remain suspended up to 1.4 km from the works site. For the remaining type of works, suspended solids concentrations will be much lower (Appendix No. 2 to the EIA Report). At suspended solids concentration above 250 $mg \cdot l^{-3}$, the growth of macrozoobenthic organisms [Essink 1999] is reduced and even increased mortality of bivalve molluscs [Moore 1977; Miller *et al.*, 2002] is observed.

The **sensitivity** of the soft seabed macrozoobenthos association inhabiting the Baltic East OWF area to this impact is low. The population structure of this association of organisms is dominated by polychaetes and oligochaetes inhabiting the sediment, which are resistant to a significant decrease in oxygen content, as well as clams *Macoma balthica*, which, being an optional filterer and detritus feeders, exhibit tolerance to the increase in suspended solids [Olafsson 1986; Budd and Rayment 2001]. Under the influence of the stressor, which is an increase in suspended solids concentration in water, no significant changes in the structure and functioning of this association of organisms are expected.

On the other hand, the hard seabed macrozoobenthos association, consisting mainly of filtering organisms, i.e. bay mussels *Mytilus trossulus*, will be characterized by moderate sensitivity, as it cannot be excluded that due to the increase in suspended solids concentration in water in some of the most vulnerable individuals, the functioning of the filter apparatus will be reduced and thus the survival of organisms will be limited.

The impact significance of the increase in the suspended solids concentration in the water column will be insignificant for the hard seabed macrozoobenthos association and negligible for the soft seabed macrozoobenthos association.

- **Redeposition of sediments**

Redeposition of sediments will cause sedimentation of suspended solids on the seabed, thus covering benthic habitats with an additional layer of sediment.

Many macrozoobenthic organisms are naturally adapted to life under conditions of agitation and settlement of sediments on the seabed (as a result of storms or tides cycles) causing them to become buried, and the natural response to the adverse impact is the mechanical ability of some macroinvertebrates to move in the sediment towards the oxygenated bottom layer or physiological resistance to hypoxia and even anoxia conditions [Miller *et al.* 2002; Hinchey *et al.* 2006; Birklund 2009]. Vagile infauna species (e.g. polychaetes and oligochaetes) are more tolerant to being buried with an additional layer of sediment. They can move through a layer of suspended solids up to 10 cm thick, although it also depends on the type of the fraction forming the sediment and the time of negative impact, but the infauna may be briefly exposed to anaerobic conditions. Species forming part of sedentary epifauna and macrozoobenthos larvae are more sensitive to this impact, as they have limited possibilities of movement and contact with the sediment surface, which is a necessary condition for respiration and the cause of the nutrition process inhibition. Clams may expose their siphons above the sediment layer [Maurer *et al.* 1986, Hiscock *et al.* 2002; Miller *et al.* 2002; Gibbs and Hewitt 2004]. The Baltic macoma *Macoma balthica* is one of the macrozoobenthos species most resistant to the described impact as it can survive for one month with a layer of sedimenting suspended solids increased by 7–20 cm [Turk and Risk, 1981; Essink, 1999]. The maximum tolerance of the soft-shell clam *Mya arenaria* to sedimentation of sandy sediment is 5 cm/month [Essink, 1999]. The most important factor affecting the survival of benthic fauna under the conditions of the impact described is access to oxygen dissolved in water [Hinchey *et al.* 2006]. As a rule, macrozoobenthos is quite tolerant to the conditions of coverage by a sedimenting additional layer of suspended solids up to 0.2–0.3 m thick, especially if this layer consists of fine sand fractions [Essink 1999; Miller et al. 2002; Gibbs and Hewitt 2004]. However, the long duration of the described negative impact contributes to increased mortality of all benthic species [Hiscock *et al.* 2002].

The thickness of the newly created sediment layer as a result of the sedimentation process due to the works related to the foundation of vessel supports (spudcans) will have the most adverse impact. In cohesive soils, it may reach up to 23 NM at a distance of 150 m from the construction site, but already at a distance of 500 m – up to 5.5 NM. The additional sediment layer will be thinner compared to the remaining works (cable foundation, removal of stones and boulders from the seabed) (Appendix No. 2 to the EIA Report). In total, the thickness of the newly formed sediment layer in the Baltic East area, in the long term, will not cause any significant changes in the structure and functioning of macrozoobenthos.

The **sensitivity** of the soft seabed macrozoobenthos association from the Baltic East OWF area to sedimentation of suspended solids on the seabed will be low. The clam *Macoma balthica* dominates the structure of this association in terms of biomass. These are organisms in which, as a result of burial with an additional layer of sediment, access to oxygen dissolved in water may be hindered and the filtration process may be limited by clogging of the digestive structures. However, *Macoma balthica* is tolerant to being covered with an additional layer of sediment causing suffocation of benthic organisms [Budd and Rayment 2001]. The infauna may also be briefly exposed to anaerobic conditions.

However, in the hard seabed macrozoobenthos association, there may be a negative impact related to inhibition of the filtration process for clams *Mytilus trossulus*. Due to relatively low maximum values of the newly formed sediment layer, the sensitivity of this association was also assessed as low.

Sedimentation of suspended solids on the seabed may temporarily reduce benthic resources and thus limit the food base for fish and seabirds in this area, but it will be a short-term and reversible impact.

Impact significance of suspended solids sedimentation on the seabed will be negligible for both macrozoobenthos associations (soft and hard seabed).

- **Redistribution of pollutants from sediments into water**

Redistribution of pollutants from sediments into water causes exposure of benthic fauna to increased concentrations of pollutants, e.g. heavy metals, toxic organic compounds: polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs), tributyltin (TBT), released from sediments into the water column by chemical and biochemical processes [Bourg and Loch 1995; Uścinowicz 2011]. Of the substances listed, organotin compounds are the most harmful (toxic) to benthic organisms. The use of TBT in anti-fouling paints is currently prohibited. Tributyltin is bioaccumulated by marine organisms and its harmfulness mainly depends on its final concentration in tissues. Clams are unable to degrade TBT by debutylation, as can some fish and certain marine gastropods. Accumulation of toxic substances affects reproductive function impairment, disease development and increased macrozoobenthos mortality, decrease in macrozoobenthos abundance and biodiversity. Filtering organisms, such as clams, which, by accumulating toxic substances in soft tissues, develop cancer diseases are, in particular, highly exposed [Galer *et al.* 1997; Grant and Briggs 2002; Hummel *et al.* 2000; Gosz *et al.* 2011].

The impact on the macrozoobenthos was indirectly determined using surveys of the physical and chemical condition of bottom sediments in the Baltic East OWF area with regards to their contamination (section 3.2.2). As a result of the conducted surveys, it was found that the analysed surface bottom sediments belong to inorganic sediments with organic matter content [expressed as losses on ignition (LOI) below 2%. Concentrations of biogenic substances (total nitrogen and total phosphorus) in the area surveyed did not exceed the values typical for sediments of the southern Baltic Sea. The concentrations of persistent organic pollutants (i.e. PAH, PCB, TBT) and harmful substances such as metals and mineral oils in the surveyed area were low and did not differ substantially from the literature data for sandy bottom sediments of the southern Baltic Sea. The surveyed sediments were also characterized by low concentrations of the radioactive element ^{137}Cs, typical of sandy sediments. Values obtained for labile metal form concentrations, responsible, among others, for their toxicity, bioavailability or accumulation in bottom sediments of the OWF area, as well as PAH and PCB values, compared to the normative values specified in the Regulation of the Minister of the Environment of May 11, 2015 *on recovery of waste outside systems and equipment* (Journal of Laws of 2015, item 796), in the bottom sediments surveyed, were low and the sediments were not contaminated with compounds from these groups (Appendix No. 1 to the EIA Report).

Due to the possibility of redistribution of pollutants from the sediment into water, both the representatives of the soft seabed macrozoobenthos association and the hard seabed association will be characterized by insignificant **sensitivity** to this impact. It is expected that this phenomenon has a very small impact on changes in the structure and functioning of both macrozoobenthos associations, taking into account the results that all substances toxic and hazardous to benthic fauna in the surveyed area were of low values, and the processes related to the release of labile forms of metals, biogenic substances, PAHs and PCBs will take place with low intensity throughout the OWF area. Moreover, it is a short-term impact.

The impact significance of redistribution of pollutants from sediment to water was assessed as negligible for both soft and hard seabed macrozoobenthos.

A summary of the characteristics of impacts on the soft- and hard-bottom macrozoobenthos associations is presented in tables [Table 63, Table 64].

Table 63 Assessment of the scale of impacts on the soft-bottom macrozoobenthos association during the implementation phase for the APV [source: internal materials]

IMPACT CHARACTERISTICS	TYPE OF IMPACT			SPATIAL RANGE			DURATION					TYPE	
	Direct	Indirect	Secondary	Transboundary	Regional	Local	Long-term	Medium-term	Short-term	Temporary	Permanent	Positive	Negative
Seabed interference – disturbance of the seabed sediment structure	x					x	x				x		x
Agitation of sediments – increase in the concentration of suspended solids in the water depth	x					x			x	x			x
Sediment redeposition – sedimentation of suspended solids on the seabed	x					x			x		x		x
Redistribution of pollutants from the sediment into the water depth	x					x			x	x			x

Table 64 Assessment of the scale of impacts on the hard-bottom macrozoobenthos association during the implementation phase for the APV [source: internal materials]

IMPACT CHARACTERISTICS	TYPE OF IMPACT			SPATIAL RANGE			DURATION					TYPE	
	Direct	Indirect	Secondary	Transboundary	Regional	Local	Long-term	Medium-term	Short-term	Temporary	Permanent	Positive	Negative
Seabed interference – disturbance of the seabed sediment structure	x						x						x
Agitation of sediments – increase in the concentration of suspended solids in the water depth	x								x				x
Sediment redeposition – sedimentation of suspended solids on the seabed	x								x				x
Redistribution of pollutants from the sediment into the water depth	x								x				x

The assessment of the significance of impacts on soft seabed macrozoobenthos is included in table [Table 65], and on hard seabed macrozoobenthos in table [Table 66].

Table 65 Assessment of the significance of impacts on soft seabed macrozoobenthos during the Baltic East OWF implementation phase for the APV [source: internal materials]

IMPACT	SCALE OF IMPACT	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
Seabed interference – disturbance of the seabed sediment structure	Insignificant	Moderate	Negligible (N)
Agitation of sediments – increase in the concentration of suspended solids in the water depth	Insignificant	Low	Negligible (N)
Sediment redeposition – sedimentation of suspended solids on the seabed	Irrelevant	Low	Negligible (N)

IMPACT	SCALE OF IMPACT	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
Redistribution of pollutants from the sediment into the water depth	Insignificant	Low	Negligible (N)

Table 66 Assessment of the significance of impacts on hard- seabed macrozoobenthos during the Baltic East OWF implementation phase for the APV [source: internal materials]

IMPACT	SCALE OF IMPACT	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
Seabed interference – disturbance of the seabed sediment structure	Insignificant	High	Low (N)
Agitation of sediments – increase in the concentration of suspended solids in the water depth	Insignificant	High	Low (N)
Sediment redeposition – sedimentation of suspended solids on the seabed	Insignificant	Moderate	Negligible (N)
Redistribution of pollutants from the sediment into the water depth	Insignificant	Moderate	Negligible (N)

The impact assessment carried out for both macrozoobenthos associations during the implementation phase for the Baltic East OWF indicates that both physical interference of the seabed by disturbing the seabed sediment structure and agitation of sediments causing an increase in the concentration of suspended solids in the water depth will be of **low importance** for the hard-bottom macrozoobenthos association and negligible for the soft-bottom macrozoobenthos association. Direct physical destruction of benthic specimens and limitation of the filtration process and thus survival of clams may lead to negative changes in the structure and functioning for a part of the macrozoobenthos association in the Baltic East area, which consist mainly in increasing the importance of opportunistic species and reducing specialized species. There may also be changes in the proportion between the percentage of mobile and sedentary species. The rate and efficiency of recolonization of the disturbed seabed will be the result of reproduction and migration processes, whereas reproduction plays a fundamental role in sedentary organisms (e.g. clams *Mytilus trossulus*). All other types of impacts will be negligible for both macrozoobenthos associations and will not significantly affect macrozoobenthos of the soft and hard seabed inhabiting the Baltic East OWF area.

5.1.1.9.3 Impact on ichthyofauna

The main impacts on the ichthyofauna will be as follows:

- emission of noise and vibration;
- increased suspended solids content;
- release of pollutants and biogens from sediments into water;
- habitat change;
- barrier creation.

- **Emission of noise and vibration**

The main source of noise and vibrations at the construction stage is the installation of foundations using the piling method. The noise generated during piling is of pulsating nature, has a short duration (less than 1 second), and wide frequency band from 100 to 1000 Hz, with most energy concentrated in the range up to 500 Hz [Dahl *et al.*, 2015]. Noise level generated during works depends on:

- hammer impact energy,
- pile material, diameter and length,
- the depth to which the pile is driven into the sediment,
- parameters of the sediment into which the pile is driven (composition, cohesion, resistance set when driving the pile) [de Haan *et al.* 2007].

Impact characteristics

The noise level values expressed as cumulative sound energy for one pulse (SEL_{ss}) given in the literature, measured at a distance of 750 m from the sound source, range from 157 dB re: 1 µPa²s (for a 0.9 m diameter pile) up to 180 dB re: 1 µPa²s (for a 5 m diameter pile). On the other hand, the maximum pressure values recorded for one SPL_{peak} pulse range from 183 dB re: 1 µPa (for a 0.9 m diameter pile) up to 200 dB re: 1 µPa (for a 4 m diameter pile) [Andersson *et al.*, 2017]. The noise generated during driving of piles with larger diameters, calculated using the exponential relation between the pile diameter and the noise level, may reach above the SEL level of 180 dB re: 1 µPa and above SPL_{peak} 205 dB re: 1 µPa for an 8 m diameter pile.

The spatial range of noise impact is largely dependent on salinity, temperature, pressure and in shallower areas, type of sediments and seabed morphology. Simulations carried out by Andersson *et al.*, [2017] indicate that for the conditions of the southern Baltic Sea, the noise level at its source is 226 dB re: 1µPa²s (SEL_{ss}) at a distance of 5 km will drop to 170 dB re: 1 µPa²s in winter and 160 dB re: 1 µPa²s in summer and at a distance of 20 km it will amount to 155 dB re: 1 µPa²s and 143 dB re: 1 µPa²s, respectively.

A slightly lower noise level should be expected during cable laying works. The values reported in the literature during the construction of cable trenches range from 178 dB re: 1 μPa²s [Wilhelmsson, 2010] to 188.5 dB re: 1 μPa [Bald *et al.* 2015]. The range of this impact is highly dependent on noise intensity and seabed morphology which may affect sound propagation. According toTaormina i in. (2018) the noise level up to 120 dB re: 1 μPa²s can be expected in the area of approximately 400 km².

Receptor sensitivity

The acoustic stimuli coming from the environment are perceived by the fish as a movement of water particles and in some cases a change in pressure. Surveys carried out so far show that all fish have the ability to register sound, but it is very diverse and highly dependent on the structure of sound receptors. A common receptor for all species is the inner ear, where the movement of particles is converted through otoliths and sensory hair into nerve pulses. The sound perception mechanism of fish without swim bladder (e.g. the adult flatfish) or fish with a bladder far from the ear (e.g. the salmon, trout) is limited to registering the movement of water particles. This involves a narrow range of audible frequencies (usually up to approximately 300 – 500 Hz) as well as a higher sound sensitivity threshold. In the case of fish with swim bladder connected to or close to the inner ear, pressure changes converted by this body into particle movement are an additional element enhancing the sound stimulus. Such a registering mechanism includes, for example, Clupeidae whose upper frequency limit of the registered sound exceeds 100 kHz [(Mann et al., 2002)]. On the other hand, cod perceives sounds in the narrower frequency range (18–470 Hz), whereas the registering of lower frequency sounds (<50Hz) is mainly the responsibility of the mechanism based on particle motion registration. In contrast, at higher frequencies the swim bladder also plays an important role(Hawkins i Popper 2020 [Popper and Hawkins, 2019].

Popper i in. (2014) they proposed to divide ichthyofauna into four groups taking into account differences in the morphology of hearing organs and additionally a group including larvae and eggs [Table 67].

Table 67 Division of ichthyofauna due to the hearing organ morphology and sound registering mechanism

FISH GROUP	SOUND REGISTERING MECHANISM	REGISTERED FREQUENCY RANGE	REPRESENTATIVES
Fish without swim bladder	movement of water particles	narrow frequency range	flatfish
Fish with swim bladder at a greater distance from the inner ear, not involved in sound registering	movement of water particles	narrow frequency range	salmonids
Fish with swim bladder near the inner ear, not connected to the inner ear	water particle movement, pressure changes	wider frequency range up to approximately 500 Hz	Gadidae, Anguillidae
Fish with swim bladder connected to the inner ear	first of all, pressure change, also particle movement	Wide frequency range, up to several kHz	Clupeidae, Perciformes

Depending on the intensity of noise and the distance from its source, the impact can have various effects ranging from behavioural changes to the death of fish [Table 68].

Table 68 Potential impact of noise on ichthyofauna; based on Popper et al. [2014]

IMPACT EFFECT	IMPACT CHARACTERISTICS
Behavioural changes	Disturbance of normal activities such as feeding, spawning, formation of shoals, migration, displacement from preferred areas, avoidance reaction
Masking	Masking of important biological acoustic signals from the environment, including from other individuals
Temporary hearing organ damage (TTS)	Hair cell damage causing temporary hearing impairment (TTS)
Tissue damage; physiological disorders	Examples of injuries: internal hemorrhages; damage to gas-filled organs such as the swim bladder and surrounding tissues
Death	Death as a result of injuries caused by exposure to noise

At the scale of local ichthyofauna groups, the disturbance of the normal noise level may lead to **behavioural effects** such as abandoning feeding grounds, hiding places, and changing spawning territory [Slotte *et al.*, 2004], thus affecting the survival of individuals and their reproductive success. Fish may react to increased noise level abandoning the affected area (avoidance reaction) [Nedwell *et al.*, 2003; Mueller-Blenkle *et al.*, 2010; Andersson, 2011]. The avoidance effect may be particularly important in case of spawning areas if there are no areas with equally favorable conditions for reproduction in the vicinity of the abandoned area. In experimental studies, Thomsen *et al.* [2012] showed that a sound at a level of SPL_{peak} 144–178 dB re: 1 µPa for common sole and 140–161 dB re: 1 µPa for cod caused an acceleration of movements in both species or a freezing reaction of cod. However, as this reaction lessens as a result of subsequent exposures to noise emission, the authors believe this may suggest a kind of acclimatisation to conditions of an increased noise level (so-called habituation effect). In the case of sprat (sound registration range similar to herring), behavioral changes were observed at SPL $_{peak-peak}$ 163 dB re: 1 µPa and SEL_{ss} 135 dB re 1 $µPa^2s$ [Hawkins *et al.* 2014].

Surveys of the behavioral response of large fish groups to noise generated during seismic surveys conducted in the natural environment showed changes in the vertical and horizontal distribution of both pelagic and benthic fish. A return to the original distribution usually occurred within hours or days after the noise ceased [Engås and Løkkeborg 2002, Løkkeborg *et al.* 2012].

An increased noise level in relation to the noise normally present in the environment may dampen biologically significant sounds, such as those generated by predators and prey, individuals of the same species in reproduction processes, or acoustic signals used for orientation. Such a **masking effect** occurs more frequently in fish with a low threshold of sensitivity to sound, while low-hearing fish may be less susceptible to the masking impact of noise (Hawkins & Johnstone, 1978).

Another effect of fish exposure to increased noise level may be **temporary hearing impairment or loss** (TTS) resulting from damage to hair cells in the middle ear or neurons that repair them. Such an effect occurs in case of repeated exposure to very intense sounds or long-term exposure (tens of minutes or hours) to less intense noise [Popper and Hawkins 2019]. During the period of decreased sensitivity to hearing stimuli, there may be a decrease in communication efficiency, detection of predators or prey and orientation in the environment, which may result in increased mortality. At the end of the sound activity, these cells regenerate and the hearing capacity returns to normal within a period that can range from a few minutes to several days. The length of this period depends on the duration of the noise exposure and its intensity [Smith *et al.*, 2006; Smith & Monroe, 2016]. Surveys by Hammar *et al.* [2007] showed that the sound level causing the TTS effect in well-hearing fish is lower than in species with limited sound registering capability.

Popper and Hawkins [2019] emphasize that at this stage of knowledge, it is difficult to quantify sound levels causing the TTS effect. Experimental surveys indicate that the response to the same type, intensity and duration of stimulus impact may differ in the case not only for different species, but even for genetically different groups of organisms belonging to the same species [Halvorsen *et al*., 2013; Popper *et al.*, 2007]. This makes it difficult to determine the sound level which could be considered a threshold causing TTS in fish [Andersson *et al.*, 2017]. Also, no experiments were carried out to determine the level of sound generated during piling works causing this effect. In *Sound Exposure Guidelines for Fishes and Sea Turtles,* Popper *et al.* [2014] use the results of an experiment in which sound was emitted from an air-gun, to determine the TTS threshold value for piling.

The lethal impact of impulse sound and related tissue damage and disturbances in body function result from rapid changes in pressure to which gases in fish bodies (barotrauma) are subjected. These changes lead to damage to the swim bladder and surrounding tissues. Damage to the swim bladder impairs the swimming and buoyancy capacity of fish, increasing the risk of death due to predation.

A drop in pressure caused by sound reduces the solubility of gases which leads to the generation of bubbles, which increases blood pressure and can cause blood vessel ruptures in extreme cases. Gas bubbles in the blood system can interfere with or damage important organs such as the heart, gills, kidneys, brain or gonads. The presence of these bubbles in the gills or heart can lead to immediate death. Even if noise does not cause immediate death, it may lead to delayed mortality due to haemorrhage and increased susceptibility to predators attack [National Academies of Sciences, Engineering, and Medicine 2011]. The surveys carried out so far under environmental conditions indicate that piling is the only source of impulse sound that may cause fish death [Popper and Hawkins, 2019]. However, such an impact was found only in the immediate vicinity of the performed works. Immediate noise-induced mortality evidenced by an outflow of dead fish to the surface was observed within a radius of 10–12 m from the piling site [Caltrans 2001]. The values adopted as thresholds causing individual impact effects are presented in the table. They were proposed on the basis of a review of the available data by Popper *et al.* [2014] as “Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI” [Table 69].

Table 69 Piling noise impact on ichthyofauna, taking into account morphology and development stage [source: Popper et al., [2014]

Type of organism*	Mortality and potential lethal damage	Renewing damage*	Temporary threshold shift of hearing*	Masking*	Behavioural disturbances*
Fish without swim bladder (particle movement detection) e.g. flatfish	>219 dB SEL_{cum} >213 dB_{peak}	>216 dB SEL_{cum} >213 dB_{peak}	>>186 dB SEL_{cum}	(B) moderate (U) low (D) low	(B) high (U) moderate (D) low
Fish with swim bladder not connected to the inner ear (particle movement detection) e.g. Atlantic salmon	210 dB SEL_{cum} > 207 dBpeak	203 dB SEL_{cum} > 207 dBpeak	>186 dB SEL_{cum}	(B) moderate (U) low (D) low	(B) high (U) moderate (D) low
Fish with swim bladder connected	207 dB SELcum	203 dB SELcum	186 dB SELcum	(B) high	(B) high

Type of organism*	Mortality and potential lethal damage	Renewing damage*	Temporary threshold shift of hearing*	Masking*	Behavioural disturbances*
to the inner ear (acoustic pressure detection) e.g. Atlantic cod, herring	> 207 dBpeak	> 207 dBpeak		(U) high (D) moderate	(U) high (D) moderate
Eggs and larvae	> 210 dB SELcum > 207 dBpeak	(B) moderate (U) low (D) low	(B) moderate (U) low (D) low	(B) moderate (U) low (D) low	(B) moderate (U) low (D) low

* For effects of impact for which it was impossible to determine the sound level, relative risk (low, moderate, high) was determined depending on the distance from the sound source: (B) near – several dozen meters, (U) moderately far – several hundred meters, (D) far – several thousand meters. Units for peaks: dB re 1 µPa and for the cumulative value of SEL: dB re 1 $\mu Pa^2 s$

The Swedish Environmental Protection Agency [Andersson *et al.* 2017] published in 2017 the sound pressure levels at which adult fish, larvae and eggs are at risk of death or serious injury to internal organs, which are consistent with those proposed by Popper *et al.* [2014]. However, this document does not include the TTS occurrence and behavioral effects thresholds. The authors conclude that noise levels causing such impacts are specific to individual species and should not be generalized as thresholds for the entire ichthyofauna or groups distinguished based on the hearing organ functioning. There is also insufficient data to assess whether and how behavioral changes negatively affect ichthyofauna at the population level. Andersson *et al.* [2017] as well as Popper and Hawkins [2019] emphasize that basing noise levels affecting fish only on the parameters related to pressure change may be too simplistic. Since they do not take into account the hearing mechanism based on recording the movement of water particles. This mechanism is particularly important for flat fish, for which it is the only source of information on the change of acoustic conditions in the environment. Previous surveys do not allow the presentation of threshold values on the basis of units quantifying particle movement. Therefore, the use of threshold values based on pressure change that cause individual impacts in flat fish may not be justified.

The impact of noise caused by piling in the Baltic East OWF area may cause increased **fish mortality**. However, taking into account the very small area where the death of fish may occur(up to several dozen meters from the location of works) and the possibility of adult individuals escaping from the threatened area facilitated by the soft-start procedure, it can be assumed that a possible increase in mortality will not affect ichthyofauna both on the population scale and on the scale of local groups. It cannot be excluded that a certain indirect impact on the increase in fish mortality may be caused by a temporary limitation of the ability to record sound stimuli (reversible hearing damage, TTS) leading to a decrease in the detection efficiency of predators or casualties and orientation in environment.

However, the range of this impact is relatively small, reaching, in the worst-case modeling scenario, an area of 575 km^2 for the TTS effect and 4.4 km^2 for reversible hearing damage**.** At the same time, given the relatively short period of decreased hearing efficiency, which is up to a few days for TTS, it can be assumed that a possible increase in mortality will not be significant at the population level.

Due to too low salinity, the Baltic East OWF area is not a spawning ground for **cod**. The closest main spawning ground for cod (Bornholm Deep) is more than 90 km from the Baltic East OWF area. However, the Słupsk Furrow, located at a distance of approximately 20 km, plays only a secondary role in the reproduction of these fish compared to the Bornholm Deep. The results of noise modeling for the worst-case scenario in the summer period, when cod spawning takes place, indicate that, with the application of maximum mitigation measures, both these areas are located too far away from the Baltic East OWF so that piling carried out in the Project area may cause lethal or reversible damage to tissues in breeding areas. The maximum range of the TTS impact may occur within a small area of the Słupsk Furrow (secondary spawning ground), whereas the main breeding area located on the Bornholm Deep is beyond the range of this impact. According to the modeling results, the Słupsk Furrow area is within the range of noise that may cause behavioural effect. As mentioned earlier, changes in the behaviour of cod observed during exposure to sound were manifested in a reaction of freezing and/or increasing the speed of movement, so it is difficult to infer from them a possible reaction of avoiding the spawning area or disturbances in the reproduction process. Additionally, during these surveys, a habituation effect was found that may reduce the level of response. In the surveys conducted in the North Sea on the behaviour of cod living in the area of the wind farm located at a distance of several kilometres from the place where piling was carried out during the construction of the new project, no escape of cod from the inhabited area was observed [van der Knaap *et al.*, 2022]. Considering the above information, it can be assumed that the noise caused by piling should not affect the effectiveness of cod reproduction.

Surveys carried out in the Baltic East OWF area have shown that this area is – regardless of the season – an important habitat and feeding ground for cod. At the construction stage, the Project area may be partially abandoned due to intensive noise. However, taking into account the aforementioned observations of the piling impact on the cod behaviour in the North Sea indicating the presence of cod in the area ensuring favourable food conditions despite high noise level, it can be assumed that the limitation of the available feeding ground will apply only to the direct vicinity of the performed works.

Due to too high depth, the Baltic East OWF area is not a spawning ground for spring or autumn **herring**. This is also confirmed by a low number of larvae of this species found during the surveys carried out in 2022–2023 in the area of the proposed Project. The depth of the areas covered by the range of noise level causing TTS, reversible damage and behavioural changes determined on the basis of modelling is also too high for the spawning of this species. Therefore, it can be assumed that the impact of noise at the construction stage will not have a significant impact on herring reproduction processes.

Herring aggregations were observed in the Baltic East OWF area during the summer surveys. They may be within the range of impacts causing reversible damage, TTS and behavioral changes. Their area determined on the basis of the model for the summer period is 4.5, 251 and 1295 km^2, respectively. Compared to the habitat of this species covering a significant part of the Baltic Sea pelagic zone, its size is too small for leaving the area of impacts to have a significant negative impact at the population level.

Surveys of adult **sprat** stages have shown that the Baltic East OWF area is not a significant spawning ground for this species, although relatively numerous sprat larvae indicate the occurrence of spawning in this area. Increased mortality of larvae caused by piling cannot be excluded, however, due to a very small range of such an impact (in the order of several dozen meters from the performed works), its significance will be low. Some or all of the Baltic East OWF area may be abandoned due to piling noise. However, due to the pelagic lifestyle of sprat and wide availability of areas with similar conditions in the water column, periodical abandoning of both the Project area and larger areas affected by noise should not have a significant impact at the population level.

The Baltic East OWF area is not a **European flounder** spawning ground**,** the presence of larvae in this area was the result of transport by sea currents from the Słupsk Furrow or the Gdańsk Deep. Piling may cause an increase in their mortality, but it will occur only in a small area limited to several dozen meters. However, spawning areas of this species may be located in the area under the influence of noise, but it is difficult to determine the impact range due to the specificity of the receptor. Taking into account the relatively low sensitivity of fish without swim bladder, flat fish, it can be assumed that the range of impact of noise that may cause temporary departure from feeding grounds or disturbance of reproduction processes will be relatively small.

In the ichthyoplankton caught in the Baltic East OWF area, larvae of three semi-protected fish taxa were found: few larvae of **straightnose pipefish** and **common seasnail** and numerous larvae of gobies probably belonging to the **sand goby** species. Due to the environmental conditions prevailing in this area, it is not a spawning ground for any of the above-mentioned taxa. Small numbers of common seasnail and straightnose pipefish larvae exclude the presence of these species in the vicinity of important spawning grounds. However, the high abundance of goby larvae indicates the possibility of reproduction of this taxon in shallower areas located at a certain distance from the surveyed area. However, they are outside the impact range determined in the model for reversible hearing damage, TTS and behavioral responses. Increased larval mortality that may occur in the immediate vicinity of the performed works does not pose a significant problem due to a very limited range of this impact.

The impact of noise and vibration on adult fish will be: negative, direct, short-term and regional.

Impact significance was assessed as insignificant or negligible for individual fish species.

Increase in the concentration of suspended solids in the water depth

During the works related to the preparation of the seabed for the construction of OWF components**, sediments** are disturbed, resulting in increased concentration of suspended solids in water and deterioration of visibility. The response of fish to the increase in the concentration of suspended solids depends on physical factors resulting from local conditions of the abiotic environment and related to the biology of ichthyofauna.

Impact characteristics

The first group of factors includes sediment characteristics such as grain size distribution, mineral composition, adsorption and absorption capacity, hydrological parameters (salinity, temperature, oxygen concentration), seabed morphology or area hydrodynamics (direction of currents, waves) [Engell-Sørensen and Skyt, 2001]. The effect of suspended solids on fish is dependent on the concentration of suspended solids and the exposure time of the organism [Newcombe and MacDonald, 1991]. It should be emphasized that both of these factors depend on the type of sediment. In the case of sandy sediments, especially those with coarser grain-size distribution, both the spatial range and the impact time will be much lower than in the case of silty sediments or silty and sandy sediments.

Receptor sensitivity

The main biological factors shaping the reaction to the increase in the concentration of suspended solids are the lifestyle, method of reproduction, development stage and condition of fish.

The impact of suspended solids on ichthyofauna may result in a whole range of negative effects, starting from avoidance reaction, by slowing down the rate of growth and reducing the success of reproduction up to an increase in mortality. Early stages of fish development are particularly sensitive to the impact of increased content of suspended solids. According to Engell-Sørensen and Skyt [2001], in the case of juvenile and adult fish, the fatal effects of suspended solids may occur at a level of grams per dm^3, whereas earlier development stages may similarly react to a level of milligrams per dm^3. The higher sensitivity of juvenile stages is due to higher oxygen demand than in adult fish associated with a higher rate of metabolism of juvenile stages [Auld and Schubel, 1978;

Partridge and Michael 2010]. Particles of suspended solids penetrating into the gills hinder the respiration process and may cause an increase in mortality rates [de Groot, 1980]. The experimental studies showed the inhibition of herring larvae growth at suspended solids content above 500 mg dm^{-3}, whereas at concentration of 19 g dm^{-3}, larvae mortality of 100% was observed [Messieh *et al.*, 1981]. Particularly high sensitivity is observed for the earliest development stages. Westerberg *et al.* [1996] found an avoidance reaction for cod larvae with yolk sac already with a suspended solids content of 3 $mg{\cdot}dm^{-3}$, whereas values up to 10 $mg{\cdot}dm^{-3}$ increased mortality rates.

The impact of increased content of suspended solids may not only directly disturb the physiological processes of fish, but also affect their behavior. The reduction in visibility caused by the presence of suspended solids lowers the efficiency of larvae sensing and consuming food [Bone *et al.*, 1987]. This is confirmed by Utne-Palm surveys [2004] showing that the increase in turbidity (80 JTU) had a negative impact on the ability of herring larvae to obtain food. Increased suspended solids content may negatively affect the growth and survival of eggs at the earliest development stages. Sediment particles adhering to the egg shells may limit gas exchange and removal of metabolites [Chapman, 1988; Kiørboe *et al.*, 1981; Argent and Flebbe, 1999]. The content of suspended solids exceeding 100 $mg{\cdot}dm^{-3}$ may result in increased mortality of cod eggs [Rönbäck and Westerberg, 1996]. In the case of pelagic eggs, their buoyancy may also be reduced due to adhesion of sediment particles to their surface. This results in eggs falling to lower water levels or to the seabed. This may result not only in deterioration of oxygen conditions, but also in an increase in the pressure of predation of benthic organisms and physical and physiological stress. According to Rönnbäck and Westerberg [1996], a suspended solids content of 5 $mg{\cdot}dm^{-3}$ occurring for 4 days may cause cod eggs to fall to the seabed.

In the case of demersal eggs (spawned on the seabed), the negative impact of increased suspended solids content is much lower than in the case of eggs developing in the water column. Surveys carried out by Messieh *et al.* [1981] did not show any significant impact of suspended solids content up to 7 $g{\cdot}dm^{-3}$ on herring eggs. Similar conclusions were reached by Kiørboe *et al.* [1981] during the experiments carried out for the suspended solids content of 300–500 $mg{\cdot}dm^{-3}$. However, these authors suggested that the impact of the increased content of suspended solids may be significant in the event of a deterioration of oxygen conditions. However, an indirect negative impact on herring reproduction cannot be excluded. De Groot [1980] suggests that specimens of this species may spawn in random places due to the problems with finding traditional spawning grounds. Unless there is a clear negative impact of the increased suspended solids content on demersal eggs, the harmfulness of covering the grains deposited on the sediment surface by a layer of sedimenting particles cannot be excluded. The limitation of visibility resulting in the loss of benthic vascular plants may also cause deterioration of spawning conditions for certain fish species laying eggs on plants.

Increased suspended solids content rarely increases mortality of juvenile and adult ichthyofauna stages. This results from the possibility of active movement of fish to areas not affected by this factor (avoidance effect). The values of suspended solids content that produce this effect vary depending on the species and development stage of fish. In the case of young herrings, it was observed at 12 mg·dm^{-3} [Messieh *et al.* 1981], whereas for adult fish the response was observed at a slightly lower level (10 mg·dm^{-3}) [Johnston and Wildish, 1981]. According to the Westerberg surveys, referred to in the Environmental Impact Assessment Report for the Kriegers Flak Wind Farm [Sweden Offshore Wind AB 2007], the avoidance reaction for herring and sprat was already observed at concentrations above 3 mg·dm $^{-3}$, whereas according to Hansson (quoted therein), such a reaction should be expected only at concentrations above 100 mg·dm^{-3}. Apart from the avoidance reaction, effects of an increased suspended solids content were also observed, such as disorientation, reduced response time, increased or reduced predation, disorders in food intake. A reverse reaction to avoidance responses is also possible for species that prefer an increased level of turbidity, which limits the predation pressure [ECORP Consulting 2009; Kjelland *et al.* 2015].

The literature data mentioned above indicate an increase in fish larvae mortality at suspended solids content of approximately 10 mg·dm^{-3}.

The report prepared for the Sæby OWF EIA [Rambøll 2014], based on the analysis of available literature, proposed concentration limits at which avoidance reactions can be expected [Table 70].

Table 70 Limit values of suspended solids concentrations causing avoidance reaction and lethal effect in adult fish [source: Rambøll 2014]

SPECIES	AVOIDANCE REACTION	LETHAL EFFECT
Pelagic	10 mg·dm^{-3}	>500 mg·dm^{-3}
Demersal	50 mg·dm^{-3}	>3000 mg·dm^{-3}

The analysis carried out using the Ecological Risk Assessment (ERA) method assessed the significance of the impact of suspended solids on various development stages of cod in the area of the project implemented on spawning grounds of this species in Danish straits [Hammar *et al.*, 2014]). This analysis showed that only for early development stages (eggs, larvae and fry up to 3 months of age) there is a low risk of this factor impact. However, no significant impact was found at other development stages.

The modeling results indicate that in the most unfavorable scenario, the expected highest suspended solids concentrations should not cause death of adult European flounder, whereas in the case of adult pelagic fish, the range of impact that may cause a fatal effect will be less than 500 m. In both cases, it can be assumed with high probability that the possibility of fish leaving the area where such conditions prevail will allow to avoid an increase in mortality. In the case of larvae, due to the inability to actively move and avoid certain areas, mortality may increase at a distance of 5 km from the performed works, where the modeling results indicate the presence of suspended solids concentration above 10 mg·dm^{-3}.

Sprat spawning takes place within the Baltic East OWF area. Increased concentration of suspended solids may cause an increase in mortality of larvae and eggs of this species and may cause adult individuals to avoid parts of the area during the performance of works. However, the spatial range of this impact is very small compared to the total surface of the spawning area of this species.

The investment project area is not a spawning ground for other species under consideration. However, numerous occurrences of larvae subject to partial protection of sand goby were found in the Baltic East OWF area during the surveys. An increase in their mortality caused by an increased concentration of suspended solids may adversely affect the effectiveness of reproduction of this species. However, due to the short-term (duration of from several to a dozen hours) and relatively small range of this impact (less than 6 km from the location of works), this effect will be only local. Due to the short-term occurrence of increased suspended solids concentrations and the limited spatial range of occurrence of this phenomenon, this factor should not significantly affect the reduction of food availability for fish present in this area.

The impact on fish related to the increase of suspended solids content will be negative, direct, local, and short-term.

The **impact significance** is assessed to be negligible for all investigated fish species.

Release of pollutants and biogens from sediments

During the works related to foundation and cable laying, sediments will be resuspended and the accumulated pollutants will be released into the water column. Additional emission sources may include leakages of petroleum products caused by equipment or vessel failures. Taking into account the low concentrations of most harmful substances in sediments found during the years 2022–2023 in the Baltic East OWF area, it can be assumed that they will not pose a significant threat to ichthyofauna.

The greatest **sensitivity** of fish to harmful substances is observed in maturing females and early larval stages. The exposure of maturing females to even low concentrations of harmful substances may have an impact on their reproductive organs and the effects are often visible in the next generations. Morphological changes caused by this factor include deformations of spine, jaws or reduction of the size of hatching larvae. Surveys performed in the North Sea showed the occurrence of morphological changes in species such as common dab, European flounder, cod [Dethlefsen *et al.*, 1986] and herring [Linden, 1976]. Physiological effects due to toxic substances the most frequently include reduced pulse and hormonal disorders that may affect ovulation and spawning. Behavioral disturbances may also occur resulting in a decrease in the effectiveness of fish feeding [Rosenthal *et al.*, 1986; Struhsaker, 1977; Wedemeyer *et al.*, 1984]. A potentially high hazard may be caused by emission of oil derivative substances (hydrocarbons), including PAHs, whereas light fractions cause a much higher hazard than heavy ones. In the case of juvenile stages, a clear negative impact of even low concentrations of PAHs on embryonic growth was identified [Collier *et al.*, 2014]. However, according to the assessment of the U.S. National Oceans and Atmosphere Administration (NOAA), the impact of petroleum products on fish is largely limited to coastal and closed sea basins where active risk avoidance is hindered. Also, the surveys of Koehler [2004] and Vethaak and Wester [1996] did not show a statistically significant link between the concentrations of PAH and the occurrence of liver tumors in flounder in Danish and German waters of the North Sea, although the researchers did not exclude the possibility of tumors being triggered by these substances [Koehler, 2004; Vethaak *et al.*, 2009].

During the works related to foundation and cable laying, sediments will be resuspended and the accumulated pollutants will be potentially released into the water column. Additional emission sources may include leakages of petroleum products caused by equipment or vessel failures. Taking into account the low concentrations of most harmful substances in sediments found during the years 2022–2023 in the Baltic East OWF area, it can be assumed that they will not pose a significant threat to ichthyofauna. The impact on fish related to releasing pollutants and biogenic substances from the sediments to the body of water will be negative, direct, temporary and local.

The **impact significance** is assessed to be negligible for all investigated fish species.

Habitat change

The occurrence of many impacts related to the implementation of the Baltic East OWF, such as noise or increased suspended solids concentration, may lead to a temporary significant reduction in **the availability of the Project area** for ichthyofauna. Works carried out during the Baltic East OWF implementation phase will lead to permanent destruction of benthos in places where foundations are installed and periodic reduction of benthos resources in the areas of trenches where cables will be laid. This will result in a **depletion of food resources** for benthivorous fish on a local scale. However, the surface of the seabed where the works will cause destruction of benthic organisms should not exceed 5% of the total Baltic East OWF area.

Impact characteristics

Given the active movement of fish in search of food, this relatively low, in the scale of available resources, loss of organisms in the benthophelagic fish diet can be considered insignificant. Also, the potential reduction of the fish food resources caused by the negative impact of the increase in suspended solids concentration in water and covering the seabed with a layer of fine sediment from water on zoobenthos will probably be insignificant.

The Baltic East OWF area is neither a cod spawning ground nor a deep-water spawning ground of the European flounder dominant in this area. During ichthyological surveys sprat spawning was discovered, but this sea basin is small in comparison with the large area of this species' spawning grounds. Due to too deep depth of this sea basin, the herring demersal eggs are not spawned there either. There is also no spawning of partially protected species: sand goby, common seasnail and straightnose pipefish.

Surveys carried out in 2022–2023 showed that the Baltic East OWF area provides favorable food conditions for cod. Destruction of zoobenthos in a small part of this area (below 5% of the total area) should not significantly reduce the food base of this species, and possible avoidance of a part of this area caused by the performed works may be of greater significance. However, it is difficult to assess the extent of such an impact. The aforementioned surveys carried out in the North Sea [van der Knaap *et al.* 2022] showed that piling carried out at a distance of 2.3 to 7 km from the area where favorable food conditions for cod occurred (the area of the neighboring wind farm) did not result in cod leaving the feeding ground area. Therefore, it can be assumed that the works carried out at certain spots will not result in exclusion of the availability of the entire area. A similar assumption can be made for European flounder, although the tendency to avoid the area of performed works should be smaller due to lower sensitivity to acoustic stimuli.

Receptor sensitivity

In the case of fish feeding in the pelagic zone (herring, sprat), even complete periodic leaving the Project area will not limit the food base due to its availability in the neighboring areas.

The impact on fish related to the change of habitat will be negative, direct, temporary and local.

The **impact significance** is assessed to be negligible for all investigated fish species.

Barrier creation

Unfavorable environmental conditions caused by the performed works (high concentration of suspended solids in the water column, noise caused by the installation and dredging works performed) and increased vessel traffic in relation to the one present at the implementation stage may cause fish to avoid the Project area. This may result in disturbance of migration routes running through the area discussed. However, the surveys carried out at Danish offshore wind farms did not show any significant disturbances in fish migration caused by vessel traffic [Leonhard *et al.*, 2011]. Despite potentially higher traffic intensity during the implementation phase, the active ability of fish to move should limit the negative impact of this factor. If no similar impacts from nearby regions occur at the same time, it can be assumed that the scale of the impact will be local and short-term, leading only to temporary avoidance of the area during the works.

The impact related to the creation of the barrier will be a negative, direct, local and short-term impact on all fish species.

The **impact significance** is assessed to be negligible for all investigated fish species.

For the assessment of impacts, the methodology developed for the purposes of the EIA Report was adopted. The impact significance of the Baltic East OWF was assessed for the implementation phase after the application of the noise reduction system (NRS). The results are presented in table [Table 53]. The basis for assessment were the results of underwater noise propagation modeling, which are included in Appendix No. 2 to the EIA Report.

A summary of the impact of the Baltic East OWF implementation phase on ichthyofauna is presented in table [Table 71] below. The impact significance of the Baltic East OWF was assessed for the implementation phase after the application of the noise reduction system (NRS). The basis for assessment were the results of underwater noise propagation modeling, which are included in Appendix No. 2 to the EIA Report.

Table 71 Significance of impact on ichthyofauna during the Baltic East OWF implementation phase

IMPACT	IMPACT DESCRIPTION	SPECIES	SCALE OF IMPACT	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
Noise and vibrations	Mortality	Cod	Low	High	Insignificant (N)
	Reduction in spawning processes		Low	High	Insignificant (N)
	Reduction in foraging		Low	High	Insignificant (N)
	Mortality	Herring	Insignificant	High	Negligible (N)
	Reduction in spawning processes		Insignificant	Moderate	Negligible (N)
	Reduction in foraging		Low	High	Insignificant (N)
	Mortality	Sprat	Insignificant	Moderate	Negligible (N)
	Reduction in spawning processes		Low	Moderate	Insignificant (N)
	Reduction in foraging		Low	Moderate	Insignificant (N)
	Mortality	European flounder	Insignificant	Moderate	Negligible (N)
	Reduction in spawning processes		Low	Moderate	Insignificant (N)
	Reduction in foraging		Low	Moderate	Insignificant (N)

IMPACT	IMPACT DESCRIPTION	SPECIES	SCALE OF IMPACT	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
	Mortality	Protected species	Insignificant	High	Negligible (N)
	Reduction in spawning processes		Low	Very high	Insignificant (N)
	Reduction in foraging		Low	High	Insignificant (N)
Increase in the concentration of suspended solids in the water depth	Increased mortality, reduced growth rate, susceptibility to diseases	Cod	Insignificant	High	Negligible (N)
		Herring	Insignificant	Moderate	Negligible (N)
		Sprat	Insignificant	Moderate	Negligible (N)
		European flounder	Insignificant	Moderate	Negligible (N)
		Protected species	Insignificant	Moderate	Negligible (N)
Release of pollutants and biogens from sediments	Morphological and physiological changes, reproductive and developmental disorders, most vulnerable maturing females, young embryos, larvae just after resorption of the yolk sac and early larval stages	Cod	Insignificant	Moderate	Negligible (N)
		Herring	Insignificant	Moderate	Negligible (N)
		Sprat	Insignificant	Low	Negligible (N)
		European flounder	Insignificant	Low	Negligible (N)
		Protected species	Insignificant	Moderate	Negligible (N)
Habitat change	Temporary or permanent loss of habitat, reduction in food base, deterioration of spawning conditions	Cod	Insignificant	Moderate	Negligible (N)
		Herring	Insignificant	Moderate	Negligible (N)
		Sprat	Insignificant	Low	Negligible (N)
		European flounder	Insignificant	Moderate	Negligible (N)
		Protected species	Insignificant	Moderate	Negligible (N)
Barrier creation	Physical barrier to fish migration	Cod	Insignificant	Moderate	Negligible (N)
		Herring	Insignificant	Low	Negligible (N)
		Sprat	Insignificant	Low	Negligible (N)
		European flounder	Insignificant	Low	Negligible (N)
		Protected species	Insignificant	Low	Negligible (N)

The conducted assessment showed that the significance of all impacts at the implementation stage, except for noise and vibration emission, will be negligible. The impact of noise and vibration will be of little importance for cod both in terms of mortality and spawning and nutrition processes. In the case of sprat, European flounder and the protected species, negligible significance was determined for the level of mortality and insignificant impact on spawning and feeding.

5.1.1.9.4 Impact on marine mammals

During the Baltic East OWF implementation phase, the following impacts on marine mammals were identified:

- increase in underwater noise level;
- change in the habitat and food base.

- **Increase in underwater noise level**

During the Baltic East OWF implementation phase, **two main noise sources** are identified, which may have an impact on marine mammals – piling and increased vessel traffic in relation to the one present in this area.

1) **Piling**

Wind turbines will be erected on large-diameter piles driven into the seabed. The pile driving process during construction works will involve the generation of underwater noise, which may significantly increase the ambient noise level around the construction site and at large distances from it.

One of the common methods of pile foundation is impact driving, during which a hydraulic hammer repeatedly hits the top of the pile, approximately once per second. Sounds generated during piling are high intensity and have a wide frequency range, including in bands important for porpoises and seals. They may significantly impact both these groups of marine mammals.

Impact characteristics

Marine mammals, both porpoises and seals, respond to increased noise levels in the environment. Underwater noise is detected by animals when its values exceed the naturally occurring ambient noise level. Due to the major importance of sounds for the biology of porpoises and seals, noise may have a significant impact on their behavior and physiological condition. In general, the impact of noise on animals can be divided into several categories: detection, masking, behavioral changes and physiological damage, such as permanent and temporary hearing loss [Thomsen *et al.*, 2021].

Detection means that the body is able to hear the signal but does not show a clear response. Masking occurs when noise interferes with the detection of biologically relevant signals, for example, used for communication and orientation in space. This occurs when the frequency of sounds in the environment is in a spectrum relevant to a given species and exceeds the level of naturally occurring ambient noise. Behavioral response involves various behavioral changes due to exposure to noise, such as, for example, escaping from the affected area, cessation of foraging or resting, faster swimming or deeper diving. Under the influence of long-term exposure to unwanted sounds, repeated behavioral modifications may lead to a decrease in the physiological condition of individuals and a change in their range of occurrence. As a result, there may be an impact at the population level. Hearing damage includes temporary (TTS) and permanent (PTS) hearing threshold shifts. In the case of TTS, the animal may regain its original ability to perceive sounds after the negative factor has ceased and the recovery period has elapsed. PTS leads to irreversible damage to the hearing organ. In the case of marine mammals that rely primarily of hearing senses, such impacts are of very significant negative significance and may have an impact at the population level. Noise-induced physiological changes affect tissue or organ damage, which in extreme cases can even lead to death.

The above impacts occur in zones the size of which depends on the sensitivity of organisms exposed to noise, type of emitted sounds and conditions of their propagation in a given location.

In order to determine the impact zones in the form of hearing damage (TTS and PTS) and behavioral changes for various groups of organisms, criteria are used to describe the noise level that cannot be exceeded in order to produce a given effect. Such criteria are used internationally, including for the description of the impact of noise on porpoises and seals [e.g. NMFS 2018 and 2022].

The way piling sounds propagate depends on many factors such as seabed type, seabed penetration depth, water depth, and hydrological conditions. Therefore, the degree of generated noise impact on marine organisms is strongly dependent, among others, on the location of works. To estimate the potential impact of piling noise during the construction of the Baltic East OWF on marine mammals, numerical modeling of underwater noise propagation was conducted, constituting **Appendix** No. **3 to** this Report. As part of modeling, the distance ranges and areas where animals could potentially be affected were calculated. The analyses were carried out taking into account impulse noise exposure thresholds based on international criteria and survey results. The values applied are presented in table [Table 72].

Table 72 Acoustic thresholds adopted for the assessment of the impulse noise impact on marine mammals [Source: internal materials based on the indicated literature]

SPECIES/ ANIMAL GROUP	EFFECT	ACOUSTIC THRESHOLD SEL [DB RE 1µPA²S] / SPL [DB RE 1 µPA]]	ACOUSTIC THRESHOLD SPL PEAK [DB RE 1 µPA]	SOURCE
Common porpoise	PTS cum.	155 (VHF-weighted SEL)	202	NMFS, 2018; 2023; Southall i in., 2019
	TTS cum.	140 (VHF-weighted SEL)	196	
	Behavioural change	103 (VHF-weighted SPL_{125ms})	-	Tougaard, 2021
Seals	PTS cum.	185 (PW-weighted SEL)	218	NMFS, 2018; 2023
	TTS cum.	170 (PW-weighted SEL)	212	
	Behavioural change	158 (Unweighted SEL)	212	Russel i in., 2016

Sound propagation analyses during piling works in the Baltic East OWF area were carried out for scenarios without the application and with the use of mitigation measures representing sample elements of a Noise Reduction System. Two types of mitigation were considered – application of a big bubble curtain (BBC) and with simultaneous use of a double big bubble curtain (DBBC) and a hydro sound damper (HSD). The modeling was performed for two seasons – summer and winter. The summer season was considered the worst scenario from an environmental point of view (on the basis of the results of marine mammal monitoring). In contrast, the winter season was considered the worst scenario from a physical point of view (best conditions for sound propagation). The analyses were performed for a monopile with a diameter of 12 m, for two potential locations of piling sites located in different parts of the OWF area, at different depths – western (35 m) and eastern (41 m) locations.

Mitigation measures used in the modeling are examples of currently available technologies, which constitute one of the elements of the Noise Reduction System, which is an integral part of the Project (detailed description in section **2**).

Taking into account the assessment of the impact on animals, the most important results obtained for the hearing damage effect (TTS and PTS) during piling of a single turbine concerned the cumulative case, i.e. assuming the total time required for driving a single pile. In the case of behavioral change, the response of animals to sound from a single hammer impact was taken into account. The obtained results allowed to determine approximate ranges and areas where a given impact may occur. Additionally, in the case of the porpoise, the obtained values were used to calculate to what extent the proposed construction works may impact the population status of this species in the Baltic Proper. For this purpose, the number of animals potentially exposed to a given effect and the percentage of the population that these individuals represent were estimated. Data on the abundance and density of porpoises from the population of the north-eastern Baltic Sea based on Amundin *et al.* [2022] were used for calculations, assuming two seasons were included in the modeling [Table 73].

Table 73 Estimated values of density and abundance of porpoises of the Baltic Proper population adopted for calculations of the piling noise impact [Source: internal materials based on Amundin et al. 2022]

REGION	SEASON		DENSITY [NUMBER OF ANIMALS/ 1000 KM^2]		ABUNDANCE	
	References	Modeling	Value	95% CL	Value	95% CL
North-East Baltic Sea	May – October	Summer	3.70	0.54–8.33	491	71–1,105
	November – April	Winter	1.83	0.71–4.22	243	94–560

Receptor sensitivity

Porpoises rely on sound in most aspects of life, and hearing is their most important sense. These mammals can hear in a wide frequency range – from much below 1 kHz to 180 kHz, with the highest sensitivity in the ultrasonic range, between approximately 50–130 kHz [Andersen, 1970; Popov *et al.*, 1986; Kastelein *et al.*, 2002, 2010]. They also use echolocation signals with a frequency centered around 130 kHz [Villadsgaard *et al.*, 2007].

Seals are two-environment animals whose hearing is good, both in the air and in water. Underwater vocalization of gray seals and harbor seals is characterized by low frequencies. In the case of gray seal, mating sounds were tested in the frequency range of 100 Hz–1.3 kHz, whereas in the case of harbor seals – approximately 250 Hz to 1.4 kHz [Asselin *et al.*, 1993; Van Parijs *et al.*, 2003A, 2003b]. In general, seals are considered to be less sensitive to unwanted sounds than porpoises. The surveys also indicate that seals may get used to exposure to certain types of noise [Edrén *et al.*, 2010].

Data on the impact of piling noise on porpoises and seals are taken from surveys carried out both in the field, i.e. during the construction of wind farms and in laboratory conditions. Important information in this respect was obtained during the construction of wind farms in the North Sea. The surveys showed that the zone where the behavior of porpoises changes depends on the location and may extend up to 26 km depending on the case analysed. Behavioral changes observed included avoidance response and reduction of acoustic activity [Tougaard *et al*., 2009; Dähne *et al.*, 2013; Brandt *et al.*, 2012, 2018]. Recorded sound intensity levels for which responses took place were relatively low, on average approximately 140 dB re 1 $\mu Pa^2 s$ [Dähne *et al.*, 2013; Brandt *et al.*, 2011]. Moreover, laboratory analyses showed that pulse noise generated during piling may cause temporary hearing loss (TTS) in porpoises [Lucke *et al.*, 2009; Kastelein *et al.*, 2012, 2016]. In the worst-case scenario, complete hearing loss (PTS) is also possible.

Surveys of the impact of piling noise on seals carried out in the North Sea and in laboratory conditions showed that the responses of animals may differ. It was found that seals may not react at all, change behavior, for example by stopping to forge, or leave the area around the noise source. For the cases analysed, the avoidance zone extended up to 25 km from the place where the piles were driven [Dietz *et al.*, 2003; Russell *et al.*, 2016; Aarts *et al.*, 2018; Kastelein *et al.*, 2018]. As in the case of porpoises, laboratory tests have shown that noise generated during piling may cause temporary hearing loss in seals [Kastelein *et al.*, 2012, 2018]. Similarly, complete hearing loss is also possible.

The sensitivity of receptors was determined as a result of the following parameters: sensitivity of the receptor to a given effect from the point of view of the species/population biology, size of the population and size of the population within the impact range, significance of the population within the impact range, protection level. Sensitivity of receptors to possible impacts of underwater noise is moderate to high.

Impact significance

The results of numerical modeling showed that in order to carry out the piling process in the Baltic East OWF area, it will be necessary to use mitigation measures due to the possibility of hearing damage to porpoises and seals, both in the form of TTS and PTS. Exceeded permissible acoustic thresholds were found for all scenarios analysed (Appendix No. 3 to the EIA Report). Therefore, the impact assessment as part of this report was carried out with the assumption of applying measures that limit noise propagation during piling, which the Applicant treats as an inseparable element of the Project.

In the case of porpoises, on the basis of the results obtained, it can be assumed that during piling in a single location, the use of mitigation in the form of BBC will be sufficient to reduce the impact of noise in the form of hearing damage (TTS, PTS). The impact ranges obtained in each of the scenarios analysed are limited to the area directly around the sound source [Table 74]. The results were presented taking into account piling in a single location, with the application of mitigation measures. The number and percentage of porpoises was calculated on the basis of data on the population size of the north-eastern Baltic Sea in Amundin *et al.* [2022]. The results were presented assuming the upper and lower limit of density and abundance of animals within a 95% confidence interval, taken into consideration in Amundin *et al.* [2022].

Table 74 Expected ranges of piling noise impact during construction works in the Baltic East OWF area obtained for porpoises on the basis of numerical modeling, together with the results of calculations of the part of the Baltic Sea porpoise population exposed to impact.

Piling location	Type of mitigation	Season	Effect	Maximum impact range [km]	Impact area [km^2]	Number of porpoises affected	Percentage of porpoises affected [%]
Western	BBC	Summer	PTS cum.	0.1	0.03	<0.01	<0.01
			TTS cum.	0.1	0.03	<0.01	<0.01
			Behavioural change	10.6	239	0.1 – 2	0.2 – 0.2
		Winter	PTS cum.	0.1	0.03	<0.01	<0.01
			TTS cum.	0.1	0.03	<0.01	<0.01
			Behavioural change	15.5	558	0.4 – 2.4	0.4 – 0.4
	HSD + DBBC	Summer	PTS cum.	0.1	0.03	<0.01	<0.01
			TTS cum.	0.1	0.03	<0.01	<0.01
			Behavioural change	8.8	153	0.1 – 1.3	0.1 – 0.1
		Winter	PTS cum.	0.1	0.03	<0.01	<0.01
			TTS cum.	0.1	0.03	<0.01	<0.01
			Behavioural change	12.3	326	0.2 – 1.4	0.2 – 0.2
Eastern	BBC	Summer	PTS cum.	0.1	0.03	<0.01	<0.01
			TTS cum.	0.1	0.03	<0.01	<0.01
			Behavioural change	11.1	268	0.1 – 2.2	0.2 – 0.2
		Winter	PTS cum.	0.1	0.03	<0.01	<0.01
			TTS cum.	0.1	0.03	<0.01	<0.01

Piling location	Type of mitigation	Season	Effect	Maximum impact range [km]	Impact area [km²]	Number of porpoises affected	Percentage of porpoises affected [%]
			Behavioural change	16.8	599	0.4 – 2.5	0.5 – 0.5
	HSD + DBBC	Summer	PTS cum.	0.1	0.03	<0.01	<0.01
			TTS cum.	0.1	0.03	<0.01	<0.01
			Behavioural change	9.1	164	0.1 – 1.4	0.1 – 0.1
		Winter	PTS cum.	0.1	0.03	<0.01	<0.01
			TTS cum.	0.1	0.03	<0.01	<0.01
			Behavioural change	12.9	342	0.2 – 1.4	0.3 – 0.3

None of the mitigation methods analysed will allow reducing the range of behavioral response to a minimum. The modeled impact areas are up to 599 km^2 for BBC and 342 km^2 for HSD + DBBC in the winter scenario, in the eastern location. The results for the western location and summer season are within the lower range of values, up to a maximum of 239 km^2 for BBC. It should be taken into account that in the area analysed the frequency of occurrence of porpoises is generally low. Animals appear occasionally and the detection number for them even during the period of the highest activity (summer/autumn) is relatively low. This is evidenced by the results of the conducted acoustic monitoring and literature data, including from the neighboring proposed OWFs (section 3.1.1.1.6). Moreover, the forecast impact ranges for behavioral response are smaller than the distance from areas important for the biology of Baltic porpoises or within which the species is protected. The closest Natura 2000 sites, where the porpoise is the subject of protection, are *Ostoja Słowińska* [Słowińska Refuge] and *Hoburgs bank Midsjöbankarna*, located approximately 27 km and 67 km away from the Baltic East OWF (distance from the locations for which modeling was conducted), respectively. However, the maximum modeled impact range is approximately 17 km (eastern location). Therefore, it can be assumed that the behavioral change effect due to piling will not have a significant impact on the condition of the Baltic Proper population. Porpoises are likely to avoid the area with increased sound intensity, which may result in temporary limitation of the availability to food in the area affected by the impact. It is assumed that after the disruptor has ceased, the animals will reappear.

As regards seals, the analyses carried out showed that a single mitigation measure of BBC is not sufficient to exclude the probability of hearing damage in the form of TTS. The largest impact areas were found in the winter season, up to 109 km^2 for the eastern location and 72 km^2 in the western location [Table 75]. The results were presented taking into account the application of mitigation measures.

Table 75 Expected ranges of piling noise impact in a single location during construction works in the Baltic East OWF area, obtained for seals based on numerical modeling.

Piling location	Type of mitigation	Season	Effect	Maximum impact range [km]	Impact area [km^2]
Western	BBC	Summer	PTS $_{cum.}$	0.1	0.03
			TTS $_{cum.}$	2.0	1.9
			Behavioural change	4.5	54.7
		Winter	PTS $_{cum.}$	0.1	0.03
			TTS $_{cum.}$	5.9	71.8
			Behavioural change	5.9	96.0
	HSD + DBBC	Summer	PTS $_{cum.}$	0.1	0.03
			TTS $_{cum.}$	0.1	0.03
			Behavioural change	2.0	10.8
		Winter	PTS $_{cum.}$	0.1	0.03
			TTS $_{cum.}$	0.1	0.03
			Behavioural change	2.3	13.6
Eastern	BBC	Summer	PTS $_{cum.}$	0.1	0.03
			TTS $_{cum.}$	3.3	8.4
			Behavioural change	7.6	114
		Winter	PTS $_{cum.}$	0.1	0.03
			TTS $_{cum.}$	8.6	108.6
			Behavioural change	9.1	203
	HSD + DBBC	Summer	PTS $_{cum.}$	0.1	0.03
			TTS $_{cum.}$	0.1	0.03
			Behavioural change	2.4	13.8
		Winter	PTS $_{cum.}$	0.1	0.03
			TTS $_{cum.}$	0.1	0.03
			Behavioural change	2.7	17.7

In the summer season, the impact range is smaller, covering an area of up to approximately 8 km^2 in the case of the eastern location. The use of double mitigation in the form of HSD + DBBC limits the impact in the form of TTS to negligible. Taking into account the behavioral response of seals, none of the mitigation measures analysed completely reduce the probability of impact. The largest impact areas with the application of BBC were found in the eastern location – 203 km^2 in the winter season and 114 km^2 in the summer season. The use of HSD + DBBC limits the occurrence of the effect to a maximum of 18 km^2 in winter and 14 km^2 in summer (eastern location). When analysing the above values, it should be taken into account that the frequency of occurrence of seals in the area analysed is generally low. Animals appear in the area around the Baltic East OWF occasionally throughout the year, probably during migration and in search of food. The low number of seals reduces the probability of the TTS occurrence predicted in the BBC scenario and the impact of the effect on the population condition. In the case of behavioral changes, the impact of piling noise may cause animals to temporary avoid the area of works, which should not have a significant impact on them.

To sum up, the conducted analyses showed that noise generated during piling in the Baltic East OWF area may propagate over long distances significantly affecting marine mammals, therefore the application of mitigation measures is necessary when carrying out the piling process. Taking into account the effect of hearing damage, the use of a single mitigation measure in the form of BBC may not be sufficient to exclude the possibility of TTS occurrence in seals. In the case of behavioral changes, the mitigation methods analysed do not ensure limiting the impact ranges to a minimum. In particular for porpoises, the impact areas are relatively large. However, given that the proposed location of the Baltic East OWF is located in the area where porpoises and seals appear at low frequency, it is assumed that the significance of the behavioral effect related to piling noise will be minor. Additionally, the modeling results showed that if mitigation measures are applied, in none of the scenarios analysed are the permissible noise levels expected to be exceeded in the nearby Natura 2000 sites, where the porpoise is the subject of protection.

2) Vessel traffic

The Baltic East OWF implementation phase will involve an **increased vessel traffic,** which may increase the level of ambient noise naturally occurring in the area.

Impact characteristics

Underwater noise generated by vessels and boats comes, among other things, from propulsion systems. Its intensity and properties depend on many factors, including the type and size of the vessel, engine type, fuselage shape or sea conditions. Low frequency sounds are generated mainly by large and slower vessels, while high frequencies are mainly related to small and fast boats. The division of vessels taking into account the frequency and intensity of generated noise according to OSPAR (2009) is presented in table [Table 76].

Table 76 Division of vessels taking into account the frequency and intensity of generated noise [source: OSPAR, 2009]

VESSEL TYPE	LENGTH [M]	FREQUENCY AND INTENSITY OF THE SOUND GENERATED
Small pleasure crafts and boats	<50	160–175 dB re 1µPa at 1 m; <1kHz>10 kHz
Medium-sized vessels	50–100	165–180 dB re 1µPa at 1 m; <1 kHz
Large vessels	>100	180– >190 dB re 1µPa at 1 m; <200 Hz

Vessel-generated sounds have a large frequency range that may coincide with frequencies relevant to marine organisms. As the main noise energy from vessels is generally below 1 kHz (e.g.Richardson, 1995; OSPAR 2009), organisms most exposed to impacts are organisms for which low frequencies are most important (e.g. fish)). However, a significant part of the noise energy generated by vessels is in the high frequency band (tens of Hz), which is very important, among others, for porpoises. **The scale of impact** on marine mammals was determined as low.

Sensitivity

Surveys of the impact of noise from vessels on porpoises were carried out, among others, in Danish straits – a region with high traffic intensity of various vessel types. The analyses showed that in the conditions of sudden increase in the level of high-frequency noise generated by fast moving vessels, animals reacted with behavioral changes – among others, they dived more frequently and stopped foraging. In some cases, a decrease in echolocation frequency was also observed, which could potentially have an impact on the efficiency of foraging [Wiśniewska *et al.*, 2018]. Porpoise responses were also investigated in another area with high vessel traffic intensity – Istanbul Bay (Turkey). Under conditions of intensive vessel traffic, reduced forging of animals at the water surface was recorded [Akkaya-Bas, 2017b]. It was also observed that porpoises avoided the areas of the Bay with the highest vessel traffic intensity. It was assumed that such impacts may have an impact on the energy budget of animals and, consequently, on the physiological condition of individuals [Akkaya-Bas *et al.*, 2017a]. However, it is worth noting that for the cases analysed, it is not clear whether porpoises responded to the presence of vessels themselves or the noise generated by them.

Impact significance

With reference to the Baltic East OWF implementation phase, it is assumed that mainly vessels generating low frequency sounds with a lower impact on porpoises will be used. However, it may be suspected that animals will temporarily avoid the area with increased vessel traffic. These assumptions are confirmed by the surveys carried out during the construction of the Nord Stream 2 pipeline. The monitoring carried out in the Swedish investment project area showed that the noise emission from vessels used at the construction stage was comparable to the commercial cargo vessels navigating in the vicinity. This applied to both the levels and frequency of the sounds generated. It was concluded that porpoises could temporarily avoid the construction site, most probably at a small distance from the noise source [Tougard and Giffits, 2020].

In the case of seals, surveys indicate that low-frequency sounds generated by vessels may disturb the vocalization of these animals [Erbe *et al.*, 2019]. However, it should be taken into account that seals are unlikely to appear in larger groups or for mating purposes in the Baltic East OWF area, i.e. in situations in which they use vocalization. Therefore, it may be suspected that sounds generated by vessels used for construction should not interfere with the behavior of the animals appearing in the area.

It is also worth noting that in the Baltic Sea, the low frequency noise level related to vessel traffic is generally high [HELCOM, 2018b]. Therefore, both porpoises and seals are exposed to this factor in many areas where they appear.

Change of habitat and food base

The construction of the wind farm may have an impact on the change of chemical parameters of sea water, e.g. due to the lifting of suspended solids from the seabed. Such fluctuations in the environment may have an indirect impact on marine mammals, mainly in relation to the impact on the food base, i.e. fish populations. Changes in water parameters related to the construction process may have a negative impact on populations of plankton and benthic organisms on which fish feed. As a result, the number of these animals may temporarily decrease and, consequently, the potential source of food and feeding habitat for marine mammals may be lost.

A summary of the impact of the Baltic East OWF implementation phase on marine mammals is presented in tables [Table 77-Table 78]. The analysis was carried out with the assumption of using a single mitigation in the form of the BBC.

Table 77 Characteristics of impacts on marine mammals forecast for the Baltic East OWF implementation phase in the offshore part, assuming the application of mitigation measures in the form of the BBC during piling [source: internal materials]

Animal species/group	Type of impact	Type of impact			Spatial range			Duration					Type	
		Direct	Indirect	Secondary	Transboundary	Regional	Local	Long-term	Medium-term	Short-term	Temporary	Permanent	Positive	Negative
Common porpoise	Increase in underwater noise level due to piling – PTS cum (BBC)	x					x					x		x
	Increase in underwater noise level due to piling – TTS cum (BBC)	x					x		x					x
	Increase in underwater noise level due to piling – behavioural changes (BBC)	x				x			x		x			x
	Increase in underwater noise level – vessel traffic	x					x		x		x			x
	Change of habitat and food base		x				x		x		x			x

Animal species/group	Type of impact	Type of impact			Spatial range			Duration					Type	
		Direct	Indirect	Secondary	Transboundary	Regional	Local	Long-term	Medium-term	Short-term	Temporary	Permanent	Positive	Negative
Seals	Increase in underwater noise level due to piling – PTS_{cum} (BBC)	x					x					x		x
	Increase in underwater noise level due to piling – TTS_{cum} (BBC)	x				x			x		x			x
	Increase in underwater noise level due to piling – behavioural changes (BBC)	x					x		x		x			x
	Increase in underwater noise level – vessel traffic	x					x			x	x			x
	Change of habitat and food base		x				x		x					x

Table 78 Assessment of the significance of impacts on marine mammals during the Baltic East OWF implementation phase, assuming the application of mitigation measures in the form of the BBC during piling [source: internal materials]

Animal species/group	Impact	Scale of impact	Sensitivity of the receptor	Impact significance
Common porpoise	Increase in underwater noise level due to piling PTS_{cum} (BBC)	Low	High	Low (N)
	Increase in underwater noise level due to piling TTS_{cum} (BBC)	Low	High	Low (N)
	Increase in underwater noise level due to piling behavioural changes (BBC)	Moderate	High	Moderate (N)
	Increase in underwater noise level – vessel traffic	Low	Moderate	Low (N)
	Change of habitat and food base	Low	High	Low (N)
Seals	Increase in underwater noise level due to piling PTS_{cum} (BBC)	Low	High	Low (N)
	Increase in underwater noise level due to piling TTS_{cum} (BBC)	Moderate	High	Moderate (N)
	Increase in underwater noise level due to piling behavioural changes (BBC)	Low	Moderate	Low (N)
	Increase in underwater noise level – vessel traffic	Irrelevant	Low	Negligible (N)
	Change of habitat and food base	Low	Moderate	Low (N)

As a result of the analysis conducted, the impact of the Project on marine mammals during the implementation phase was determined as of negligible to moderate importance assuming the use of NRS.

5.1.1.9.5 Impact on seabirds

During the Baltic East OWF implementation phase, the following impacts on seabirds were identified:

- Vessel traffic;
- Emission of noise and vibration;
- Lighting of the Project area;
- Creation of a barrier for birds;
- Collisions with vessels;
- Destruction of benthic habitats;
- Increase in suspended solids concentration in water and depositing of disturbed sediments;

- **Vessel traffic**

During the Project implementation phase there will be various types of vessels present, which will disturb seabirds by their physical presence, noise (including noise generated by driving piles) and light emission. The first two factors should not cause a change of the flight route of those species of aquatic birds that do not use the area, but only fly over it (e.g. migrating bentophagus and ichthyofauna). However, it cannot be excluded that such impact will be marked at night, especially when the construction site is heavily illuminated. Birds navigate as they migrate according to natural light sources such as stars and the sun. It has been noticed that at night they also head towards lighthouses, drilling rigs and other structures illuminated by artificial light (Wiese *et al.*, 2001).

The **scale of impact** will depend on the number of vessels involved, their size, the way the vessel is illuminated and the intensity of light sources. The duration of the implementation phase and the location of the turbine and OSS within the Baltic East OWF area where increased vessel traffic will take place are also affected. The period in which the works will take place is important, as most species of seabirds, including the long-tailed duck, show very large differences in population size in individual phenological periods. The disturbance effect will increase with the progressing development of the OWF area. Initially, it will be of local nature and birds will be able to find feeding grounds in the vicinity (e.g. in the neighboring Przybrzeżne wody Bałtyku [Costal Waters of the Baltic Sea] and Ławica Słupska [Słupsk Bank] Natura 2000 sites, however, at the end of construction phase the range of this impact will significantly increase, strongly limiting feeding and resting possibilities for birds in the Baltic East OWF area.

On the other hand, the presence of vessels and fixed structures protruding from the water will result in a higher number of gulls that use such components as resting sites and seek food in the vicinity of the vessels. In the open sea, gulls gather around fishing vessels. If, during construction (or future operation), commercial fishing is reduced in this sea basin during the wind farm operation, these gulls will move (at least partially) to other fishing sites.

Vessel traffic during the implementation phase will cause direct and negative impact on seabirds. In the case of benthivorous and piscivorous birds, this is an impact of regional range due to a possible impact on the biogeographical population of the species, and an impact of a local range in the case of gulls. In the case of benthivorous and piscivorous birds, this is a short-term impact, and a temporary impact in the case of gulls.

Sensitivity to the impact for the gulls was assessed as low, and for other species as high.

Impact significance was determined as significant for bentophagus and ichthyophagus species and insignificant for gulls.

- **Emission of noise and vibration**

The presence and traffic of construction vessels will be the main cause of disturbance of seabirds in the sea basin covered by the construction of the Baltic East OWF. This impact will be much higher than other pressures related to the implementation phase, such as underwater noise emission.

The monitoring of birds during the construction works of the Egmond aan Zee OWF in the Netherlands did not show any noticeable reaction to piling on the part of the bird species that are insensitive to disturbances related to the presence of vessels, mainly the gulls and the terns (Leopold *et al.*, 2007).

Noise and vibrations during the implementation phase are direct negative impacts on seabirds. For bentophagus and ichthyophagus species, this is an impact of regional range due to a possible impact on the biogeographical population of the species, and an impact of a local range for gulls. In the case of benthivorous and piscivorous birds, this is a short-term impact, and a temporary impact in the case of gulls.

Sensitivity to the impact for the gulls was assessed as low, and for other species as high.

Impact significance was determined as significant in the case of benthivorous and piscivorous birds, and insignificant in the case of gulls.

- **Lighting of the Project area**

Surveys on the behavior of birds near oil rigs has shown that lighting causes gathering of seabirds around these structures not only during the migration period. This was mostly the case for tubenoses (Procellariiformes), which are most often active at night, but also concentrations of the little auk were observed (*Alle alle*) (Wiese *et al.*, 2001), which are closely related to razorbills and guillemots, found in the area of the planned project. However, in the case of most species of typical seabirds (sea ducks, Gaviiformes), the impact of artificial lighting on birds present in the immediate and further vicinity of light sources remains very poorly explored.

Project area lighting during the implementation phase will cause direct and negative impact on seabirds. In the case of benthivorous and piscivorous birds, this is an impact of regional range due to a possible impact on the biogeographical population of the species, and an impact of a local range in the case of gulls. In the case of benthivorous and piscivorous birds, this is a short-term impact, and a temporary impact in the case of gulls.

Sensitivity to the impact for the gulls was assessed as low, and for other species as high.

Impact significance was determined as significant for bentophagus and ichthyophagus species and insignificant for gulls.

- **Barrier creation**

The Baltic East OWF structures gradually appearing during the implementation phase will deter birds. The influence of this impact on birds depends on the progress of constructing the OWF. At the outset, individual wind turbines will have little impact on birds, but the deterring effect will gradually increase (Stewart *et al.*, 2005). Literature data clearly show that seabirds avoid the area occupied by wind turbines and their population decreases within a radius of up to 2 or even up to 4 km (Christensen *et al.*, 2003; Petersen et al. 2006; Leopold et al. 2011; Krijgsveld *et al.*, 2011). Adult birds will most likely be able, to some extent, to get used to the presence of wind farms. However, specimens undertaking migration towards overwintering areas for the first time in life may have problems with bypassing an extensive barrier, created by a group of wind farms. This may result from their lower experience, which causes higher bird mortality in the first year of life (Clark *et al.*, 2007; Redmond *et al.*, 2012; McKim-Louder *et al.*, 2013). Lack of data on bird behavior in the vicinity of the area-wide OWF indicates the necessity to plan post-project monitoring surveys. The parameter affecting **the scale of impact** is the number and size of wind turbines under construction. The distance between individual wind turbines in the Baltic East OWF and neighboring OWFs is also important.

Both the implementation and operation of OWFs located close to the Baltic East OWF will result in the accumulation of the barrier effect for birds.

Given the requirements of environmental decisions for neighboring OWFs (Baltic Power and BC-Wind), in the design basis of the Baltic East OWF, the applicant designated an area excluded from installation of structures above water. This is a 4 km wide migration corridor for birds. Such separation of the Baltic East OWF development area allows to prevent and/or minimize the occurrence of the barrier effect for seabirds.

The presence of a large number of vessels used for the implementation of the wind farm may result in an additional barrier effect, thus reducing the possibility of birds moving between the resting areas during the migration. **The scale of impact** will depend on the number of vessels involved in the implementation phase, their size, the duration of the construction phase and the phenological period in which the works will be carried out.

The creation of a barrier will cause direct and negative impact on seabirds. In the case of benthivorous and piscivorous birds, this is an impact of regional range due to a possible impact on the biogeographical population of the species, and an impact of a local range in the case of gulls. In the case of benthivorous and piscivorous birds, this is a short-term impact, and a temporary impact in the case of gulls.

Sensitivity to the impact for the gulls was assessed as low, and for other species as high.

Impact significance was determined as significant for bentophagus and ichthyophagus species and insignificant for gulls.

- **Collisions with vessels**

Collisions between birds and the vessels used for implementation of the Baltic East OWF may occur, mainly during the night hours when the birds are lured by the light they emit. **The scale of impact** will depend on the number of vessels involved in the construction phase, their size, illumination configuration and its intensity, the duration of the implementation phase and the phenological period in which the works will be carried out.

Collisions with vessels during the implementation phase are direct and negative impacts on seabirds. In the case of benthivorous and piscivorous birds, this is an impact of regional range due to a possible impact on the biogeographical population of the species, and an impact of a local range in the case of gulls. In the case of benthivorous and piscivorous birds, this is a short-term impact, and a temporary impact in the case of gulls.

Sensitivity to the impact on the gulls was assessed as insignificant and for other species as high.

Impact significance was determined as significant in the case of benthivorous and piscivorous birds, and insignificant in the case of gulls.

- **Destruction of benthic habitats**

The design of support structures and laying of inter array power cables will cause numerous disturbances of bottom communities at the Project site.

Some of the habitats used by seabirds stopping during migration will be lost due to the construction of the foundations of support structures. This process will have a direct impact on the seabed and will have an impact on the water column. Natural benthic environments will be lost, but most likely they will be replaced by new ones (artificial reef effect). **The scale of impact** will mainly depend on the number of foundations or support structures of wind turbines as well as their type and size.

Bird species exposed to impacts related to the loss of bottom habitats as a result of occupied space are mainly sea ducks feeding on benthos. However, those species are very sensitive to disturbance caused by boats presence and other human activities at sea, therefore it is estimated that the disturbance impact due to the presence of construction vessels will be the main impact in the area, thus resulting in the movement of sensitive species to other areas. Therefore, those birds will not experience an additional impact related to the occupation of space in the implementation phase.

Destruction of benthic habitats is a direct and negative impact on seabirds. For bentophagus species, this is an impact of a regional range, due to a possible impact on the biogeographical population of the species, and an impact of a local range for gulls and ichthyophagus species. This is a short-term impact for bentophagus species and a temporary impact for gulls and ichthyophagus species.

Sensitivity to the impact on gulls and ichthyophagus species was assessed as insignificant and for bentophagus species as high.

Impact significance was determined as significant for bentophagus species, moderate for ichthyophagus species and insignificant for gulls.

- **Increase of suspended solids content in water and depositing of disturbed sediments**

During the OWF implementation, the bottom sediments will be disturbed and the concentration of suspended solids in water will increase. These factors may affect the ability of benthophagus and diving ichthyofagus to obtain food.

Direct transfer of sediments and their resuspension will result in reducing water transparency. If it exceeds the natural level, it could cause difficulties in hunting for birds that use their eyes when searching for food (ichthyophagus and bentophagus species), and thus result in the movement of birds preferring more transparent waters. No impact on birds feeding on the water surface (gulls) is expected.

The local decrease in water transparency in the OWF area will be short-term and its impact will be eliminated by other, more intensive disturbances causing birds to leave the area.

Sediment deposition related to preparation of the OWF seabed for foundation of support structures of wind turbines may affect benthic environments located in the OWF area and in its vicinity. A layer of disturbed sediments will be deposited on benthic organisms, which may disturb the possibility of gas exchange by these organisms and collection of nutrients by them. This phenomenon may lead to a reduction of benthic resources and fish that feed on it (reduction of biomass, reduction of growth and productivity) and, consequently, affect the food base for seabirds in this area.

An increase in suspended solids content in water during preparatory and construction works and sedimentation of disturbed sediments are indirect, negative and short-term impacts of local range on bentophagus and ichthyophagus species (birds diving in water in search of food). The impact on gulls was assessed as indirect, negative, temporary impact of local range.

Sensitivity to the impact on the gull was considered insignificant, for ichthyophagus species moderate and for bentophagus species high.

Impact significance was determined as significant for ichthyophagus species, moderate for bentophagus species and insignificant for gulls.

A summary of the impact of the Baltic East OWF implementation phase on seabirds is presented in table [Table 79] below. As a result of the conducted analysis, the Project impact on seabirds during the implementation phase was determined as low to significant.

Table 79 Significance of impact on seabirds during the Baltic East OWF implementation phase [Source: internal materials]

Species	Impact	Impact description	Scale of impact	Sensitivity	Impact significance
Piscivorous birds	Vessel traffic	Disturbance of the species as a result of transport to and from the project site and as a result of construction works, operation of machines and equipment necessary for the Project implementation	High	High	Significant (N)
	Emission of noise and vibration	Presence and movement of construction and other vessels	High	High	Significant (N)
	Illumination of the project site	Attracting and gathering birds around the project site	High	High	Significant (N)
	Collisions with vessels	Attracting birds to vessels at night and collisions with vessels	High	High	Significant (N)
	Barrier creation	Creation of a barrier by the structures of subsequent wind turbines and substations	High	High	Significant (N)
	Destruction of benthic habitats	Loss of habitats due to the erection of supporting structures	High	Insignificant	Moderate (N)
	Increase of suspended solids content in water and settling of agitated sediment	Disturbance of seabed sediments	High	Moderate	Significant (N)
Benthivorous birds	Vessel traffic	Disturbance of the species as a result of transport to and from the project site and as a result of preparation and construction works, operation of machines and equipment necessary for the Project implementation	High	High	Significant (N)
	Emission of noise and vibration	Presence and movement of construction and other vessels	High	High	Significant (N)
	Illumination of the project site	Attracting and gathering birds around the project site	High	High	Significant (N)
	Collisions with vessels	Attracting birds to vessels at night and collisions with vessels	High	High	Significant (N)
	Barrier creation	Creation of a barrier by the structures of subsequent wind turbines and substations	High	High	Significant (N)
	Destruction of benthic habitats	Loss of habitats due to the erection of supporting structures	High	High	Significant (N)

Species	Impact	Impact description	Scale of impact	Sensitivity	Impact significance
	Increase of suspended solids content in water and settling of agitated sediment	Disturbance of seabed sediments	High	Moderate	Moderate (N)
Seagulls	Vessel traffic	Disturbance of the species as a result of transport to and from the project site and as a result of preparation and construction works, operation of machines and equipment necessary for the Project implementation	Low	Moderate	Low (N)
	Emission of noise and vibration	Presence and movement of construction and other vessels	Low	Moderate	Low (N)
	Illumination of the project site	Attracting and gathering birds around the project site	Low	Moderate	Low (N)
	Collisions with vessels	Attracting birds to vessels at night and collisions with vessels	Low	Moderate	Low (N)
	Barrier creation	Creation of a barrier by the structures of subsequent wind turbines and substations	Low	Moderate	Low (N)
	Destruction of benthic habitats	Loss of habitats due to installation of foundations or support structures	Low	Moderate	Low (N)
	Increase of suspended solids content in water and settling of agitated sediment	Disturbance of seabed sediments	Low	Moderate	Low (N)

5.1.1.9.6 Impact on migratory birds

During the implementation phase, there will be impacts on migratory birds as a result of the barrier effect and the risk of collision with Baltic East OWF construction vessels, as analysed and described in detail in **Appendix No. 4 Results of modeling the collision risk and barrier effect on migratory birds**. Underwater noise and surface noise are not considered a potential impact on migratory birds.

- **Barrier effect**

The presence of construction vessels in the surveyed Baltic Sea area creates a physical barrier, which may affect the manner of movement of migratory birds. The scale of impact will depend on the number of vessels, their size, operating time, as well as season. Migratory birds that are sensitive to vessel-generated disturbances may change the flight trajectory vertically or horizontally, which may extend the flight and thus also increase the energy costs of migration. However, a change of route will constitute only a small part in the scale of the entire migration, therefore additional energy input related to this will be irrelevant, such as those calculated for the long-tailed duck by the Masden's team (Masden and Cook 2016). The analysis of the change of the migration route length during the next phase, namely operation phase, indicates a small extension of the route (approx. 0.02%). Changes in such size have a minimal impact on the length of the entire migration (Pennycuick 2001, Skov *et al.*, 2011). Due to the fact that the distance traveled by birds of the same species is not the same (due to different resting places, nesting places, differences in the route taken, etc.), the impact significance was assessed as negligible during the implementation phase for all analysed species and groups of species.

Collisions with construction vessels

Migratory birds, in particular some terrestrial species, may be attracted by lights used at night on vessels or during bad weather conditions (strong precipitation, fog). So far the scale of this impact is poorly known and the current state of knowledge does not allow to quantify this impact. There are reports documenting that passerine birds, similarly as in the case of onshore structures, occasionally collide with offshore structures (Blew *et al.*, 2013). During night migration, birds may be particularly attracted by the light of vessels. Such situations were documented in the southern Greenland area where collisions were significantly correlated with poor visibility at sea (Masden and Cook, 2016).

The barrier effect and collisions with vessels were classified as direct impacts because the presence of erected structures as well as construction vessels may directly affect the change of flight trajectory of migratory birds or cause collisions. The range of these impacts was considered local because if impacts occur, they will be limited to a small area where construction works are carried out at a given moment. The time frame of both impacts was considered temporary. The barrier effect has reversible features which cease to exist upon conclusion of construction works, but collisions were considered irreversible due to 100% mortality of birds in the case of collisions. Based on the analysis of impacts during the implementation phase, the size of the barrier effect was considered low and the size of collisions with vessels was considered moderate.

A summary of the impact of the Baltic East OWF implementation phase on migratory birds is presented in the table [Table 80] below.

Table 80 Assessment of the significance of impacts on migratory birds during the Baltic East OWF implementation phase [source: internal materials]

ENGLISH NAME	LATIN NAME	IMPACT	RECEPTOR VALUE	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
Common scoter	*Melanitta nigra*	Barrier effect	Moderate	Low	Negligible (N)
		Risk of collision	Moderate	Low	Low (N)
Velvet scoter	*Melanitta fusca*	Barrier effect	Moderate	Low	Negligible (N)
		Risk of collision	Moderate	Low	Low (N)
Eurasian wigeon	*Mareca penelope*	Barrier effect	Low	Insignificant	Negligible (N)
		Risk of collision	Low	Insignificant	Low (N)
Long-tailed duck	*Clangula hyemalis*	Barrier effect	Moderate	Low	Negligible (N)
		Risk of collision	Moderate	Low	Low (N)
Anatini ducks	*Anatini*	Barrier effect	Low	Low	Negligible (N)
		Risk of collision	Low	Insignificant	Low (N)
Divers	*Gaviidae*	Barrier effect	Moderate	Low	Negligible (N)
		Risk of collision	Moderate	Low	Low (N)
Crane	*Grus grus*	Barrier effect	Moderate	Low	Negligible (N)
		Risk of collision	Moderate	Low	Low (N)
Auks	*Alcidae*	Barrier effect	Low	Low	Negligible (N)
		Risk of collision	Low	Low	Low (N)
Great cormorant	*Phalacrocorax carbo*	Barrier effect	Low	Insignificant	Negligible (N)
		Risk of collision	Moderate	Insignificant	Low (N)
Geese	*Anserini*	Barrier effect	Moderate	Insignificant	Negligible (N)
		Risk of collision	Moderate	Insignificant	Low (N)
Lesser black-backed gull	*Larus fuscus*	Barrier effect	Moderate	Insignificant	Negligible (N)
		Risk of collision	Low	Insignificant	Low (N)
Little gull	*Hydrocoloeus minutus*	Barrier effect	Moderate	Insignificant	Negligible (N)
		Risk of collision	Moderate	Insignificant	Low (N)
Swans	*Cygnus spp.*	Barrier effect	Low	Insignificant	Negligible (N)
		Risk of collision	Low	Insignificant	Low (N)

ENGLISH NAME	LATIN NAME	IMPACT	RECEPTOR VALUE	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
Passerine	*Passeriformes*	Barrier effect	Low	Insignificant	Negligible (N)
		Risk of collision	Low	Insignificant	Low (N)
Terns	*Sternidae*	Barrier effect	Low	Insignificant	Negligible (N)
		Risk of collision	Low	Insignificant	Low (N)
Charadriiformes	*Charadriidae*	Barrier effect	Low	Insignificant	Negligible (N)
		Risk of collision	Low	Insignificant	Low (N)

Impact significance on migratory birds during the construction phase was considered negligible for an impact in the form of a barrier effect and insignificant for collisions with construction vessels.

5.1.1.9.7 Impact on bats

During the implementation phase, a large part of the works will be carried out under the water surface. These will include works related to seabed preparation, installation of foundations and laying of cables. It is estimated that this part of the preparatory and construction works will have no impact on bats. Works and activities carried out on the sea surface may have a potential impact on bats. Preparation and construction of the wind farm will involve an increased presence of vessels, which may cause both positive and negative impact on bats.

The performed works will be a source of noise that may scare bats. When assessing the potential scaring of bats as a result of noise related to the implementation of the Baltic East OWF, the works will be carried out successively, i.e. not all wind turbines will be constructed at the same time. Possible modification of the bat flight route during these works should not be of major importance.

Vessels anchored and illuminated with intense light during night works and standstill may attract plenty of night insects which, for migratory bats, will be an opportunity to replenish energy during their sea migration. These vessels will also be a resting place for bats as a daytime hiding place with numerous nooks, but also as a short-term night hiding place. This is confirmed by the observations of resting bats on anchored vessels made during other surveys and numerous reports of seafarers (own data). There may then be a risk of collision with vessels and structural members in the construction area. The described impacts on bats during the implementation phase will be direct, local, short-term and momentary.

Sensitivity for national bat species is determined on the basis of the degree of exposure to mortality in collisions with wind turbines (on the basis of: Rydell *et al.*, 2010a; Rodrigues *et al.*, 2009; Rodrigues 2011). For species identified during inventory surveys (section **3.11.4.7**), the risk of mortality was determined as very high. Sensitivity of the receptor to potential impact was assessed as very high.

When assessing the potential impact of the implementation phase on bats, the results of the conducted surveys should be taken into account, which showed that the Baltic East OWF area is used by bats to a small extent during the spring migration period, and their activity in the autumn migration period is higher only in a short period: in the second half of August and in the first half of September.

As a result of the conducted analysis, the significance of the Project's impact on bats during the implementation phase was determined as insignificant due to the identified low activity of bats during surveys in the period of seasonal migrations.

5.1.1.10 Impact on the areas and facilities protected under the Act of April 16, 2004 on nature conservation

Impacts on protected areas and the probability of their occurrence generally decrease as the distance from the project area increases.

Due to the location of the Baltic East OWF outside of the areas protected under the Act of April 16, 2004 on nature conservation (consolidated text: Journal of Laws of 2024, item 1478), there will be no significant impacts on this area, including on any of the compartments for which it was established, i.e. biodiversity, resources, deposits and constituents of inanimate nature and landscape values. All protected areas identified during the analyses are located at a significant distance from the Baltic East OWF area – the smallest distance is 11.8 km for the marine Natura 2000 site Przybrzeżne Wody Bałtyku [Coastal Waters of the Baltic Sea] (PLB990002). When analysing the potential impacts during the implementation phase of the Baltic East OWF on protected areas located further away (beyond the OWF area boundaries), it is necessary to consider the potential project impact on the valuable and protected species of animals (key and rare ones) in these areas – in particular those species of fish, mammals and birds the occurrence of which was recorded during the monitoring carried out on the Baltic East OWF site. Another factor to be taken into account when assessing the threat scale is the mobility of a given animal species – for a species that has sedentary lifestyles (moving within several or dozen square meters, if any), even if it is identified both in the protected area and within the OWF, there will be no interaction of animals from these biotopes, and thus no wind farm's impact on individuals located several (dozen) kilometres further.

Due to the nature of implementation phase impacts that occur in the case of the Baltic East OWF, in relation to the conditions described above, in the context of the conducted impact assessment on protected areas in accordance with the aforementioned Act, the greatest potential impact should be considered in relation to maritime/coastal areas of the Natura 2000 network, i.e.: SPA Przybrzeżne Wody Bałtyku [Coastal Waters of the Baltic Sea] (PLB990002) and SPA/SAC Ławica Słupska [Słupsk

Bank] (PLC990001) and SAC Ostoja Słowińska [Słowińska Refuge] (PLH220023) and species present there. A detailed analysis in this respect is presented in the next sub-chapter.

Additionally, potential impacts may be significant in the case of areas of higher conservation status – the Słowiński National Park (whose area overlaps mostly with the Natura 2000 site Ostoja Słowińska [Słowińska Refuge] (PLH220023) and may be related to the disturbance of the existing landscape as a result of introduction of machines used for OWF construction – as described in Chapter **5.1.1.7**. Regulation of the Minister of Climate of December 23, 2019 *on protective tasks for the Słowiński National Park* for 2020-2022 (Journal of Laws of the Ministry of Climate of 2019, item 4, as amended), in which the existing and potential internal and external threats as well as the methods of eliminating or reducing these threats and their effects were identified and assessed, the threat resulting from an increase of areas for the construction of wind farms in the municipalities adjacent to the park was classified in the category of existing external threats. It was stated under the category of potential external threats that only the construction of wind farms in the park buffer zone could constitute a potential external threat and, consequently, it should be concluded that, through its location, the Baltic East OWF will not pose a threat to the Słowiński National Park.

The second potentially significant impact may be related to the impact on birds within the construction works carried out, causing a change in flight routes and onshore avifauna destinations. However, **due to the impact duration, scale and effects, they were assessed as insignificant**.

With reference to other (not listed above) forms of nature protection identified onshore (i.e. natural monuments, documentation sites, ecological areas), due to the location of the planned project in the area of sea waters (at a distance of more than 20 km from the land) and the more local nature of these sites, it was found that they did not **constitute a significant part in the context of the conducted environmental impact analysis, and the impact significance is negligible**.

Potential negative impact on these sites may only be related to the process of transport of structural members and materials used during the construction and may only apply to protected sites located in the immediate vicinity of roads. At the same time, it should be noted that such an impact could result only from emergencies, and therefore it is not possible to identify and determine it in detail. However, due to the low probability of occurrence and possible scale of impact, **the threat in this respect was assessed as negligible**.

A detailed assessment and nature of possible impacts on specific groups of animals (benthos, fish, marine mammals, birds) that may cause the deterioration of living conditions and the manner (direction and area) of animal movement are presented in separate subchapters.

Given that protected areas may be classified as receptors of very high sensitivity and at the same time the insignificant scale of impact on them at the Baltic East OWF construction stage, the significance of this impact is of low importance.

5.1.1.10.1 Impact on the protected Natura 2000 sites

The identification and assessment of impact on areas protected under the European ecological network Natura 2000 are presented in Subsection 3.3.

5.1.1.10.2 Impact on wildlife corridors

Wildlife corridors within the Baltic Sea are relatively poorly investigated – this applies to all groups of animals: fish, marine mammals and birds.

Regular bird migrations take place over the Baltic Sea in spring and autumn, but the routes of these migrations are very poorly understood and the detailed migration tactics of individual bird species are not known.

Given the lack of information on the occurrence, functioning and significance of wildlife corridors in the Baltic Sea and the spatial scale of the Baltic East OWF area in relation to the size of the Baltic Sea maritime area, including the increasing effect of spatial development, the planned development method including the corridor without development above the water surface and bearing in mind the specifics of various groups of animals, it was assessed that the impact of the Baltic East OWF during the implementation phase on potential migration routes of migratory species (Chapter 5.1.1.9.6) would be negligible.

5.1.1.10.3 Impact on biodiversity

Macrozoobenthos

Disturbance of the bottom sediments structure will result in physical destruction of the macrozoobenthos association only at 4.8% of the Baltic East OWF, at the location of foundation of monopiles and along the route of laying cables inside the OWF. However, this will not result in a significant change in the quality structure of the soft seabed macrozoobenthos associations, consisting of typical and common taxa in open waters of the southern Baltic Sea.

Ichthyofauna

Impacts occurring during the implementation phase may reduce the diversity of ichthyofauna by deterring fish due to noise. Fish may react to an increased level of noise by leaving the affected region (avoidance reaction) [detailed description in section **5.1.1.9.3**]. Avoidance response will be stronger in the case of clupeidae and codfish, but probably to a lesser extent it will concern flatfish due to the absence of swim bladder and the associated low sensitivity to noise impact. An increased concentration of suspended solids may cause a similar reaction to avoid and periodically reduce diversity. Similarly as in the case of noise emission, the impact effect will be small in relation to fish living at the seabed (flatfish, common seasnail, gobies). However, in the case of the last two species, there may be a restriction of reproduction caused by backfilling of the bottom spawn through sedimentation from the water column. A local drop in diversity may occur throughout the construction period.

Marine mammals

There are three species of marine mammals in the Baltic East OWF area and in adjacent waters. During the construction of the OWF, underwater noise may be generated, having a significant impact on the biodiversity of marine mammals, including in particular porpoises. The application of appropriate noise reduction measures significantly reduces this negative effect. The modeling results show that the use of the Noise Reduction System e.g. in the form of HSD and a double big bubble curtain (DBBC) should effectively reduce the impact of noise generated during piling on all three species of marine mammals and thus reduce the impact on biodiversity of these animals in the analysed area.

Seabirds

The analysis of possible impacts resulting from the construction activities performed in the OWF implementation phase shows that their effects will in most cases be temporary and local. This applies to all types of emissions (noise, suspended solids, release of biogenic substances from seabed sediments).

As a result of construction works being performed, there may be a temporary change in the species structure in the Baltic East OWF area and in the direct vicinity of this area. In the case of seabirds, the most sensitive species will be displaced from the farm area already during the implementation phase. An increase in the number of gulls is expected, which use structures protruding from water as resting places. Therefore, we cannot say in the case of birds that biodiversity will remain unchanged. It should be emphasized that this change concerns the site where the wind farm will be constructed and its nearest vicinity. After completion of the Baltic East OWF implementation phase and start-up of wind turbines, some birds from species more sensitive to the impact of wind farms (razorbills, sea ducks) may leave the Baltic East OWF area and move to the adjacent feeding grounds. The loss of zoobenthos in quantities not relevant from the perspective of food resources for seabirds will not cause disturbances in food dependencies, which will not disturb the existing balance and will not lead to permanent elimination of species.

The sea habitat will not be fragmented in such a manner that the populations permanently or temporarily related to the Baltic East OWF area and adjacent sea basins could be isolated.

To sum up, the impact of the Project in question on biodiversity can be considered to be of low significance due to the local range of this impact limited to the area occupied by the wind farm together with the surrounding buffer with a width of 2–4 km.

5.1.2 Operation phase

5.1.2.1 Impact on geological structure, seabed topography and availability of raw materials and deposits

Changes within the seabed associated with the project impact in the operation phase will be local and within the entire area occupied by the Baltic East OWF – insignificant for the overall nature of the seabed and its structure.

Activities related to the operation phase may cause the following **impacts on** the seabed:

- local changes in the seabed topography related to the presence of OWF components and their impact on sediments transport and sedimentation processes;
- scour of the seabed in front of/behind OWF components,
- formation of deposits in front of/behind the components (sandy deposits),
- pits forming in the seabed at the anchoring locations of vessels servicing the OWF;

All of the above impacts will be direct, local, short-term and reversible.

Depending on its structure, the seabed may exhibit different **sensitivity** to the project impact during its operation phase. A till seabed bottom and a till seabed with a stony cover are difficult to wash out and change their morphology. A sandy, sandy and silty, and silty seabed are more susceptible to scour and material displacing over it, e.g. in the form of sandy waves. Thus, OWF components may be uncovered or covered both as a result of natural processes displacing rock material along the seabed and as a result of this transport being disturbed by OWF components.

It is not expected that there will be any changes in the seabed structure during the project operation phase. The overall impact of the project in the operation phase can be assessed as negligible.

The assessment of **the scale and significance** of the identified impacts on the geological structure and the availability of raw materials and deposits during the operation phase is included in table [Table 81].

Table 81 Assessment of the significance of impacts on the geological structure during the Baltic East OWF operation phase [source: internal materials]

Impact	Scale of impact	Receptor sensitivity	Impact significance
Local changes in the seabed topography	Low	Low	Negligible (N)

In geological terms, taking into account the nature of deposits forming the seabed surface of the OWF area, no significant changes in the nature of deposits are expected in the operation phase. The project impact at the operation phase on bottom sediments in terms of their geological nature can be assessed as negligible.

During the operation of the Baltic East OWF, access to possible identified deposits of raw materials on its surface will be impossible or significantly limited in accordance with the provisions of the Spatial Development Plan for Polish Maritime areas (PZPPOM) "in the entire sea basin (POM.46.E), the performance of functions (for prospecting and exploration of mineral deposits and extraction of minerals from deposits) is limited to methods that do not affect linear components of technical infrastructure; that do not threaten the ecological function of spawning grounds and survival of early development stages of fish (eggs and larvae) of commercial species; in the entire sea basin, the extraction of minerals from deposits is limited to projects agreed with the competent investor of offshore wind farms." Because the basic function in the sea basin is to generate energy from renewable sources, and other functions, including those related to prospecting and extraction of minerals, are subordinate, its impact on raw materials and deposits will be of negligible significance.

Given the results of the impact assessment and possible technologies during Project operation, there is no indication that it is necessary to apply measures minimising the negative impact of the Baltic East OWF on the geological structure and the seabed topography, as well as the availability of raw materials and deposits.

5.1.2.2 Impact on the dynamics of sea waters

The **impacts** of wind wave motion on the free sea surface and water flows in the entire section of the water column from the surface to the seabed were analysed as part of the assessment of the Project impact on sea waters. The measurements performed during the surveys show that the velocities and directions of water flows in the Baltic East OWF area change depending on the current circulation conditions over the area of the southern Baltic Sea and the related wind velocities and directions. However, given metering data from selected places at sea, a clear dominant feature of flows in directions similar to the isobath route in a given place of the field is noticeable.

After the construction of the Baltic East OWF, the dynamics and directions of water flows may be slightly disturbed only in the vicinity of the supporting structures of wind turbines and offshore substations. As a result, the velocities and directions of water flow and pressure in the direct vicinity of each structure may change, which manifests itself in a local increase in water flow velocity due to narrowing of the flow stream and formation of swirls around the structure. The swirls may develop both downstream the current and immediately upstream the obstacle. The range of impact of the support structure on water flows in the sea column is only equal to several diameters of this structure, i.e. not more than several dozen meters. The anticipated distances between individual wind turbines will amount to approximately 1 km, i.e. they will many times exceed the range of such an impact. This means that overlapping of these impacts should not be expected and disturbances will be only local. Given the above values and nature of the impact of water flows on seabed sediments, there may be a slight modification (increase) only in the immediate vicinity of the supporting structures, therefore the impact on sediments movement in the entire farm area should be considered negligible.

Any modifications of the wave motion can be noticed only in the close vicinity of individual supporting structures of wind turbines and the OSS. They will be local and should not occur outside the Baltic East OWF area. Wind waves on the free sea surface, when encountering any obstacles in the form of wind farms and offshore substations, flow around them, while losing part of their energy. If the diameters of these structures are smaller than one fifth of the length of individual waves propagating in their direction (Massel (ed.) 1992), they may be treated as streamline structures. This means that they will not cause disturbance of the wave field. Otherwise, the waves, approaching the structure on the windward side, will be partially reflected and broken, and on the leeward side – diffracted, i.e. subject to symmetrical deflection of the wave radius behind the obstacle encountered. In the shadow area, i.e. directly downstream the obstacle encountered by waves, there is no wave motion, but there may be swirls of water. However, upstream the structure, the reflected waves interfere with the incoming waves, as a result of which standing waves may be formed. In consequence, when applying the linear theory for simplification reasons, vertical orbit velocities of water particles will increase twice immediately upstream the structure. If such waves are long enough to affect the seabed, they may, in connection with near-bottom sea currents, contribute to entraining the sediments from the seabed and, consequently, lead to erosion in the immediate vicinity of the support structures. The resulting disturbances of wave motion (wave diffraction) can be noticed only in the leeward zone. However, they are of local nature and should not be present outside the Baltic East OWF area.

The Baltic East OWF is located outside the Słupsk Furrow sea basin, through which cold, oxygenated and more saline waters from the North Sea are transported, and which flow through the Słupsk Furrow to the Gdansk and Gotland Deeps during rare inflows which are very important for the Baltic Sea ecosystem. Baltic East OWF will not affect the course of this phenomenon.

The scale of impact for the wave field and structure of water flows on the installed wind turbine towers and offshore substations is described in a five-stage scale in accordance with the data presented in table [Table 82].

Table 82 Scale of impact for the wave field and structure of water flows resulting from activities related to operation of the Baltic East OWF [source: internal materials]

Scale of impact	Description
Insignificant	No noticeable changes in wave field and structure of water flows
Low	Changes in the wave field and structure of water flows are limited only to the nearest vicinity of the structure
Moderate	Changes in wave field and structure of water flows extend beyond the nearest vicinity of the structure, but cover less than half of the OWF developed area
High	Changes in wave field and structure of water flows cover more than half of the OWF developed area
Very high	Changes in wave field and structure of water flows cover the entire OWF area

Impact significance of the Baltic East OWF during the operation phase on the wave field and structure of water flows is presented in table [Table 83].

Table 83 Assessment of the significance of impacts on wave field and water flow structure during the Baltic East OWF operation phase [source: internal materials]

Impact	Scale of impact	Receptor sensitivity	Impact significance
Wave field change	Low	Low	Negligible (N)
Change of water flow structure	Low	Low	Negligible (N)

The impact of Baltic East OWF on the wave field and sea current field will be direct, long-term and local and will not have a key impact on these elements. Impact significance of the Baltic East OWF on the dynamics of sea waters was assessed as negligible.

5.1.2.3 Impact on the quality of sea waters and seabed sediments

Impacts on the quality of water and bottom sediments caused by operation (maintenance) of the Baltic East OWF are similar to impacts that may occur at the Project implementation phase. The main difference is the lack of construction works causing long-term seabed disturbance. Most impacts at the operation phase result from the movements of vessels operating and servicing the OWF and the presence of a large number of underwater structures (foundations and/or support structures and solutions for cable protection) and above-water structures (nacelles, rotors). These will mainly be service works and interventions in case of an emergency situation.

It was found that OWF during the operation phase may cause various **types of impacts on** the discussed receptors (water and bottom sediments). These are:

- release of pollutants and biogenic compounds from sediment into water,
- contamination of water and seabed sediments with petroleum products,

- contamination of water and seabed sediments with anti-fouling agents,
- contamination of water and seabed sediments by an accidental release of nutrients together with waste or (raw) wastewater,
- contamination of water and seabed sediments with accidentally released chemicals,
- contamination of water and seabed sediments with compounds from anti-corrosion agents,
- change in water and bottom sediments temperature as a result of heat emission from inter array power cables.

- **Release of pollutants and biogenic compounds from sediments into water**

During the Baltic East OWF operation, works will be carried out causing disturbance of bottom sediments, e.g. maintenance of foundations, cables or anchoring of vessels. They may cause the transfer of pollutants and biogenic compounds from sediments to water.

Labile metal complexes, organic pollutants, i.e. PAHs, PCBs and biogenic compounds (nitrogen and phosphorus) may enter the water. As the bottom sediments in the surveyed area is characterized by low content of harmful substances (metals, PAH, PCB, TBT) and biogenic substances, the risk of their penetration to water is low (will slightly deteriorate the water quality). The **sensitivity** of sea waters was determined as low and of bottom sediments as insignificant.

Release of pollutants and biogenic substances from bottom sediments during the operation phase is a direct, temporary, short-term negative impact of local range.

The **significance** of this impact during the operation phase in the APV was assessed to be of low importance for sea waters and as negligible for bottom sediments.

- **Contamination of water and bottom sediments with oil derivative substances during normal operation of OWF, including vessels during routine maintenance activities and as a result of failures or collisions**

During normal operation of vessels when carrying out Baltic East OWF service works, leakages of various types of oil derivative substances (lubricating and diesel oils, petrol and other) may take place.

They may contribute to a minor extent to the deterioration of water quality. Heavier oil fractions may be subject to sorption on the surface of organic and mineral suspended matter, which will increase their specific gravity and gradually make them sink onto the seabed. They may also be bound there by bottom sediments.

During the maintenance of Baltic East OWF components, leakages of various types of oil derivative substances may occur as they are being replaced while servicing wind turbines and substations. The transformers should be equipped with devices reducing such threat – have tight oil pits – and the rainwater drainage system should be equipped with an oil/water separator (Stryjecki *et al.*, 2011). If such solutions are applied, no significant spills outside the installed equipment are expected.

Pollution of sea waters and bottom sediments with oil derivative substances released during normal operation of the OWF, including service vessels, is a temporary, short-term direct negative impact of local range.

The **significance** of the impact during the operation phase in the APV was assessed as negligible for sea waters and bottom sediments, but as a result of failure or collision, it was assessed to be moderate.

- **Contamination of water and bottom sediments with anti-fouling agents containing TBT**

The description of this impact is the same as in the implementation phase and is presented in detail in Section **5.1.1.2**.

Pollution of water and/or bottom sediments with anti-fouling substances during the operation phase is a direct, permanent, short-term negative impact of local range.

The impact significance during the operation phase in the APV was assessed as negligible for sea waters and bottom sediments.

- **Contamination of water and seabed sediments by an accidental release of nutrients together with waste or (raw) wastewater**

The description of this impact is the same as in the implementation phase and is presented in detail in section **5.1.1.2**.

The sensitivity of both receptors is insignificant.

Pollution of water and/or bottom sediments with waste or wastewater is a direct, short-term or temporary negative impact of local range.

The significance of this impact during the operation phase in the APV was assessed as negligible for sea waters and bottom sediments.

- **Contamination of water and seabed sediments with accidentally released chemicals**

During the OWF operation, the maintenance of its facilities will be carried out. One cannot rule out a possibility that small quantities of chemical waste or operating fluids may be accidentally released into the sea.

The waste most frequently generated in this operation phase is waste from groups 13, 15, 16 and 17 of the Appendix to the Regulation of the Minister of Climate of January 2, 2020 on the waste catalog (Journal of Laws item 10). It is necessary to comply with the procedures concerning waste handling.

The sensitivity of both receptors to this impact is small.

Pollution of water and/or bottom sediments related to the OWF operation phase is a direct, short-term or temporary negative impact of local range.

The **significance** of this impact during the operation phase in the APV was assessed as negligible for sea waters and/or bottom sediments.

- **Contamination of water and seabed sediments with compounds from anti-corrosion agents**

Steel structures of the foundations of the turbines and substations will corrode in the marine environment. It will therefore be necessary to apply appropriate safeguarding measures.

The most common corrosion protection method used in the marine environment is cathodic protection. It can be implemented as a galvanic or electrolytic protection.

Galvanic cathodic protection consists in mounting aluminum or zinc anodes on the foundations. The anodes are gradually worn out and aluminum or zinc are transferred to the water and accumulate in the bottom sediments.

Zinc is the most common steel protection agent for sea water. Its current efficiency reaches 90% at a relatively low production cost. The disadvantage of zinc is a small potential difference compared to steel, amounting to approx. 0,25 V. Zinc is used as pure metal (99,99%, with a limited pollutant content of Fe, Cu and Pb) or as a metallic matrix containing: Zn + 0.1 to 0.15% Hg, Zn + 0.12 to 0.18% Al + 0.05 to 0.1% Cd, Zn + approx. 0.5% Al + approx. 0.1% Si (Surowska 2002).

Aluminum is used only in the form of alloys: zinc (3-6% Zn), tin (0.1-1% SN), Zn+In, Zn+Hg, Zn+Sn. The current efficiency of these alloys is high, of the order of 80%. Aluminum alloys are used in the same manner as zinc. Apart from zinc and its alloys, they are low-potential protectors (Surowska 2002).

The advantages of the galvanic cathodic method are independence from current sources, ease of installation, possibility of local protection and low impact on neighboring structures. On the other hand, the most important defects include: irreversible loss of anode material, possibility of contamination of the environment with corrosion products of the protector, limited use due to environmental resistance and low protective current.

In the initial period of operation, the emission of zinc and aluminum from anodes will not be observed. This process will take place over the years and as the damage to the protective coating on the elements subject to corrosion protection progresses. It is assumed that anodes dissolve completely within approx. 20 years. The metals in question will first be transferred to water from which they can be precipitated and collected in the sediments. This applies in particular to aluminum compounds, as its solubility in natural waters (with pH of approx. 8) is very small. It will be largely absorbed by bottom sediments in the form of stable compounds. Zinc compounds may be present longer than aluminum in water, as most of them are soluble in water. Zinc will be adsorbed and co-precipitated with hydrated Fe, Mn and Al oxides, present in sediments, however, this process will take place slowly due to the low content of silty minerals in the Baltic East OWF area, which favor zinc adsorption (Alloway and Ayres 1999; Rousseau 2009).

Ecotoxicity tests have shown a significant toxicity of aluminum to aquatic organisms such as algae, fish and first-order consumers (Klöppel et al., 1997; Migaszewski and Gałuszko 2007). Excess aluminum causes decalcification and deformation of bones as well as anemia and hardening of cell membranes (Migaszewski and Gałuszko, 2007). Harmful effects on fish are probably associated with the process of precipitation of this metal on gills as a result of activity of defensive mechanisms (e.g. release of compounds neutralizing Al+3) (Kabata-Pendias and Pendias, 1993). The biological role of aluminum for humans has not yet been fully clarified, but it is suspected that it may cause Alzheimer's disease. Aluminum is accumulated in brain (Epstein, 1990; Migaszewski and Gałuszko, 2007).

Zinc is one of the more mobile metals in sediments, which is affected by its replaceable forms as well as its binding with organic substances (Kabata-Pendias and Pendias, 1993). It regulates the metabolism of carbohydrates and proteins in plants. Its excess (100-400 mg·kg-1 depending on the species) causes the development of chloroses and necroses. This phenomenon is related to iron deficiency and braking of photosynthesis. In vertebrate organisms, zinc also contributes to the metabolism of proteins and carbohydrates, to the detoxification of heavy metals in cells, and it increases the activity of enzymes and hormones. Zinc also has a positive effect on brain activity, tissue regeneration and healing of wounds. In case of acute zinc poisoning, there may be a shortage of copper in blood, hypocalcemia, inflammation of the pancreas, vomiting, diarrhea and kidney failure (Migaszewski and Gałuszko, 2007).

In the electrolytic cathodic protection, the protected object becomes a cathode of an electrolytic cell supplied with direct current from an external source. The anode used in this circuit is most often insoluble. The most persistent anode materials used in this method are platinum and titanium electrodes covered with a 2-3 µm platinum layer. When electrolytic cathodic protection is used, no impact on the quality of water and sediments is observed.

If electrolytic cathodic protection is used, metal (Al, Zn) emissions to the water environment will not be observed due to the use of insoluble anodes. This impact was not assessed.

The most important parameters affecting the impact scale are: type and quantity of released elements, water quality in the project area, type of rock material forming the seabed.

The **sensitivity** of both receptors to this impact is moderate.

Contamination of the environment with aluminum or zinc released during operation by means of galvanic cathodic protection is a direct, negative long-term impact of local range.

The **significance** of this impact during the operation phase in the Applicant Proposed Variant was determined as insignificant for sea waters and bottom sediments.

- **Change in water and sediments temperature due to heat emission from cables**

The electric current flowing through a power cable causes the cable heating caused by power losses due to resistance, in accordance with the Joule's law. As the cable temperature rises above the ambient temperature, heat is released into the environment surrounding the cable.

A precise quantification of the dissipated heat is difficult because of the phenomena such as conductivity, drift and heat radiation, subject to various physical laws (Stiller *et al.*, 2006).

Increasing the temperature of sediments in which the cable is buried and interstitial waters (water filling the spaces between sand grains in the sediment) may cause:

- increased bacterial activity resulting in accelerated distribution of organic matter;
- decrease of oxygen content in water;
- release of harmful substances, including metals, from sediments into water;
- adverse effects on benthic organisms.

The most important parameters affecting the impact level are: depth of cable burying and type of seabed.

For example, on the operating Nysted Offshore Wind Farm, the temperature increase emitted by the transmission cable (132 kV) buried at a depth of 1 m did not exceed 1.4°C in a layer of 20 cm above the cable, and the temperature changes were not visible already on the seabed surface (Merck 2009). This cable was buried in gravel sediments, which favors much higher heat loss in interstitial spaces between sediments grains than in the case of fine sediments (Merck 2009 ibidem). Both types of sediments are common in the Baltic East OWF area. It should be assumed that the heat dissipation (24 W·h-1 m-1 on the cable surface) emitted by inter-array 66 or 132 kV power cables belonging to the Baltic East OWF will be smaller than (or at the most similar to) that recorded in the Nysted OWF.

Warming of bottom sediments and interstitial waters may also promote the transfer of metals from the sediments to the water column and may accelerate the processes of decomposition of organic pollutants in the bottom sediments. In principle, the seabed fauna is naturally adapted to large seasonal temperature changes, and is not sensitive or shows very low sensitivity to temperature increase by 2°C (Birklund, 2009). In accordance with the standards proposed by the German Federal Environment Protection Agency, the temperature increase due to heat emission of the transmission cable of offshore wind farms in a layer 20 cm below the seabed surface, which is the main habitat of the infauna, must not exceed (2°C).

Heat emission above the Baltic East OWF cables in the sediments will be local and the effect will be insensitive if the cable is buried deeper than 1 m, which is in line with the technical Project assumptions for inter array power cables to be buried to a depth of 3 m and locally due to the specific seabed structure up to 5 m.

The **sensitivity** of both receptors to this impact is determined as small.

Heat emission by the cables is a direct, negative impact of local range which is long-term, reversible, permanent over the operation period. There are no field surveys and literature reports on operational submarine cables and the resulting increase in the temperature of bottom sediments and bottom water and the impact of this phenomenon on their quality.

Therefore, only the significance of this impact during the operation phase can be estimated.

This impact **significance** in the operation phase in the APV for sea water quality and bottom sediments was determined as of little importance.

The characteristics and scale of the identified impacts and the impact significance on the quality of waters and bottom sediments during the Baltic East OWF operation phase are presented in tables [Table 84, Table 85].

Table 84 Characteristics of impacts on the quality of waters and bottom sediments during the Baltic East OWF operation phase [source: internal materials]

IMPACT CHARACTERISTICS	TYPE OF IMPACT			SPATIAL RANGE			DURATION					TYPE	
	Direct	Indirect	Secondary	Transboundary	Regional	Local	Long-term	Medium-term	Short-term	Temporary	Permanent	Positive	Negative
Release of pollutants and biogenic compounds from sediments into water	x					x			x				x
Contamination of water and seabed sediments with petroleum products (normal operation)	x					x				x			x
Contamination of water and seabed sediments with petroleum products (emergency situations and collisions)	x				x			x					x
Contamination of water and seabed sediments with anti-fouling agents	x					x				x			x
Contamination of water and seabed sediments by an accidental release of nutrients together with waste or (raw) wastewater,	x					x				x			x
Contamination of water and seabed sediments with accidentally released chemicals	x					x			x				x
Contamination of water and seabed sediments with compounds from anti-corrosion agents	x					x					x		x
Change in bottom sediments and water temperature as a result of heat emission from inter array power cables	x	x				x	x				x		x

Table 85 Assessment of the significance of impacts on the quality of waters and bottom sediments during the Baltic East OWF operation phase [source: internal materials]

Impact	Scale of impact	Receptor sensitivity	Impact significance
Release of pollutants and biogenic compounds from sediments into water (for water)	Moderate	Low	Low (N)
Release of pollutants and biogenic compounds from sediments into water (for water)	Low	Insignificant	Negligible (N)
Contamination of water and seabed sediments with petroleum products (normal operation)	Low	Low	Negligible (N)
Contamination of water and seabed sediments with petroleum products (emergency situations and collisions)	High	Moderate	Moderate (N)
Contamination of water and seabed sediments with anti-fouling agents	Low	Low	Negligible (N)
Contamination of water and seabed sediments by an accidental release of nutrients together with waste or (raw) wastewater,	Low	Insignificant	Negligible (N)
Contamination of water and seabed sediments with accidentally released chemicals	Low	Low	Negligible (N)
Contamination of water and seabed sediments with compounds from anti-corrosion agents	Moderate	Moderate	Low (N)
Change in bottom sediments and water temperature as a result of heat emission from inter array power cables	Moderate	Low	Low (N)

In the operation phase, the impact of the Project on the quality of sea waters and seabed sediments is insignificant or negligible, except for the contamination of seabed sediments and sea waters with petroleum products as a result of oil spills during collisions or emergency situations, which was assessed as moderate.

Given the results of the impact assessment, the limited Project area and the possible technologies of its operation, there is no indication that it is necessary to apply measures minimising the negative impact of the Baltic East OWF on the quality of sea waters and bottom sediments.

5.1.2.4 Impact on ambient air quality, including climate and greenhouse gas emissions

The operation of wind turbines will cause local wind energy reduction and atmospheric pressure disturbance directly in the area of the rotor operation. Therefore, local velocities and directions of near-surface water flows and reduced energy of sea waves may be disturbed, which may be manifested in a decrease in wave height.

Due to the significant distance of the Baltic East OWF area from the coastline and other potential sources of pollutants emission, it may be assumed that it is likely that the air purity within this area will correspond to class A purity. Because the emission generated during the operation of the Baltic East OWF will be minimal (coming mainly from emergency generators from facilities installed at substations and air conditioning equipment and to a small extent from servicing units), it is practically possible to assume insignificant emission of gas pollutants and dust pollutants, including emissions of carbon dioxide, which is a greenhouse gas. Therefore, it is not expected that air quality will deteriorate and its purity class will be reduced.

During the operation phase, Baltic East OWF will have both negative and positive impacts on the climate. Negative impacts are related to greenhouse gas emissions caused by fuel combustion – short-term at substations and regular by service vessels. The positive impact on the climate will be the generation of electricity by the Baltic East OWF from a renewable source amounting to 966 MW, which – in the case of carbon dioxide emission of the conventional old-type electricity generation amounting to 900–960 kg of CO_2 per 1 MWh – will enable noticeable reduction of this gas emission in Poland.

With a conservative assumption of 40% capacity and 55 years of operation, the Baltic East OWF with a maximum capacity of 966 MW can produce 186.17 TWh/670.21 PJ of electricity, which will avoid emissions of approx. 66.37 million Mg of CO_2, approx. 911,000 Mg SO_2, over 121,000 Mg of nitrogen oxides and approx. 2.21 million Mg of dust in lignite-fired power plants (EEA, 2008).

According to the findings of the GP WIND project (2012), the production of electricity from OWE is associated with the emission of 6 to 34 kg of CO_2 per 1 MWh in all phases of the life of the OWF, which, with the expected production of 186.17 TWh during 55 years of operation, means the emission of 1.117 to 6.330 million Mg of CO_2. Given more recent findings, these figures appear to be overestimated. Assuming the value of CO_2 emissions OWF amounting to 3.9 kg per 1 power megawatt-hour for the entire operation cycle (XIe, 2020), converted to the assumed capacity and operation time of the Baltic East OWF, we will obtain the value of CO_2 emissions amounting to 0.726 million Mg of CO_2. The Baltic East OWF emissions will be at least 10 times lower than from producing energy from other sources fired with hard or brown coal (emission reductions of over 45.8 million Mg of CO_2 are expected – excluding the emissions related to the construction of these sources).

During the operation phase, local greenhouse gas emissions will slightly increase as a result of fuel combustion at substations by service vessels handling the wind farm, but their impact will be compensated by reduction of emissions during the generation of wind energy. The operation of the wind farm will indirectly result in a reduction of greenhouse gas emissions to air by other sources, e.g. coal-fired power plants located in other areas of the country.

Climate conditions of the southern Baltic area related to the formation of weather phenomena (mainly temperature, precipitation and wind) over a multiannual period are subject to continuous changes, which, although related to global climate changes, are generally of a regional nature. Therefore, the impact exerted by the operation of the Baltic East OWF on the climate conditions of this area and adjacent water regions will be negligible.

During the operation phase, the direct and local impact of the Baltic East OWF related, among others, to farm servicing by means of vessels and their fuel consumption will not have a significant impact on the climate conditions of this sea area. Despite the long-term impact, the range will be local and limited in time. Therefore, it can be assumed that the impact in terms of emissions of greenhouse gases from substations and vessels to air will be negligible.

Impact significance of the Baltic East OWF during the operation phase on meteorological conditions, climate and air quality is presented in Table [Table 86].

Table 86 Assessment of the significance of impacts on meteorological conditions, climate and air quality during the Baltic East OWF operation phase [source: own study]

IMPACT	SCALE OF IMPACT	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
Impact on meteorological (weather) conditions	Moderate	Low	Low (N)
Impact on climatic conditions	Insignificant	Insignificant	Negligible (N)
Impact on air quality (air emissions)	Insignificant	Moderate	Negligible (N)

The significance of the Project's impact during the operation phase on the wave field and water flow structure as well as on meteorological conditions, climate and air quality is negligible to insignificant.

5.1.2.5 Impact on systems using EMF

The operation of offshore wind farms so far shows that some types of tower structures and operation of wind turbines may adversely affect ship and onshore navigation support equipment or other applications. This applies primarily to radars, radar transponders, such as AIS installed on any vessel with a gross tonnage of more than 300 Mg, as well as communication systems.

According to the Act of August 18, 2011 on maritime safety (consolidated text: Journal of Laws of 2024, item 1068), the Applicant shall prepare and obtain the Gdynia Maritime Office Director's approval of expert opinions on the Baltic East OWF's impact: on the safety and efficiency of navigation of vessels in Polish maritime areas, the Global Maritime Distress and Safety System (GMDSS), the Operational Communication System of the Maritime Search and Rescue Service (SAR) and the National Maritime Safety System. As part of these arrangements, prior to the approval of the aforementioned expert opinions, obligations may be established on the implementation of remedial measures to maintain the Baltic East OWF impact on communication and radar systems at an acceptable level. Therefore, given the importance of these systems for society and the interest of the state, it should be assumed that the approval procedure will ensure relevant requirements and therefore the impact significance of the Baltic East OWF on these systems will be of little importance. The same measure will be carried out in the context of military and Border Guard systems after preparation of expert opinions set forth in the Regulation of the Minister of National Defense of October 10, 2022 on the detailed scope of technical expert opinions in the scope of assessment of the impact of the offshore wind farm and the set of power output equipment on the state defense systems and on the system of protection of the state border at sea (Journal of Laws, item 2115).

The key activities during the project operation phase that may have an impact on systems using EMF include:

- tower structures,
- operation of wind turbines.

The impacts may consist in creating obstacles or barriers to the transmission of communication signals. These may be direct and cumulative impacts with other structures and with operating wind turbines located in the water region. The impact range may be regional as the communication equipment is located outside the Baltic East OWF area, these may be short-term, medium-term or long-term impacts, both temporary and permanent ones. The nature of the impact will be negative.

The sensitivity of communication systems to potential impacts during the project operation phase can be assessed as remarkably high.

Due to the need to ensure uninterrupted communication of the operating systems of different operators, the scale of impact should be considered very large.

Impact **significance** in accordance with the adopted methodology of preparation of the EIA Report will be significant. It is assumed that possible impacts will be identified in the documents described above and as part of arrangements in accordance with the applicable legal requirements. The Applicant will apply the specified measures and methods aimed at avoiding, preventing, mitigating or compensating for possible negative impacts on EMF-based systems.

To sum up, the table below defines the impact significance on systems using EMF during the operation of the Baltic East OWF.

Table 87 Assessment of the significance of impact on systems using EMF during the Baltic East OWF operation phase [source: own study]

IMPACT	SCALE OF IMPACT	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
Tower structures	Insignificant	Very high	Low (N)
Operation of wind turbines	Insignificant	Very high	Low (N)

As a result of the conducted analysis, the project impact on the systems using EMF at the Project operation phase was determined to be of low importance, provided that mitigation or compensatory measures are applied if they result from the prepared expert opinions or arrangements with competent administrative authorities.

5.1.2.6 Impact on cultural values, monuments and archaeological sites and facilities

During project operation, the requirements specified in relation to monuments and archaeological sites obtained by the Applicant in the arrangements of the Pomorskie Voivodeship Heritage Conservation Officer will be met.

What will be most exposed to negative impacts are the sites discovered during geophysical surveys (wrecks with ID: SSS-033 and SSS-049). The discovered wrecks are located at a distance of 67 m and 113 m to the east of the boundary of the Baltic East OWF area.

The Applicant assumes that the activity will be limited at a distance specified in the permit for erection and use of artificial islands, structures and devices, i.e. up to 25 m from the reported wrecks until further procedure is determined by the Pomorskie Voivodeship Heritage Conservation Officer in Gdańsk.

It is not excluded that wrecks reported to the Pomorskie Voivodeship Heritage Conservation Officer, discovered during geophysical surveys or other monuments and archaeological sites, possibly discovered later will be subject to conservator's conservation and will require designation of a protection zone. The Applicant's activities during the operation of the Baltic East OWF will be carried out in accordance with the maintenance requirements.

Based on the conducted analysis, it was found that the impact significance of the project in question during operation phase on potential monuments and/or archaeological sites will be negligible.

5.1.2.7 Impact on the use and management of the sea basin and tangible property

The Baltic East OWF operation phase will cause a similar but larger range of impacts than the implementation phase on the use and development of the water region: maritime transport (shipping), fisheries, aviation, defense and other developments and for tangible goods. Obstructions or obstacles during operation will consist of:

- closing or restricting the movement of vessels and other vessels in the water region except for OWF service vessels,
- exclusion of the water region from transport and navigation, fishing, research cruises, tourist trips and other,
- occupancy of space by wind turbines, substations and platforms,
- occupancy of space during operation and due to downtime of wind turbines.

During its operation, the Baltic East OWF area will be excluded from regular navigation due to safety reasons. Traffic of other vessels (fishing, research or tourist vessels) may be permitted depending on the location of offshore wind turbines under the conditions agreed upon with investors.

Exclusion of the Baltic East OWF area from the free passage by fishing vessels may result in extension of their routes to and from the fisheries. However, given the location of the Baltic East OWF in relation to the shortest routes to fisheries in the area of the Słupsk Furrow from the ports in Władysławowo and Łeba, the extension of these routes may occur only after taking into account subsequent areas of the planned OWFs. In no manner will the exclusion from free passage through the Baltic East OWF area affect fishermen from other ports fishing in the Słupsk Furrow area.

As a result of the Baltic East OWF occupying the maritime area, this area may be excluded from fishing. The Baltic East OWF area is located within two fishing squares. This area is characterized by low fishing productivity; therefore the impact significance was assessed to be of low importance.

The above impacts may be direct and indirect and long-term. The spatial range of the impact may be regional. The nature of the impact will be negative.

The assessment of the significance of impact on the use and development of the water region and tangible assets during the operation phase of the Baltic East OWF is included in Table [Table 88].

Table 88 Assessment of the significance of impacts on the use and development of the water region and tangible assets during the operation phase of the Baltic East OWF [source: own study]

IMPACT	SCALE OF IMPACT	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
Restrictions on maritime transport (shipping)	Moderate	Very high	Significant (N)
Restricted availability of airline routes and other facilities	Moderate	Very high	Significant (N)
Restrictions on fishing, as well as the need to extend fishing routes	Low	Very high	Moderate (N)
Unavailability of the Baltic East OWF area for users other than the Applicant	Moderate	Moderate	Low (N)

During the operation phase, the impact significance on aviation and maritime transport was assessed as significant, and the range of this impact will be regional. During the operation phase, the Baltic East OWF area will be excluded from regular shipping for safety reasons and maritime transport for purposes other than servicing and operating the OWF may be permitted depending on the location of wind turbines. Decisions on the approval of vessels other than those operating the Baltic East OWF will be made by competent maritime administration authorities.

The exclusion of the Baltic East OWF area from use by fishing vessels will result in longer routes to and from fishing grounds. The range of this impact will be regional, and the impact significance was assessed as moderate.

5.1.2.8 Impact on landscape, including the cultural landscape

During the Baltic East OWF operation phase the following potential project impacts on the landscape, including the cultural landscape, were identified:

- functioning offshore structures, such as wind turbines, substations (occupancy of underwater and above-water areas, landscape industrialization, landscape dominator);
- Baltic East OWF lighting;
- vessel traffic required for the Baltic East OWF operation.

Objectively, the landscape within the OWF area will be industrial, but its impact will also be subjective and will depend on individual characteristics of the receiver and may be perceived negatively, positively and indifferently. The Baltic East OWF structures in a given sea area and shore section will become the dominant landscape feature.

The impact of the OWF on the landscape during the operation phase depends on:

- the size of the structure, diameter of the rotor and its position in relation to the viewer;
- number and location of wind turbines and substations;
- the traffic of vessels related to the operation of the OWF;
- meteorological conditions and the sea state;
- the location where the landscape observer is located and individual visual perception characteristics of the observer,
- the observer's perception of the landscape (aesthetic preferences).

the OWF will operate for up to 55 years. The offshore structures will be painted, marked and illuminated at night to ensure maritime and aviation safety, including the safety of the contractors for service works.

In the OWF Area, people not directly associated with the OWF are present temporarily. During the operation phase, these will include employees on board vessels, i.a. used for regular operation of the OWF, as well as passengers of tourist ferries, fishermen and deep-sea anglers, tourists on recreational craft, participants in search and rescue operations, flying over the sea in airplanes, scientists and others. The Baltic East OWF will be the most visible to these groups, but more people will be able to observe the OWF during the day rather than at night, when, for example, some of ferry crews and passengers will be asleep. The impacts on the landscape will be direct, with regional range, long-lasting (up to 55 years), reversible, because after completion of the operation the OWF is to be decommissioned.

During the operation phase, it is important for how long the observer will be able to see the OWF. It is expected that the above-mentioned persons will stay at sea in the Baltic East OWF area occasionally, some of them repeatedly and for a short time.

The meteorological conditions, and more specifically the visibility understood as the range of visibility of and ability to differentiate facilities that depends on weather and ontogenetic conditions, are the basic factor which will determine whether wind turbines will be visible or not from the coastline or further from land.

A limitation related to the visibility of wind turbines from the mainland is the Earths' curvature and the related limitation of the height of facilities that can be seen from a large distance. In practical terms, this limitation is that the further the wind turbines are located from the observer, the fewer of them can be seen. The actual visibility of the wind turbine/structure will also be affected by horizontal visibility resulting, among others, from weather conditions, time of day. Visualizations of the view on the Baltic East OWF from the beach in Białogóra and Słowiński National Park in various weather conditions during daytime and nighttime are presented **in Appendix No**. 5 to the EIA Report.

Due to the structure size, the Baltic East OWF will be visible at sea and on shore from a distance of several dozen kilometres – from beaches at the section from Ustka to Hel, it will also be visible from higher and uncovered onshore sites. The impact will vary depending on the observer's distance from the Baltic East OWF and the observer's characteristics. In the open sea, the landscape is not resistant to disturbance, its value is high. From a short distance, few people and for a short time will be exposed to landscape change, and some of them (e.g. tourists) may perceive it as beneficial or interesting. Therefore, the impact will be negative or positive, direct, short-term and observer-dependent. The scale of impact will be regional, it will decrease as it moves away from the OWF, it will be a long-term change, but reversible upon the Baltic East OWF decommissioning.

In the APV, the maximum wind turbine height will be 347.5 m (above the mean sea level) and the rotor diameter will be 310 m. From the land, under favourable weather conditions, i.e. very good visibility, the highest parts of the OWF structure will be visible in the horizon line. The Baltic East OWF will be poorly visible for most days in the year. Whether the OWF will be visible to people on the mainland, it will depend on the place from where they will observe the sea. For persons on the beach the OWF will be less visible than for persons staying at a higher altitude above sea level, for example in such places on the coast as: Ustka, Rowy, Czołpino lighthouse, dunes in the Słowiński National Park, Łeba, Stilo lighthouse, Jastrzębia Góra. For each of the observers staying on the mainland in good visibility conditions, the OWF will be in the horizon line. The operating OWF will not have a negative impact on the onshore forms of nature and landscape protection.

During the operation phase of the Baltic East OWF, which will be located at a distance of at least 22.5 km from the shore, it will not cause any impact on land, such as the effect of rotation of the rotor blades, the flickering of light because they occur only in closely operating structures and their range will not reach the mainland. However, this impact may be detrimental to persons who stay at sea. This impact will be negative, direct, short-term, temporary and of negligible significance.

As a result of the conducted analysis, it was determined that the project operation impact on the landscape, including the cultural landscape, will be moderate, and occasional traffic of service vessels in the landscape will be negligible.

Visualizations of the Baltic East OWF view from the beach in Białogóra and in the Słowiński National Park are presented in **Appendix No. 5 to** the EIA Report.

5.1.2.9 Impact on population, health and living conditions of people

OWF operation requires regular maintenance. Scheduled inspections and interventions are carried out as a result of observing faulty operation, i.a. wind turbines, foundations or supporting structures, substations and submarine cables. These activities will be carried out with the use of, among others: specialist vessels, service vessels, working boats, submersible vehicles. During the Baltic East OWF operation, the number of passages of vessels servicing the OWF may reach 700 per year. These vessels will move between the port in Łeba or Władysławowo and the Baltic East OWF area and less frequently between the Gdańsk Bay and the Baltic East OWF and the Gdańsk Bay, where traffic of 100 cruises per year is expected.

The need to provide maintenance services to the Baltic East OWF directly affects the creation and/or maintenance of jobs and the development of entrepreneurship in many specialized areas of onshore and offshore services (among other things, vessel crews, engineers, surveyors and monitoring specialists, maintenance of service ports, onshore service back-up facilities, administration, logistics) for up to 55 years of expected operation. This impact will be a direct, positive, regional and long-term.

For safety reasons, access to the Baltic East OWF area may be limited for fishing vessels and may mean, for instance, extension of routes for fishing vessels from certain ports to the fisheries located north of the Baltic East OWF area. The range of these impacts will apply to several dozen fishing vessels, mainly from the ports in Łeba and Władysławowo. At the same time, owners and crews of fishing vessels, as local representatives experienced in working at sea, may abandon unprofitable fishing in order to engage in servicing the Baltic East OWF.

The living standards of coastal cities and municipalities depend to a large extent on the development of coastal tourism and recreation. In some municipalities, e.g. Łeba, the income of local government and inhabitants is mostly derived from services provided to tourists and qualified tourism and recreation. The tourist and recreational potential of this part of the Baltic coastline is one of the highest in the country, and thousands of inhabitants provide various services to travelers mainly during the summer season, with a tendency to extend the recreation and rest season. Introduction of the Baltic East OWF structure into the landscape may affect adversely by disturbing the natural marine landscape or affect positively by constituting an additional tourist attraction, allowing for the development of tourism (e.g. by organizing cruises in the vicinity of OWF), this depends on the preferences of observers.

Due to the long distance from the shore (approx. 22.5 km and more), the Baltic East OWF will be poorly visible from the land during most meteorological conditions (wind, wave motion, cloud cover, air humidity). Only from higher viewing points and under suitable visibility conditions, it will be possible to observe a larger number of wind turbines (parts of the tower and the rotor) and substations. The number of visible wind turbines will depend on their spacing, alignment to the observer and distance from the coastline. For such long distances, weather conditions will result in maximum reduction of the light flicker impact onshore. At night, OWF lighting components will be quite clearly visible from the land along a part of the coast.

Human health and life are related to direct or indirect impacts related to the emission of noise, air pollution, electromagnetic fields and radiation as well as wastewater and waste. These impacts will mostly not have any significant impact on human health and living conditions due to significant distance (above 22.5 km from the shore). Due to the presence of electromagnetic fields originating from equipment at substations and the transmission capacity of radar and radio communication equipment, a potential hazard will occur throughout the period of their operation for the service personnel of such equipment, but these will not be places intended for permanent stay of people. Bystanders will never be within the range of electromagnetic impact of this equipment. Persons staying within the Baltic East OWF area because of their work duties will be subject to the provisions of the labor law and OH&S regulations. Therefore, in case of occurrence of the above-mentioned emission hazards, they will be provided with personal protection equipment or their working time under such conditions will be optimized accordingly so that the exposure does not exceed the time permitted by the OH&S regulations.

Events that may affect human health and living conditions may involve different types of collisions of vessels at sea. Such events are random and local or regional, and the operation of the OWF may hinder rescue operations at sea.

The assessment of the significance of impact on the population, health and living conditions of people during the Baltic East OWF operation phase is included in Table [Table 89].

Table 89 Assessment of the significance of impacts on the population, health and living conditions of people during the Baltic East OWF operation phase [source: own study]

IMPACT	SCALE OF IMPACT	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
Increase in employment for the operation of OWFs	High	High	Significant (P)
Change in the landscape of an attractive tourist area	Moderate	High	Moderate (P/N)
Disturbances in fishing in the area of fishing rectangles	Insignificant	High	Low (N)

As a result of the analysis, it was determined that the project impact on the population, health and living conditions of people during the operation phase will primarily have a significant positive impact on maintaining employment and developing the local economy, generating numerous jobs for many professions in the planned 55 years of OWF operation. The impact on tourism in the region will be moderate, and disturbances for fishing were assessed as insignificant.

5.1.2.10 Impact on biotic components in the offshore area

5.1.2.10.1 Impact on phytobenthos

The Project area is located outside the depth range of phytobenthos occurrence, and no aquatic plants were identified in the inventory surveys.

Introduction of permanent support structures of wind turbines and substations into the water column during the operation phase will allow for their surface to be settled by macroalgae in the euphotic zone, i.e. the maximum depth of penetration of the water column by sunlight at the intensity enabling the photosynthesis to take place [Birklund and Petersen 2004, Birklund 2005, Leonhard and Pedersen 2006, Wilhelmsson and Malm 2008]. The sensitivity (understood as the potential) of macroalgae to inhabit such places depends largely on the environmental conditions in a given location. In the open sea zone, high water dynamics, especially in the surface zone, may hinder or prevent the development of macroalgae characterized by weak thallus, therefore, in accordance with the assumptions of the impact assessment methodology, **the sensitivity** (potential) of macroalgae to this impact was assessed as high.

The maximum depth of the euphotic zone in Polish Sea Areas is approx. 20 m, therefore it should be assumed that macroalgae may inhabit all submerged structures in the vertical profile from the sea surface to the depth of approx. 20 m (indirect impact). The process of epiphytes overgrowth will most likely start in the first growing season after completion of construction of a given substructure and will last for the entire decades of operation time of Baltic East OWF (long-term impact). Rare and protected species may appear among epiphytic macroalgae, and taxons not previously recorded in Polish Sea Areas may also appear. The Project area is located far away from areas where macroalgae communities are commonly found in the Polish Sea Areas, i.e. shallow-water rock and boulder fields in the coastal zone (e.g. boulder field near Rowy) and boulder fields deposited on bottom elevations, e.g. boulder fields of the Słupsk Bank. Therefore, the development of macroalgae on underwater structures will result in the appearance of a new portion of biocenoses in the Project area, causing a local increase in biodiversity. Macroalgae communities are considered an important habitat-forming component as they may also be associated with animal organisms using macroalgae thallus as a place of refuge and development and food, such as crustaceans and fish [Wilson et al., 2010, Andersson et al., 2011). Development of macroalgae on the surface of substructures will result in a local increase in taxonomic diversity and, given the habitat-forming features of macroalgae, also potential qualitative and quantitative changes in local biocenoses (local impact). This impact will be positive, direct, local and long-term. To sum up, in accordance with the methodology described in Chapter 1.8.4, the impact resulting from the introduction of several dozen underwater structures into the sea area, which in the euphotic zone may be overgrown by macroalgae with high sensitivity (potential) to this impact, was considered a positive impact of negligible significance.

5.1.2.10.2 Impact on macrozoobenthos

The operation phase of the Baltic East OWF for the APV will cause the following impacts on macrozoobenthos inhabiting this area:

- new structures on the seabed – loss of a part of the macrozoobenthos habitat;
- new structures on the seabed – artificial reef effect;
- emission of electromagnetic field by power cables;
- heat emission by power cables.

The most important elements of the Baltic East OWF and their technical parameters that which are important from the point of view of the assessment of the project impact on macrozoobenthos during the operation phase include:

- Baltic East OWF surface area;
- foundations of wind turbines and offshore substations – type, number and shape of foundations occupying the seabed;
- surface area of the scour protection layer around the foundations, gravel rip-rap, rock rip-rap, stone rip-rap, cuttings surface;
- cable parameters and burial depth.

The impact analysis of the Baltic East OWF operation phase was carried out separately for the soft seabed macrozoobenthos association and hard seabed macrozoobenthos association.

This results from the fact that these two associations of bottom fauna (soft and hard seabed) differ in taxonomic composition, population abundance and biomass of the taxons forming them. Therefore, they differ in importance and sensitivity in the context of different types of impact.

The definition of macrozoobenthos sensitivity is given in Table [Table 62].

- **Loss of habitats**

New structures on the seabed will result in the **loss of a part** of the natural macrozoobenthos habitat. The seabed development will permanently eliminate biological life from the surface of the sediments occupied permanently (natural habitat of soft and hard seabed macrozoobenthos), to a greater extent under various types of sediments (e.g. drilling sediments with a thickness of up to 2 m) or rip-raps: scour protection layer, gravel rip-raps, rock bedding formed before the jack-up vessels installation, which will not be removed after the construction phase, stone rip-rap for inter array cables (IAC). To a lesser extent, this will eliminate the natural benthic habitat under the seabed surface occupied by the foundations of wind turbines and offshore substation.

Two types of foundations may be installed in the Baltic East OWF area: monopiles or jacket foundations. Foundations on the seabed will exist throughout the entire period of the farm operation, i.e. up to 55 years. Foundations of wind turbines and substations with surrounding gravel and rock rip-raps will also modify the distribution of sea current velocity around them. As a result of changes in hydrodynamics, the granulometry of bottom sediments may change in the immediate vicinity of foundations. In turn, they will cause the alteration of the qualitative and quantitative structure of zoobenthos associations in places where the benthos was not totally destroyed. Also during the works related to inspection and repair of underwater OWF components, benthos will be periodically and locally destroyed. All these impacts will indirectly also lead to temporary reduction of feeding grounds for benthivorous birds and fish for which clams are a key diet component [Köller et al., 2006; Petersen and Malm 2006; Zucco et al., 2006, Rydell et al., 2012).

Estimated calculations showing the amount of loss of macrozoobenthos resources in the Baltic East OWF area are presented below.

In the APV, permanent loss of habitats with macrozoobenthos associations under the foundations of up to 66 wind turbines (assuming monopiles with a larger occupied seabed area than tripods) and up to 2 offshore substation foundations will take place on the surface of 0.01 km^2. Additionally, the loss of habitat on the seabed occupied by the drilling sludge for monopiles and various types of rip-rap will cover the area of 1.81 km^2. In total, the loss of the seabed with macrozoobenthos associations of both soft and hard seabed will cover the area of 1.82 km^2, which constitutes 1.63% of the area of Baltic East OWF area.

The sensitivity of both the soft seabed macrozoobenthos and hard seabed macrozoobenthos to this impact is very high, since a part of the benthos association will be permanently destroyed under the impact of stress acting during the entire operation phase.

Additionally, when assessing the impact on the hard seabed macrozoobenthos association, it should be taken into account that an important component of the food base of fish and benthivorous birds will be eliminated from the environment, including the long-tailed duck recorded in shallower areas of the Baltic East OWF area [Appendix No. 1]. On the other hand, sea ducks in the Baltic East OWF area have difficult access to this type of food due to the high depth of the water region (approx. 25–40 m), where the rocky seabed overgrown by Mytilus trossulus bivalve molluscs is located. In the worst case scenario assuming that the hard seabed occupies approx. 70% of the BE area, the loss of *Mytilus trossulus* mussel may cover up to 0.56 km^2, which equals the biomass loss of approx. 1,747,200 kg, with the average biomass of macrozoobenthos of the hard seabed inhabiting the Baltic East OWF area of approx. 3,117 g m.m.·m^{-2} and with over 99% share of *Mytilus trossulus* mussel in this association. This negative impact related to the partial loss of important food resources will be compensated for by the positive impact when bivalve molluscs, mainly mussels re-colonize, quickly and as one of the first ones, underwater parts of wind turbines and the bottom environment around them on a hard and artificial substrate.

Given the above impact features, i.e. their impact range based on the area of loss of the seabed and macrozoobenthos inhabiting it, the permanence of this negative impact, **the significance of the loss of a part of the natural habitat** will be **insignificant** for both assessed macrozoobenthos associations – soft and hard seabed.

- **"Artificial reef" effect**

The artificial reef effect consists in colonization of artificial hard substrates (which are support structures introduced into the environment) by animal and plant epiphyte communities, as well as mobile epifauna. This impact is extensively documented in literature [e.g. Birklund and Petersen 2004; Meissner and Sordyl 2006; Wilhelmsson and Malm 2008; Birklund 2009; Langhamer et al., 2009; Kerckhof et al., 2010; Janßen et al., 2013 Rostin et al., 2013; Bergström et al., 2014; Macnaughton et al., 2014; Mesel et al. 2015; Luedke 2017; Wilding et al., 2017], but so far, there are no OWFs in the Polish Sea Area waters of the southern Baltic Sea, and it was not possible to monitor the phenomenon of artificial reef [Bergström et al., 2012; Topham et al. 2019 a and b; PWEA Report 2019]. Both experimental research on the artificial structure introduced into the environment [Dziubińska and Szaniawska 2010] and research on the phenomenon of fouling (biofouling) of the "Baltic Beta" drilling rig legs were undertaken [Kur et al., 2021). Based on the literature and environmental surveys, it is known that in the place where there has been no hard substrate so far, the qualitative and quantitative structure of the zoobenthos association will be altered within the entire microhabitat, i.e. on the surface of the underwater farm structure, on the surface of the erosion control layer and various types of rip-raps, both stone and rock ones. The process of overgrowing the support structures with periphyton organisms (invertebrates and macroalgae) begins after reproduction of periphyton species and settlement of larvae on the hard surface of the structure, most often in late spring. On the legs of the "Baltic Beta" drilling rig located approximately 80 km north of Rozewie at a depth of 80 m, a multi-layer structure with a thickness of 5-10 cm was found, consisting mainly of mussels *Mytilus sp*. and *Amphibalanus improvisus* growing on them, up to a depth of 50 m [Kur et al., 2021]. Periphyton communities have a significant impact on the marine environment at the ecosystem level, although it is difficult to clearly determine the nature of this impact. This depends on local environmental conditions, reproductive potential of zoobenthic organisms [Bergstrom et al., 2014; Mesel et al. 2015; Ojaveer et al., 2016).

This is a positive phenomenon, as local biodiversity will increase: species and habitat diversity, increase in biological production and change in natural values of this micro-habitat. A new shelter will emerge for the fry, an attractive feeding and spawning ground for many fish species, and quick colonization of hard substrate and the mussel (*Mytilus sp.*) communities usually dominating on support structures, which is predominant also in the open waters of the Baltic, will constitute a new food resource for fish and seabirds and will also act as biofilters, especially in polluted and eutrophic waters [Vuorinen et al., 2002; Wilhelmsson and Malm 2008; Langhamer et al. 2009; Bergstrom et al., 2014; Mesel et al. 2015).

The artificial reef effect may also be considered a negative impact, as the original naturality of a part of the seabed habitat and its fragmentation will be lost. Moreover, the presence of underwater hard components of wind turbines as a new microhabitat favors an increase in the biomass of gelatinous zooplankton (medusae), whose polyps (sedentary stage) attach to the surface of these structures [Janßen et al. 2013). The artificial environment created in the place of the previously existing natural habitat of the sandy and gravel seabed also favors the spread of non-native invasive alien species in the Polish Sea Areas [Bulleri and Airoldi 2005; Brodin and Andersson 2009]. Based on the surveys carried out as part of the "Second update of the preliminary assessment of the environmental status of sea waters" [Zalewska 2024] in 2016-2021 in the Polish zone of the Baltic Sea waters, six new introduced alien species were identified, of which four species represented macrozoobenthos (*Boccardiella ligerica, Callinectes sapidus, Chelicorophium robustum, Palaemon longirostris*). These introductions took place in the area of the Gdańsk Bay and Szczecin Lagoon and covered mostly the areas of ports in Gdańsk, Gdynia and Szczecin. Current information on new alien species is collected in various databases, e.g. AquaNIS. Editorial Board 2015 [http://www.corpi.ku.lt/databases/index.php/aquanis] or Ballast Water Exemption Decision Support Tool [http://jointbwmexemptions.org/ballast_water_RA/apex/]. Invasive alien species quickly displace native species, leading to undesirable changes in the existing balance in the trophic network [Janas and Kendzierska 2014; Normant-Saremba et al., 2017; Zalewska 2024].

A scenario of colonization of artificial substrates during the operation phase in the Baltic East OWF area is difficult to predict. On the basis of experimental surveys [Dziubińska and Szaniawska 2010], it is assumed that barnacles [*Amphibalanus improvisus*] and mussels (*Mytilus trossulus*) will appear first in the underwater plants, followed by mobile crustaceans (e.g. *Gammarus* spp., *Corophium volutator* and *Monoporeia affinis*), as well as macroalgae. The artificial reef will partially compensate for the destroyed macrozoobenthos association occurring there before human interference with the environment.

In the case of this impact, the assessment no longer covers the original benthos associations of the Baltic East OWF area, but the impact of the artificial reef on the natural environment. Therefore, the assessment of sensitivity of the soft seabed macrozoobenthos association is not applicable. However, the hard seabed macrozoobenthos association was very sensitive due to the ambiguous nature of the impact, positive or negative, but strongly changing the local benthic microhabitat, characterized by a different quality structure from that before the changes in the environment resulting from the project. Due to the permanent type of impact in the OWF operation period, i.e. up to 55 years, the significance of this impact will be **low**.

- **Electromagnetic field emission**

The operation of power cables connecting wind turbines and offshore substations (maximum 150 km in the Baltic East OWF area for the APV) will involve the **emission of electromagnetic field**, which is another impact that may have a negative impact on benthic organisms. The introduction into the environment of artificial magnetic fields generated by submarine cables is one of the environmental problems related to the phase of operation of offshore wind farms. Direct current cables generate a static magnetic field (CMF), while AC conductors generate a low frequency electromagnetic field (EMF). Information on the potential impact on benthic fauna in the Baltic Sea is increasingly documented, but still not clear about what extent this impact may cause a change in the structure and functioning of benthos [Andrulewicz et al., 2003; Meissner and Sordyl, 2006; Danheim et al., 2020). It is important to determine the cable burial depth, the cable type (AC or DC) and the cable insulation technology used, as well as the amount of this radiation and the exposure time [Otremba and Andrulewicz 2014; Taormina et al., 2018). For this Project, it is assumed that it will be possible to use AC cables with a rated voltage up to 132 kV.

The impact of electromagnetic field on individual species of benthic fauna, e.g. clams, crustaceans, polychaetes, has so far been investigated on the basis of laboratory experiments, and their results differ depending on the output data of the emitted electromagnetic field and the assessed organisms. One of the first surveys in this field showed that, in the worst case, emission of electromagnetic field may lead to neoplasms in bivalve molluscs and changes in motor capacity and bioturbation in polychaetes [Bochert and Zettler 2004; Jakubowska et al., 2019; Otremba et al., 2019; Stankeviciute et al., 2019). On the other hand, surveys carried out on crustaceans (*Rhithropanopeus harrisi* crab) showed that exposure to magnetic field and electromagnetic field did not significantly affect physiological processes – the rate of oxygen consumption and the rate of ammonia excretion in the dwarf crab. Also, no significant differences in osmotic concentration of crab haemolymph were observed. Moreover, attracting *R. harrisii* by electromagnetic fields may have ecological consequences in the form of increasing the abundance of crabs near cables and wind farm areas, which on the one hand may increase the pressure of these predators on their prey and on the other hand attract predators that feed on crabs [Jakubowska-Lehrmann et al., 2024). However, the latest surveys of impact of magnetic field (CMF) and electromagnetic field (EMF-50 Hz) on bioenergy (growth rate), oxidation stress and neurotoxicity of *Cerastoderma glaucum* clams confirmed that the SMF emission causes a decrease in the filtration rate and results in a smaller amount of available energy needed for the growth (biomass growth) of these clams. On the other hand, EMF is likely to have a negative effect on osmoregulation or membrane permeability in euryhaline invertebrates. A significant inhibition of acetylcholinesterase (AChE), a key enzyme for the functioning of the invertebrate nervous system with respect to EMF, was also observed [Jakubowska-Lehrmann 2022].

Experimental results on macrozoobenthos show that artificial magnetic fields can lead to behavioral, physiological, genotoxic and biochemical changes in benthic organisms. There are no standards for the introduction of these physical fields into the environment or any information on magnetic field values at which benthic invertebrates can normally function. Therefore, it is difficult to assess the project operation impact in the scope of the described parameter on macrozoobenthos. The intensity of the magnetic field decreases with the distance from the cable and already 6 m from the HVDC cable is close to the natural geomagnetic field [Bochert and Zettler 2004]. It is planned to install cables that will be buried to a depth from 3 to 6 m below the seabed surface or founded on the seabed and protected with stone rip-raps, which will effectively eliminate or reduce the impact of the EMR emitted by cables on macrozoobenthos. Given the survey results, local impact range and sensitivity of macrozoobenthos to EMR regardless of the assessed team assessed as low, thus the impact significance will be **negligible** for both macrozoobenthos associations.

- **Heat emission from cables**

The emission of heat from cables causing an increase in the sediments temperature during the operation phase will be caused by the electric current flowing in the cable along with the heating of the cable in accordance with the Joule Law. An increase in sediments temperature may lead to adverse changes in the qualitative structure of macrozoobenthos living on and in the seabed in the direct vicinity of cables, as it modifies the chemical and physical properties of bottom sediments and the availability of oxygen for bottom organisms, eliminating the most sensitive taxons [Taormina et al., 2018). For example, in Nysted Offshore Wind Farm (Western Baltic, Danish waters), the heat emitted by the transmission cable (132 kV) buried to a depth of 1 m increased the temperature by 1.4°C in a layer of 20 cm above the cable, and the temperature on the seabed surface remained unchanged [Merck 2009].

Cables in the Baltic East OWF area will be buried to a depth of up to 3 m below seabed level over most of the route length and may cause an increase in the average temperature at the seabed to 2°C at a depth of 0.2 m below seabed level. Exceeding the acceptable temperature range for sensitive species, especially infauna, may lead to physiological and behavioral changes, reproductive dysfunction and even mortality of benthic organisms [National Grid Viking Ltd. And Energinet.dk 2017]. Inventory surveys showed that the temperature of benthic waters in the Baltic East OWF area from June ranged from 4.31 to 10.06°C. Moreover, the heat emitted by cables can be effectively collected and dissipated by seawater [Taormina et al., 2018). In principle, the seabed fauna is naturally adapted to large seasonal temperature changes and is not sensitive or shows very low sensitivity to temperature increase by 2°C [Zucco et al., 2006; Birklund 2009], thus, changes in sediments and bottom water temperature caused by heat emission from power cables will not affect eurothermic bottom organisms adapted to significant temperature changes occurring in the environment. On the other hand, the research on the temperature impact on the biomass growth of benthic fauna in the disturbed seabed area (under the impact of trawling) showed no impact on the condition of bottom fauna from the North Sea at the temperature reaching 9.5°C. However, at the temperature of 11°C, the biomass of the tested invertebrates increases faster [Clare et al., 2021). Given the above arguments and due to the lack of in situ temperature measurement surveys over cables, there is still scientific uncertainty about ecological consequences for bottom fauna. While maintaining the precautionary approach, low sensitivity was assigned to two evaluated macrozoobenthos associations. For the long-term impact, its significance will be **negligible** for the soft seabed macrozoobenthos association and hard seabed.

A summary of the characteristics of impacts on soft and hard seabed macrozoobenthos associations is presented in Tables [Table 90, Table 91].

Table 90 Assessment of the scale of impacts on the soft seabed macrozoobenthos association during the Baltic East OWF operation phase for the APV [source: own study]

IMPACT CHARACTERISTICS	TYPE OF IMPACT			SPATIAL RANGE			DURATION					TYPE	
	Direct	Indirect	Secondary	Transboundary	Regional	Local	Long-term	Medium-term	Short-term	Temporary	Permanent	Positive	Negative
New structures on the seabed – loss of a part of a macrozoobenthos habitat	x					x					x		x
Electromagnetic field emission from power cables	x					x	x						x
Heat emission from power cables	x					x	x						x

Table 91 Assessment of the scale of impacts on the hard seabed macrozoobenthos association during the Baltic East OWF operation phase for the APV [source: own study]

IMPACT CHARACTERISTICS	TYPE OF IMPACT			SPATIAL RANGE			DURATION					TYPE	
	Direct	Indirect	Secondary	Transboundary	Regional	Local	Long-term	Medium-term	Short-term	Temporary	Permanent	Positive	Negative
New structures on the seabed – loss of a part of a macrozoobenthos habitat	x					x					x		x
New structures on the seabed – artificial reef effect		x				x	x					x	x
Electromagnetic field emission from power cables	x					x	x						x
Heat emission from power cables	x					x	x						x

The significance of impacts from the operation phase on soft seabed macrozoobenthos and hard seabed macrozoobenthos is presented in the Tables [Table 92, Table 93] below.

Table 92 Assessment of the significance of impacts on soft seabed macrozoobenthos during the Baltic East OWF operation phase for the APV [source: own study]

IMPACT	SCALE OF IMPACT	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
New structures on the seabed – loss of a part of a macrozoobenthos habitat	Low	Moderate	Low (N)
Electromagnetic field emission from power cables	Insignificant	Low	Negligible (N)
Heat emission from power cables	Insignificant	Low	Negligible (N)

Table 93 Assessment of the significance of impacts on hard seabed macrozoobenthos during the implementation phase of the Baltic East OWF for the APV [source: own study]

IMPACT	SCALE OF IMPACT	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
New structures on the seabed – loss of a part of a macrozoobenthos habitat	Low	High	Low (N)
New structures on the seabed – artificial reef effect	Low	Moderate	Insignificant (P)
Electromagnetic field emission from power cables	Insignificant	Moderate	Negligible (N)
Heat emission from power cables	Insignificant	Moderate	Negligible (N)

The impact assessment carried out for the soft seabed macrozoobenthos association and for the hard seabed macrozoobenthos association during the operation phase shows that the loss of a part of the habitat by placing new structures on the seabed will be of minor importance due to the high sensitivity of the seabed fauna to this type of impact. However, it should be borne in mind that this will apply to the loss of macrozoobenthos habitat with an area of approx. 0.8 km^2 and high loss of food resources in the form of elimination of *Mytilus trossulus* mussel clusters from the hard seabed with a biomass of 1,747,200 kg. Impact significance – insignificant was also assigned for the artificial reef effect in the Baltic East OWF area. Other impacts, i.e. emission of electromagnetic field and heat from cables, will be negligible for macrozoobenthos.

5.1.2.10.3 Impact on ichthyofauna

- **Emission of noise and vibration**

The impact of noise during the OWF operation phase will be much lower than that occurring during implementation. It will depend on the sources and the environmental conditions, i.e. depth, type of sediments, seabed morphology and wind speed. According to Thomsen *et al.* [2006], sound generated by operating wind turbines will be audible to salmon and common dab at a distance of approx. 1 km, and 4–5 km for cod and herring. The maximum range of the masking reaction (interference with sound perception) should be close to the range of audibility. However, for herring it is likely to be much smaller (Thomsen *et al.*, 2006). Very few data relate to possible avoidance and behavioral changes caused by noise generated by operating wind turbines. Observations carried out in the area of one of the Swedish wind farms showed no changes in behavior of eels swimming at a distance of 500 m from the operating wind turbine. Comparison of roach and cod catches in the vicinity of a shut-down wind turbine showed a significantly larger accumulation of fish in the immediate vicinity of the structure (100 m) than at a distance of 800–1000 m, which can be attributed to the artificial reef effect. In the case of an operating wind turbine, the catch volume decreased twice in a zone of 100 m. This result can be interpreted as the effect of the noise emitted, but other causes cannot be excluded (Westerberg 1994; Westerberg 2000; Thomsena *et al.*, 2006).

According to Wahlberg and Westerberg (2005), the avoidance effect can be expected at a distance of only a few meters from the wind turbines. During the operation of the wind farm, ongoing and unforeseen operational and repair works will be carried out. This will involve a periodically increased vessel traffic. This impact may result in both the avoidance reaction and the TTS. According to the report of the International Council for the Exploration of the Sea (ICES, 1995) on the impact of sound emitted by survey vessels, the avoidance reactions may occur when the noise level exceeds the audibility threshold of a given species by 30 dB and the impact range usually reaches 100–200 m. Typical reactions include diving or change of movement direction (de Robertis and Handegard 2013). Experimental surveys also found TTS in freshwater fathead minnow exposed to sound emitted by a boat's outboard engine (Scholik-Schlomer 2015). According to Thomsen *et al.* (2006), there are, however, no scientific grounds for determining an universal noise level of vessels that would not be detrimental to fish.

Fish are capable of acclimating to changing environmental conditions. During the experiments carried out on sole and cod, it was observed that during the first sound exposure tests the fish swimming speed was much faster than during the subsequent tests. This effect is most likely a result of fish getting accustomed to noise ((Mueller-Blenkle 2010). However, in the case of fish-emitted sounds used for communication, one way to adapt is to temporarily modify them. Typically, the length, amplitude or frequency of the sound changes (Radford *et al.* 2014).

The OWF Area is neither a cod spawning ground nor a deep-water spawning ground of the European flounder dominant in this area. During ichthyological surveys sprat spawning was discovered, but this sea basin is small in comparison with the large area of this species' spawning grounds. It can be assumed that the area avoidance reaction as behavioral impact is unlikely at a scale larger than several meters of direct vicinity of wind turbines.

Emission of noise and vibrations generated during the OWF operation may directly affect the ichthyofauna. The above impacts will be of negative, direct, local, long-term and permanent nature. The significance of the impact is assessed to be negligible for all investigated fish species.

- **Electromagnetic field emission**

Submarine cables through which electric current flows are an electromagnetic field source. The flowing current generates a magnetic field, which is a source of an induced electric field. Direct electric field emission occurs only in the case of solutions using electrodes placed in the sediments (Otremba and Andrulewicz 2014; Centre for Marine and Coastal Studies Ltd. 2015).

The nature of the electromagnetic field depends on the flowing current, the type of cable and whether it is located on the sediment surface or covered with a layer of sediment. Depending on the type of cable and its depth in the sediments, the range of magnetic impacts may vary from several to several hundred meters, but in the case of induced electric field it reaches several meters (Orbicon, 2014; Engell-Sorensen, 2002).

The specific dimensions of the generated fields depend on the applied technical solutions. The spatial range of the induced electric field usually reaches up to several meters from its source (Engell-Sorensen, 2002; Orbicon, 2014). For the electric field resulting from the application of the electrode solution, the field strength of approx. 3 V m-1 above the electrode may be expected to be below 0.5 V·m-1 at a distance of 40 m (assumptions: DC cable, 400 kV voltage, 1330 A current) (Otremba and Andrulewicz 2014).

The sensitivity of ichthyofauna to the impact of electromagnetic field depends on:

- the species-specific detection threshold;
- the type of sensor of the fish (magnetic, electrical);
- the lifestyle (demersal, pelagic) – bottom dwellers are exposed to a higher force of the electromagnetic field) (Engell-Sorensen, 2002).

The magnetic field detection threshold is, depending on the species, between 0.01 µT and 0.05 µT.

According to Taormin *et al.* (2018), the electromagnetic field caused by cables may affect navigation and orientation capabilities of marine organisms, cause avoidance or attraction effects, as well as cause physiological and developmental disturbances.

Disturbances in the natural field may cause problems with the orientation of migratory fish, such as European eel, in the case of which experimental surveys confirmed its sensitivity to changes in the magnetic field (Karlsson 1985). However, the previous field surveys do not indicate a significant impact of this factor on migration capabilities of this species. In surveys conducted in the southern Baltic Sea, Westerberg and Öhman *et al.* (1994, 2007) did not observe disturbances in the migration of eels swimming at a distance of 500 m from a wind turbine. Also Westerbeg and Begout-Anras (2000) did not find that the high-voltage DC cable constituted a barrier to migration of this species. Also, no significant impact of the long-term exposure of European flounder to an increased permanent magnetic field was observed (Bochert and Zettler 2004).

Surveys on the impact of the electric field on Salmonidae and eels show the possibility of occurrence of such reactions as accelerated heart rate (field strength of 0.007–0.07 V·m-1) as well as gills' and fins' vibration (field strength of 0.5–7.5 V·m-1) (Marino and Becker 1997). Harmful effects such as paralysis and temporary loss of consciousness were observed in fish exposed to an electric field with a strength above 15 V·m-1 (Balayev and Fursa, 1980; Fisher and Slater, 2010).

Surveys carried out at the Belgian C-Power wind farm located in the North Sea showed a maximum electric field strength of 0.3 MV·m-1 and a magnetic field strength of 4 nT. The predominant signal component was the 50 Hz frequency. However, no magnetic field generated by cables was found in the case of the Belgian Northwind farm, and a weak electric field was observed only at the closest distance from the turbine.

The information presented in section 2 (Description of the Proposed Project) shows that the technology optimization should minimize the emission of both the electric and magnetic components of the EMF. The above-mentioned information on EMF sizes measured in the area of already existing wind farms in the North Sea, combined with the results of surveys on thresholds causing negative impacts on fish make it possible to conclude that no significant impact of this factor on fish should be expected.

The impact related to the emission of electromagnetic field will be negative, direct, local, long-term and permanent.

The significance of the impact is assessed to be negligible for all investigated fish species.

- **Habitat change**

The presence of structural members of wind turbines and substations involves the creation of additional hard substrates forming a new habitat. Such artificial structures constitute an "artificial reef" – a new habitat that may be inhabited by periphyton organisms and, at the next stage, also by other organisms, including different fish development stages. The scale of this phenomenon depends both on the size of the reef and the complexity of its structures, the nature of the environment in which it grows and the fauna inhabiting its neighborhood (Hammar *et al.*, 2016). According to Bohnsack and Sutherland (1985), the process of forming a stable artificial reef system usually takes 1 to 5 years. Artificial reef is an attractive habitat that can offer rich food resources, shelter and create favorable conditions for reproduction for many fish species, both at adult and roe stages, larvae and juvenile specimens. Extensive hard structures (e.g. submerged structural members of a wind turbine) are attractive shelters for young (2–3 years old) cod (Reubens *et al.*, 2011). They are sheltered from sea currents, predators [Bohnsack and Sutherland,1985; Wilhelmsson and Malm, 2008) and fishing pressure. Artificial reefs may also provide favorable breeding conditions for many fish: herring, hooknose, garfish, lumpfish and rock gunnel [Zucco *et al.*, 2006]. According to Spanggaard (2006), the artificial reef area also provides the conditions preferred for spawning by gobies, which include species protected in Poland.

Surveys by Bergström *et al.* (2013) in the area of the "Lillgrund" OWF located in the Sound strait showed a clear accumulation of fish species such as cod, shorthorn sculpin, black goby, viviparous eelpout and eel in the project area. The assessment of whether the artificial reef effect is limited only to attracting fish to its area from the nearby sea basin or whether there is a real increase in productivity is ambiguous. Results of surveys performed by Reubens *et al.* (2014) carried out in the area of Belgian wind farms located in the North Sea show not only an accumulation of cod in these areas, but also an increase in local production. However, it was limited to the area in the immediate vicinity of the OWF, but this effect was not visible on a regional scale. If there are no restrictions on fishing in the OWF area, there may be a situation where large groups of fish attracted by favorable living conditions become an easy fishing target. b and biodiversity in the area adjacent to the wind farm (Goriup, 2017). b The results of surveys of the long-term impact of the Horns Rev 1 OWF on the population size and taxonomic composition of fish showed that the artificial reef effect was significant enough to cause an increase in the population of fish that prefer a hard substrate and, at the same time, too small to cause a decrease in the population of fish that prefer a sandy substrate (Sternberg *et al.*, 2015).

If possible restrictions on fishing and shipping are introduced in the Baltic East OWF area, anthropogenic pressure will decrease, and artificial reef areas may be a specific refuge for fish, both adult and their early development stages – larvae and fry – becoming an equivalent to protected areas (Degraer i Brabant, 2009).

It is possible that artificial reefs offering environmental conditions significantly different from those prevailing in a given area may constitute an environment facilitating invasion of foreign species (Langhamer 2009). However, the information available in literature concerns mainly the appearance of periphyton organisms and crustaceans. However, it is possible that artificial reefs can create an environment that also favors foreign fish species. A new habitat on the Baltic East OWF, with its hard substrate and a relatively rich food base for benthivorous fish, may constitute a favorable environment for the invasive round goby. Since the first report in 1990, on the introduction of the round goby to the Gdańsk Bay with the ballast waters of the vessels, the presence of this species has been recorded in the Polish area of the Baltic Sea, both in deeper waters (up to 40–60 m), and in the zone of shallow coastal waters: in the Pomeranian Bay and in the Vistula Lagoon. The round goby spreads in new habitats due to its tolerance to a wide range of changing environmental conditions: depth, nature of the substrate, salinity, oxygen scarcity and diversified feeding resources. It can live in marine, salty, but also freshwater environments (Charlebois *et al.*, 1997). The spawning of common goby takes place many times in several batches during the season at a depth ranging from 0.2 to 1.5 m on various substrates (Wandzel, 2003). The significant depth of the Baltic East OWF area prevents spawning in this area. It is unlikely that the area will be colonized by round gobies migrating from coastal areas due to the lack of plankton larval stages and a limited range of movements of adult fish.

This species rarely migrates far. The range of migrations is short and usually does not exceed 100 m (Skóra and Stolarski, 1996). The longest migrations take place in late autumn and early spring when fish move between shallow and deep waters (Berg 1948). The above information indicates that it should not be expected that this species will effectively inhabit the OWF area.

Given the presence of numerous boulders and relatively large seabed surfaces with abrasive dirt found during geological surveys of the Baltic East OWF area, it can be assumed that the appearance of additional hard substrates being components of the OWF will not fundamentally change the living conditions of ichthyofauna in the Baltic East OWF area. Changing the habitat will have little impact on reproductive processes. Due to the small impact of the seabed habitat change on the environmental conditions in the pelagic zone, it can be assumed that it will not affect the spawning of sprat in the water column.

However, additional overgrown areas can provide shelter and good growth conditions for juvenile cod stages, indirectly positively affecting their recruitment.

An increase in biomass of organisms growing on newly-formed substrates and crustaceans living on overgrown surfaces may increase the food base for cod, gobies, common seasnail and European flounder.

The impact related to the change of habitat will be positive, direct, local, permanent and long-term.

The significance of the impact is assessed to be negligible for all investigated fish species.

- **Barrier creation**

The construction of underwater structures may constitute a migration barrier for economically important fish whose routes run in this place. The observations carried out in the areas of the Danish OWFs show that due to the possibility of an active movement of fish, this factor does not significantly disturb migration processes (Leonhard *et al.*, 2011). The impact related to the creation of a barrier will be negative, direct, local, long-term and permanent. The significance of the impact is assessed to be negligible for all investigated fish species.

The EIA Report methodology was adopted to assess the significance of impacts. The results are presented in table [Table 94].

Table 94 Significance of impact on ichthyofauna during the operation phase

Impact	Impact description	Species	Scale of impact	Receptor sensitivity	Impact significance
Emission of noise and vibration	Behavioral reaction	Cod	Insignificant	Moderate	Negligible (N)
		Herring	Insignificant	Moderate	Negligible (N)
		Sprat	Insignificant	Low	Negligible (N)

Impact	Impact description	Species	Scale of impact	Receptor sensitivity	Impact significance
		European flounder	Insignificant	Low	Negligible (N)
		Protected species	Insignificant	Moderate	Negligible (N)
Impact of electromagnetic field	Change in fish behavior: avoiding the impact zone or attracting fish towards them, depending on the species	Cod	Insignificant	Moderate	Negligible (N)
		Herring	Insignificant	Moderate	Negligible (N)
		Sprat	Insignificant	small	Negligible (N)
		European flounder	Insignificant	small	Negligible (N)
		Protected species	Insignificant	Moderate	Negligible (N)
Habitat change	Appearance of a new hard substrate; artificial reef effect, improvement of living and reproductive conditions	Cod	Insignificant	Moderate	Negligible (N)
		Herring	Insignificant	Low	Negligible (N)
		Sprat	Insignificant	Low	Negligible (N)
		European flounder	Insignificant	Moderate	Negligible (N)
		Protected species	Insignificant	High	Negligible (N)
Barrier creation	Physical barrier to fish migration	Cod	Insignificant	Moderate	Negligible (N)
		Herring	Insignificant	Low	Negligible (N)
		Sprat	Insignificant	Low	Negligible (N)
		European flounder	Insignificant	Low	Negligible (N)
		Protected species	Insignificant	Moderate	Negligible (N)

The conducted analysis showed that the significance of impacts present at the operation phase on ichthyofauna is negligible.

5.1.2.10.4 Impact on marine mammals

Potential impacts related to the Baltic East OWF operation phase include an increase in the level of underwater noise and changes in the habitat and food base.

- **Increase in underwater noise level**

  a. **Noise from operating turbines**

The main **source of underwater noise** during the wind farm operation phase will be the operating turbines.

The wind farm operation generates noise, which is introduced into both air and water. Its source is the moving mechanical parts of the nacelle – generator and gearbox, as well as wind vibrations caused by the tower. The sound is transmitted to the water via the turbine base and the supporting structures. The generated noise is within the low frequency spectrum, with most energy below 1 kHz (Madsen *et al.*, 2006; Thomsen *et al.*, 2006). The generated sounds are continuous and are almost permanently present in the environment for the duration of the wind farm operation (up to 55 years), which may contribute to the increase of the local acoustic background level. Noise level generated by single wind turbines depends on several factors, but is generally considered low. Based on measurements performed for various wind farms, Tougaard *et al.* (2020) estimated that the noise from the operating turbine is lower by 10–20 dB than the vessel noise level measured at the same distance. In a study based on numerical modeling, Stöber and Thomsen (2021) concluded that the broadband peak operational noise level for 1 m from the sound source ranged from 129 to 166 dB re 1 µPa (nominal power: 0.45–6.15 MW). Numerical analyses carried out by Tougaard *et al.* (2020) and Stöber and Thomsen (2021) showed that the main factors affecting the noise level generated by operating turbines are: geometry and power output of the turbine, use of gearbox or direct drive, foundation type and wind speed. Tougaard *et al.* also calculated that the noise level decreases significantly with the distance – approx. 24 dB/decade and increases at wind speed – 18.5 dB/decade. Stöber and Thomsen (2021) estimated that changing the technology used from gearbox to direct drive allows the reduction of sound level by 10 dB. Broadband sound level from a direct drive turbine was estimated at 160 dB 1 µPa. Both analyses performed by Tougaard *et al.* (2020) and by Stöber and Thomsen (2021) showed a positive relationship between the nominal power output of the turbine and the generated sound. In the light of the latest surveys carried out by Bellmann *et al.* (2023) and Holme *et al.* (2023), this relationship has not been established. There was also no impact of other variables such as gearbox or direct drive or foundation type (Bellmann *et al.*, 2023).

The impact of noise from operating wind turbines on marine organisms is still poorly understood and knowledge in this respect is developing. Field data are available for a small number of species and areas, but they do not provide sufficient information in relation to the huge scale of currently planned offshore projects. Due to the fast-growing OWF industry around the world, more and more attention is being paid to the potential cumulative effects resulting from the increasing size of turbines and their nominal power output, and thus the generated sound levels.

Currently, the available results of surveys of the impact of noise from operating wind turbines on marine mammals come mainly from European waters and cover turbines with a foundation diameter below 10 m. The analyses were carried out around farms located in the North Sea and covered three species – harbor porpoise and gray seal, and harbor seal.

In the case of porpoises, the surveys were based on passive acoustic monitoring carried out within the operating wind farm and in adjacent waters, which allowed the obtaining of data on the acoustic activity of animals during OWF operation. During two years of Nysted OWF operation, porpoises gradually became accustomed to new environmental conditions and started to appear again in the monitored area (Tougard *et al.*, 2006). After 10 years of monitoring in the Nysted area, it was demonstrated that despite slow return of animals, their activity was lower than in the period before OWF construction (Teilman, Carstensen 2012). However, in the nearby Rodsand 2 wind farm, there were no changes in the overall level of porpoise detection between the baseline conditions and the operation phase (Teilman *et al.*, 2012). There were also no differences in animal activity between the OWF area and the reference area. The authors demonstrated that there were no cumulative impacts from two neighboring operating wind farms. The surveys carried out for the Egmond aan Zee OWF showed an increase in the acoustic detection of porpoises during the farm operation phase, which was consistent with the general trend of the species population increase in Dutch waters during the monitoring. It was also established that the activity of animals was much higher in the OWF area than in the reference area. In all the above surveys, the authors demonstrated a possible positive impact of the operated wind farm on the population of porpoises. Probable explanations of the phenomenon include the reef effect, which results in increased availability of food, as well as reduced vessel traffic compared to other parts of the North Sea intensively used by vessels (shelter effect).

With respect to seals, the performed surveys were based on telemetric monitoring of animals using haul-out sites in the vicinity of operating wind farms. Gray seals and harbor seals repeatedly moved between haul-out points through the Nysted and Rodsand II OWF areas (McConnel *et al.*, 2012). No impact of the operating turbines on the behavior of migrating animals was found. In the surveys at a British wind farm, an increase in the use of the area around the OWF by harbor seals was observed, which coincided with the general increase in the population of seals in the region (Russel *et al.*, 2016). None of the above surveys showed negative effects of OWF noise during the operation phase on seals.

The presented survey results cover offshore wind farms built of turbines with a smaller power output than expected in the proposed Project. Currently, there are no environmental data on marine mammals from surveys for monopile-based OWFs. Available information on the potential impact of noise comes from analyses based on numerical modeling (Tougaard *et al.*, 2020; Stöber and Thomsen, 2021). These surveys show the possibility of cumulative negative impacts of sounds generated from high-power turbines. However, the calculations were performed assuming an increase in the noise level along with the size and power output of the turbine, which might not occur in the light of the latest field surveys (Bellmann *et al.*, 2023; Holme *et al.*, 2023).

Given the above-presented results of monitoring of marine mammals carried out so far in places of operating OWFs, there are no indications that the operational noise has a significant negative impact on porpoises and seals. Moreover, it should be kept in mind that sounds generated by operating turbines are of low frequency, of lesser importance for porpoises and to which these animals are less sensitive. Seals use low frequency signals during mating vocalizations, but there are no data demonstrating the significance of the analysed area for the breeding of pinnipeds. Moreover, seals are generally less sensitive to sounds than porpoises and may show adaptive behaviors in places with increased noise levels ([Edrén *et al.,* 2010]. Given the above and the low frequency of occurrence of seals and porpoises in the analysed area, no significant impact of noise generated during the Baltic East OWF phase on marine mammals is presumed.

b. Noise from vessels

The operation of the offshore wind farm involves the traffic of service vessels, probably large and medium-sized ones. Such vessels have the potential to increase noise level in the environment, including the noise at frequencies used by marine mammals. However, it is expected that both the number of service activities and vessels moving at the same time will be low, thus having a small impact on sea mammals.

- **Changes in the habitat and food base**

It is assumed that when construction works causing disturbances in the environment and potential loss of feeding grounds for marine mammals come to an end, a gradual reconstruction process will take place. It is likely that habitats of benthic organisms will be created around the Baltic East OWF area, which will attract fish and also restore the availability of food for porpoises and seals. In the case of concrete piles on which the turbines will be installed, the reef effect may also occur (Chapter **5.1.2.10.2**). Benthic organisms often settle in large numbers on additional underwater structures placed on the seabed. This increases local populations and biodiversity of fish, often attracting marine mammals as well. Such alterations in the environment were found in the areas around offshore wind turbines. The effect of attracting organisms to offshore wind farm areas is additionally reinforced by the fact that these are areas excluded from fishing (Degraer *et al.*, 2020).

A summary of the impact of the Baltic East OWF operation phase on marine mammals is presented in tables [Table 95–Table 96].

Table 95 Characteristics of impacts on marine mammals forecasted during the Baltic East OWF operation phase [source: internal materials]

ANIMAL SPECIES/GROUP	TYPE OF IMPACT	TYPE OF IMPACT			SPATIAL RANGE			DURATION					TYPE	
		Direct	Indirect	Secondary	Transboundary	Regional	Local	Long-term	Medium-term	Short-term	Temporary	Permanent	Positive	Negative
Common porpoise	Noise level increase – operation of wind turbines	x					x	x						x
	Noise level increase – vessel traffic	x					x	x						x
	Change of habitat and food base		x				x	x					x	
Seals	Noise level increase – operation of wind turbines	x					x	x						x
	Noise level increase – vessel traffic	x					x	x						x
	Change of habitat and food base		x				x	x					x	

Table 96 Assessment of the significance of impacts of the Baltic East OWF operation phase on marine mammals [source: internal materials]

ANIMAL SPECIES/GROUP	IMPACT	SCALE OF IMPACT	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
Common porpoise	Noise level increase – operation of wind turbines	Low	Moderate	Low (N)
	Noise level increase – vessel traffic	Insignificant	Moderate	Negligible (N)
	Change of habitat and food base	Moderate	Moderate	Insignificant (P/N)
Seals	Noise level increase – operation of wind turbines	Low	Moderate	Low (N)
	Noise level increase – vessel traffic	Insignificant	Low	Negligible (N)
	Change of habitat and food base	Moderate	Moderate	Insignificant (P/N)

5.1.2.10.5 Impact on birds

5.1.2.10.5.1 Seabirds

- **Vessel traffic**

The presence of vessels and fixed structures protruding from the water will result in a higher number of gulls and great cormorants that use such components as resting sites and seek food in the vicinity of vessels. In the open sea, gulls gather around fishing vessels. If commercial fishing is reduced in this water region during the wind farm operation, these gulls will move (at least partially) to other fishing sites.

Operation of the Baltic East OWF will involve the traffic of various types of water vessels servicing the OWF. Because it is difficult to separate their impacts (unknown number of helicopters that can be used), these impacts are assessed jointly.

Vessel traffic during the operation phase will cause a direct negative impact on seabirds. In the case of benthivorous and piscivorous birds, this is an impact of regional range due to a possible impact on the biogeographical population of the species, and an impact of a local range in the case of gulls. In the case of benthivorous and piscivorous birds, this is a short-term impact, and a temporary impact in the case of gulls.

Sensitivity to the impact on the gull was assessed as low and on other species as high.

Impact **significance** was determined as significant for ichthyophagus species, moderate for bentophagus species and insignificant for gulls.

- **Scaring away and displacement from the habitats**

During OWF operation, most bird species will avoid staying in its vicinity, as a result of which they will largely lose access to their feeding grounds.

OWF operation will result in scaring away and displacing some part of seabirds from their habitats in the water region occupied by the offshore wind turbines and in the adjacent water strip that will be approximately 2 or even 4 km wide. The degree and area of birds displacement from this sea basin and its surroundings will depend on the bird species.

A single OWF is a barrier for birds, which, in the vast majority of cases, avoid the water region with offshore wind turbines. Such a behavior reduces the risk of collision, especially during the day when the visibility is good. However, the OWF area will be excluded for a large part of the population as a feeding ground for a long time, which may have a negative impact on some species.

The most important parameters affecting the scale of impact on seabirds include:

- the number of wind turbines;
- density of wind turbines;
- clearance between the sea surface and the lower level of the rotor blade (most flights take place up to 20 m above the water surface);
- rotor diameter;

- distance from the neighboring OWFs – neighboring offshore wind farms cause an accumulated barrier effect.

Scaring and displacement from the habitat during the operation phase will cause a direct and negative impact on seabirds. In the case of benthivorous and piscivorous birds, this is an impact of regional range due to a possible impact on the biogeographical population of the species, and an impact of a local range in the case of gulls. In the case of benthivorous and piscivorous birds, this is a short-term impact, and a temporary impact in the case of gulls.

Sensitivity to the impact on gulls was assessed as low and for other species groups as high.

Impact significance was determined as significant in the case of piscivorous and benthivorous birds, and insignificant in the case of gulls.

- **Barrier creation**

The structures of wind turbines will occupy a part of the OWF water region, creating a barrier for seabirds traveling on a local scale between feeding or resting grounds, which reluctantly fly over obstacles. The range of the barrier effect will depend on the number and size of constructed wind turbines. However, selection of the option will not have a significant impact on the size and significance of the project impact on seabirds. It is noted that seabirds clearly avoid the area occupied by wind turbines and their population decreases in the vicinity of wind turbines – e.g. for the long-tailed duck within a radius of up to 2, and even up to 4 km (Christensen et al., 2003; Petersen et al. 2006; Leopold et al. 2007). The only exceptions are European herring gulls and great cormorants, which often use structures protruding above water as resting sites, so that their population may even increase.

The barrier effect that will be created by the Baltic East OWF applies primarily to migratory birds. A part of seabirds migrating through the OWF area may, however, target nearby Natura 2000 sites "Ławica Słupska" and "Przybrzeżne Wody Bałtyku", where they may have their landing sites, overwintering sites or breeding grounds. The creation of a coherent barrier in this area may also hinder the movement of those populations between the closest similar wintering sites being the Słupsk Bank, the South Middle Bank and the Hoburgs Bank. Today, there are no scientific data on the significance of connections between these areas, but they cannot be dismissed.

Operating wind turbines will be a physical barrier, causing the risk of collision and, on the other hand, deterring birds and causing a loss of feeding grounds. The bird scaring effect of offshore wind farms minimizes the risk of collisions. However, the risk of collision to a larger extent applies to migratory birds flying at night and in conditions of limited visibility than to birds staying in the OWF area.

The creation of a barrier during the operation phase will cause a direct negative impact on seabirds. In the case of benthivorous and piscivorous birds, this is an impact of regional range due to a possible impact on the biogeographical population of the species, and an impact of a local range in the case of gulls. In the case of benthivorous and piscivorous birds, this is a short-term impact, and a temporary impact in the case of gulls.

Sensitivity to the impact on gulls was assessed as low and for other species groups as high.

Impact significance was determined as significant in the case of piscivorous and benthivorous birds, and insignificant in the case of gulls.

- **Collisions with wind turbines, substations and vessels**

Wind turbines cause changes in the way birds use space, which also applies to offshore areas. In the vast majority of cases, wind turbines scare away birds and migrating seabirds bypass wind turbine farms at a distance from 100 to even 3000-4000 m (Christensen et al., 2003; Petersen et al. 2006; Leopold et al. 2007). Consequently, the areas directly adjacent to the wind turbine are much less used as feeding grounds and resting sites. The area where wind turbines stand largely stops being available as a feeding ground for birds, and, in some cases, significantly lower density of birds can be observed at a distance of up to 2 or even 4 km from the wind turbine (Petersen et al., 2005). The fact that seabirds avoid the area where wind turbines are located and the low flight altitude between the offshore wind turbines reduce the risk of collisions, resulting in low mortality caused by collisions with offshore wind turbine structures. However, with poor visibility resulting from fog and rainfall, the risk of collision increases. The number of collisions with wind turbines increases significantly when they are located in areas attractive to birds and densely populated, and when the wind turbines are located on regular migration or local migration routes.

The risk of collision also depends on the species of bird. Large seabird species, such as swans, are more vulnerable to collisions with wind turbines due to difficulties in carrying out rapid mid-air maneuvers (Brown et al., 1992). Most seabird species fly low above the water and, when they are between offshore wind turbines, they move down and maintain equal distances from obstacles (Desholm et al., 2005; Hüppop et al., 2006; Petersen et al. 2006). This means that the risk of collision is influenced by the clearance between the lower position of the rotor blade and the sea surface. The smaller it is, the greater the likelihood of birds colliding with the working rotor.

The collision risk modeling for each species was carried out for a total of 28 scenarios, differing in:

- interest number of turbines (69, 64 and 38 pcs.),
- clearance between the lower rotor position and the water table (20.0; 22.5; 30.0 and 37.5 m),

- avoidance rate (0.95 to 0.995).

In order to determine the collision risk of individual species of stationary and migratory birds in the surveyed area, a commonly used Band's Collision Risk Model (CRM) was used (Band 2012; Masden et al., 2016). The maximum estimated number of collisions during spring and autumn migration for a turbine group is:

- for the long-tailed duck: 0.00-0.15 collisions/season,
- for common scoter: 0.03-0.76 collisions/season,
- for velvet scoter: 0.03-1.76 collisions/season,
- for ducks in total: 0.11-12.89 collisions/season,
- for common guillemot: 0.00-0.27 collisions/season,
- for razorbill and black guillemot: 0.00 collisions/season,
- for razorbill in total: 0.00-0.14 collisions/season,
- for black-throated loon: 0.01-0.50 collisions/season,
- for total loons: 0.04-0.95 collisions/season,
- for lesser black-backed gull: 0.22-3.18 collisions/season,
- for the little gull: 0.03-0.42 collisions/season,
- for gulls in total: 0.33-10.17 collisions/season,

During the Baltic East OWF operation phase, collisions of seabirds with service vessels may occur. However, due to the intensity of vessel traffic in the OWF area during the construction and decommissioning phases, this impact will be the smallest in the operation phase of the planned project. Along with the progressing construction of the OWF, the risk of bird collision with wind turbines will increase. It will reach its peak during the OWF operation phase.

Collisions with wind turbines during the operation phase will cause a direct negative impact on seabirds. This is an impact of regional range for bentophagus and ichthyophagus species due to possible impact on the biogeographical population of the species, and an impact of local range for gulls. In the case of benthivorous and piscivorous birds, this is a short-term impact, and a temporary impact in the case of gulls.

Sensitivity to the impact on gulls was assessed as low and for other species groups as high.

Impact **significance** was determined as significant for ichthyophagus and bentophagus species and insignificant for gulls.

- **Creation of an artificial reef**

Habitat changes caused by the formation of an artificial reef may have a certain positive impact on benthic-feeding seabirds thanks to an increase in the food base. Rich benthos associations are formed on the underwater parts of the structure and at the bottom of the water region occupied by the OWF, which may result also in an increase in the population of fish. However, these resources will be little or not at all used by birds. The effect of bird deterrence by structures protruding high from water will prevail here. The most important parameters affecting the level of impact are the shape, the diameter of the base and support structures.

The creation of an artificial reef is a positive long-term impact of local range on seabirds, direct impact on ichthyophagus species and indirect impact on ichthyophagus species and gulls.

Sensitivity to the impact on gulls and ichthyophagus species was assessed as insignificant and for bentophagus species as high.

Impact significance was determined as moderate for ichthyophagus and bentophagus species and insignificant for gulls.

- **Water region closure** (total or partial) for users

The OWF area may be, during the operation phase, a totally or partially closed water region for commercial fishing. In such a case, it may be expected that fish will find very good living conditions in the OWF area (no fishing, rich benthos associations). However, birds will benefit to a small extent from such a food base due to the prevailing deterrent effect of structures protruding high from water.

The closure of a water region has an indirect, positive, local, long-term impact on seabirds.

Sensitivity to the impact on gulls was assessed as insignificant, for bentophagus species as moderate and for ichthyophagus species as high.

Table [Table 97] presents a summary of the significance of impact of the Baltic East OWF on seabirds during the operation phase.

Table 97 Significance of impact on seabirds during the Baltic East OWF operation phase

SPECIES	IMPACT	IMPACT DESCRIPTION	IMPACT SIGNIFICANCE
Piscivorous birds	Establishment of a closed sea basin	The OWF Area may be partially closed for fishery	Moderate (P)
	Vessel traffic	Startling caused by the traffic of vessels, helicopters	Moderate (N)
	Creation of an artificial reef	Creation of a new hard substrate for macrozoobenthos	Moderate (P)

SPECIES	IMPACT	IMPACT DESCRIPTION	IMPACT SIGNIFICANCE
	Scaring away and displacement from the habitats	Caused by the operation of wind turbines	Significant (N)
	Barrier creation	Depending on the number of wind turbines, light and noise emitted	Significant (N)
	Collisions with wind turbines	Depending on bird migrations, density, flight altitude, WT parameters	Significant (N)
Benthivorous birds	Establishment of a closed sea basin	The OWF Area may be partially closed for fishery	Significant (P)
	Vessel traffic	Startling caused by the traffic of vessels, helicopters	Significant (N)
	Creation of an artificial reef	Creation of a new hard substrate for macrozoobenthos	Moderate (P)
	Scaring away and displacement from the habitats	Caused by the operation of wind turbines	Significant (N)
	Barrier creation	Depending on the number of wind turbines, light and noise emitted	Significant (N)
	Collisions with wind turbines	Depending on bird migrations, density, flight altitude, WT parameters	Significant (N)
Seagulls	Establishment of a closed sea basin	The OWF Area may be partially closed for fishery	Insignificant (P)
	Vessel traffic	Startling caused by the traffic of vessels, helicopters	Low (N)
	Creation of an artificial reef	Creation of a new hard substrate for macrozoobenthos	Insignificant (P)
	Scaring away and displacement from the habitats	Caused by the operation of wind turbines	Low (N)
	Barrier creation	Depending on the number of wind turbines, light and noise emitted	Low (N)
	Collisions with wind turbines	Depending on bird migrations, density, flight altitude, WT parameters	Low (N)

Impact significance was determined as significant for ichthyophagus species, moderate for bentophagus species and low-equivalent for gulls.

5.1.2.10.5.2 Migratory birds

During the operation phase, there will be impacts on migratory birds as a result of the barrier effect and the risk of collision with Baltic East OWF structures, as analysed and described in detail in **Appendix No. 4 Results of modeling the collision risk and barrier effect on migratory birds**. Underwater noise and surface noise are not considered a potential impact on migratory birds.

- **Barrier effect**

The presence of the OWF results in the creation of a barrier effect affecting the behavior (movement) of migratory birds. The scale of impact will depend on the number of wind turbines, their size and distribution in the Baltic East OWF area. Birds may be forced to change flight direction horizontally or vertically, which may slightly extend migration and increase energy demand. The surveys carried out so far in this respect show that bypassing even several OWFs slightly increases both the total length of the migration route and energy expenditure relating to migration (Masden et al., 2010, King et al., 2009, Drewitt et al., 2006). These results were taken into account as a reference point for this document, however, it should be emphasized that the studies presented in the literature refer to different maritime areas. Masden and Cook (2016) present the results for the Nysted OWF in the Baltic Sea (165 MW). The report prepared by JENSENA et al. (31) presents the situation for Horns Rev 3 OWF (400 MW, Horns Rev 3, North Sea). For the Horns Rev 3 OWF, which borders with two other OWFs – Horns Rev 1 (160 MW) and Horns Rev 2 (209 MW), it was considered that cumulative impacts will not occur.

Similarly to the implementation and decommissioning phases, this impact is direct, however, due to the duration of the operation phase (maximum 55 years), the time frame was determined as long-term.

Forced change of the route in order to evade the Baltic East OWF is extended by 17 km on average, which extends the migration route by 1.41% on average, and by 0.49% in the case of common cranes. Extension of the route by 17 km relating to the barrier effect of the Baltic East OWF will increase energy expenditure on crossing the route to a negligible extent (Merkel and Johansen 2021; Pennycuick 2001). Additionally, in the case of Passerine birds flying the migration route mainly at night and at high altitudes (above the rotor range), the barrier effect will not occur because the birds will fly over the Baltic East OWF. Therefore, the significance of the barrier effect impact for all bird groups and species included in the analysis was considered insignificant and negligible.

- **Risk of collision**

The impact in the form of collision risk, i.e. bird mortality resulting from collisions with OWF components, was presented in the form of the total number of collisions of a given species during spring and autumn migration in Appendix No. 4 to the EIA Report. The collision risk depends on the OWF parameters, such as the number of wind turbines, rotor diameter, the clearance between the lower range of the rotor and the water surface, on biological parameters and individual species – body size, flight speed, flight altitude, collision avoidance rate, but also on weather parameters. In the case of limited visibility (low clouds, night, dense fog), birds are able to notice the OWF from a much shorter distance, which results in a higher collision risk. A summary of the impact of the Baltic East OWF implementation phase on migratory birds is presented in the Table [Table 98] below. Although the expected number of collisions is not high, the limited population of this species (240,000 individuals) and the fact that it is characterized by a lower degree of turbine avoidance (83%) than in the case of other species (amounting to 99%) were taken into account. The modeling results for RAV do not differ significantly from the results obtained for APV1 and APV2.

Table 98 Assessment of the significance of impacts on migratory birds during the Baltic East OWF operation phase [source: own study]

ENGLISH NAME	LATIN NAME	IMPACT	RECEPTOR VALUE	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
Common scoter	*Melanitta nigra*	Barrier effect	Moderate	Low	Low (N)
		Risk of collision	Moderate	Low	Low (N)
Velvet scoter	*Melanitta fusca*	Barrier effect	Moderate	Insignificant	Low (N)
		Risk of collision	Moderate	Insignificant	Low (N)
Eurasian wigeon	*Mareca penelope*	Barrier effect	Moderate	Insignificant	Low (N)
		Risk of collision	Moderate	Insignificant	Low (N)
Long-tailed duck	*Clangula hyemalis*	Barrier effect	Moderate	Low	Low (N)
		Risk of collision	Moderate	Low	Low (N)
Anatini ducks	*Anatini*	Barrier effect	Moderate	Insignificant	Negligible (N)
		Risk of collision	Moderate	Insignificant	Low (N)
Divers	*Gaviidae*	Barrier effect	Moderate	Insignificant	Low (N)
		Risk of collision	Moderate	Insignificant	Low (N)
Crane	*Grus grus*	Barrier effect	Moderate	Moderate	Low (N)
		Risk of collision	High	Moderate	Moderate (N)
Auks	*Alcidae*	Barrier effect	High	Insignificant	Low (N)
		Risk of collision	Moderate	Insignificant	Low (N)
Great cormorant	*Phalacrocorax carbo*	Barrier effect	Low	Insignificant	Negligible (N)
		Risk of collision	Low	Low	Low (N)
Geese	*Anserini*	Barrier effect	Low	Low	Negligible (N)
		Risk of collision	Moderate	Low	Low (N)
Lesser black-backed gull	*Larus fuscus*	Barrier effect	Low	Low	Negligible (N)
		Risk of collision	Moderate	Insignificant	Low (N)
Little gull	*Hydrocoloeus minutus*	Barrier effect	High	Low	Low (N)
		Risk of collision	Moderate	Low	Low (N)
Swans	*Cygnus spp.*	Barrier effect	Low	Insignificant	Negligible (N)
		Risk of collision	Moderate	Insignificant	Low (N)
Passerine	*Passeriformes*	Barrier effect	Low	Insignificant	Negligible (N)
		Risk of collision	Low	Insignificant	Low (N)
Terns	*Sternidae*	Barrier effect	Low	Insignificant	Negligible (N)
		Risk of collision	Low	Insignificant	Low (N)
Charadriiformes	*Charadriidae*	Barrier effect	Low	Low	Low (N)
		Risk of collision	Moderate	Low	Low (N)

Both the two scenarios of the Applicant Proposed Variant (APV1 and APV2) and the Reasonable Alternative Variant (RAV) were tested in the analyses. Among all species included in the analysis, the impact significance resulting from collisions was assessed as **insignificant** for most species and groups of species. The impact in the form of collision risk was assessed as moderate **for** the crane.

5.1.2.10.6 Impact on bats

Wind turbines pose a potential threat to bats resulting mainly from the risk of direct collision as well as from barotrauma.

Operating wind turbines are a physical barrier to bat migration routes. Collision with the wind turbine rotor is the main cause of their mortality (Kunz et al., 2007, Kepel et al., 2011). Bats hit by the rotor blades die due to fractures, open wounds, multi-organ injuries or wing amputations (Kepel et al., 2011, Horn et al., 2008). The significant height of wind turbines does not protect against collisions. In the UK, the activity of bats of the genera Nyctalus and Eptesicus at a height of 30 m above ground did not differ significantly from that recorded at ground height (Collins and Jones 2009). Satter and Bontadina (2005, in: Collins and Jones 2009) recorded the signals of flying Nathusius' Pipistrelle at a height of 150 m, serotine bats at a height of 90 m and mouse-eared bats at a height of 30 m above the ground. Feeding of bats was recorded there up to a height of 90 m.

Mortality due to collisions is additionally increased by unusual behavior of bats. During migration, the flight height of the common noctule at a height of approx. 10 m above the water surface was confirmed using the radar method. However, every time bats approached an obstacle (buoy, vessel, mast), the flight height increased sharply, up to 100 m. It was also confirmed that wind turbines were used at sea as resting places as bats were found on nacelles, which was never recorded on onshore wind turbines (Ahlen et al., 2007, Ahlen et al., 2009). Feeding of species not migrating through the Baltic Sea at offshore wind turbines was also confirmed, which may potentially cause collisions of individuals from species occurring in Pomerania.

Wind turbines may attract migrating bats in the open sea area, providing a convenient resting place during migration, especially in unfavorable weather conditions. Strong and white light (lighting) will attract night insects, creating feeding grounds, which may result in bat mortality in areas not used by them before project implementation (cf. Cryan and Brown 2007, Horn et al., 2008, Hüppop et al., 2016).

Apart from the direct collision risk, there is also a risk of barotrauma – pressure shock as a result of which the lung bubbles break and no external injuries can be seen in dead bats. The rotating blades of wind turbine blades cause large pressure differences. As a result, a decompression phenomenon causing barotrauma in bats occurs (Furmankiewicz et al., 2009; Baerwald et al., 2008).

The results of pre-implementation surveys carried out prior to the preparation of this EIA Report show that the Baltic East OWF area is used by bats to a small extent in the spring migration period, and in the autumn migration period quite intensively in a very short period (the second half of August and the first half of September). The total level of bat activity in the surveyed area during spring and autumn on transects was low and remained at the maximum level of 5.9 flights/hour (median = 0.0, average = 0.23). The identification low activity may suggest that the impact of the Baltic East OWF during the operation phase will be small, but in the autumn migration period it will be large. However, only reliable surveys of activity in the first years of operation will give a real picture of the project impact on bats, and if their activity increases, they will make it possible to determine possible periods of restrictions in the operation of wind turbines.

The common noctule, found in 76.2% of activity in the surveyed area and the Nathusius' Pipistrelle (23.4%) are long-distance migrants (Dietz et al., 2009), representing the majority of the victims of collisions with wind turbines among European bats on onshore wind farm surfaces (Rydell et al., 2010). They are species classified as highly exposed to collisions with wind turbines (Kepel et al., 2011). Soprano pipistrelle (0.4% of activity) is a species classified (like all pipistrelles) as highly exposed to collisions, but in a significant part of Western and Central Europe it is considered a sedentary species (Dietz et al., 2009). The species found during the surveys are mostly common and not endangered on a regional and national scale.

Despite the low bat activity recorded, it cannot be ruled out that the migration routes of any of the species pass through the Baltic East OWF Area. Surveys monitoring bat migration over Polish maritime areas for other planned projects have not shown the existence of clear bat migration corridors within these water regions. There are also no surveys aimed at finding flight exit points along the Polish coast.

Surveys carried out in 2005-2008 along the southern coast of the Scandinavian Peninsula and the islands of southern Sweden and Denmark confirm the presence of 11 bat species. Five species (Nathusius' pipistrelle *Pipistrellus nathusii*, soprano pipistrelle *Pipistrellus pygmaeus*, common noctule *Nyctalus noctula*, parti-colored bat *Vespertilio murinus*, lesser noctule *Nyctalus leisleri*) are characterized by seasonal migrations over significant distances in north-eastern directions in spring and south-western in autumn. Migrations are dispersed and do not take place along designated routes, as animals migrate individually or in loose groups of two or three individuals (Ahlen et al., 2009; Ahlen, 1997).

The distance of the Baltic East OWF from the land (22.5 km and more) excludes the occurrence of most of the onshore bat species in the vicinity of the project in search of food (Ahleni et al., 2009, 2007; Poerink et al., 2013).

In the light of the results of radiotelemetric surveys, the common noctule during night activity move away from the day hiding place up to 23 km (Mackiei, Racey, 2007). For other species, the distances between daytime hiding places and feeding grounds are much smaller (Dietz et al., 2009), as, for example, Nathusius' Pipistrelles move away during night activity at a distance of up to 6 km from the day hiding place (Flaquer et al., 2009).

Given the above, the planned project poses a risk of bat mortality, although it would apply mainly to common and not endangered species, but protected under national and international law. This risk usually increases in late summer and early autumn (Rydell et al., 2010), and the surveys prior to the preparation of this EIA Report found the activity of bats, i.e. the increased risk of collision with wind turbines, occurring mainly in the middle of August and September. Bats collide even in large open areas (Cryan and Brown 2007, cf. Baerwald and Barclay 2009), actively flying to the rotor blades (Horn et al., 2008) and die as a result of external injuries caused by an impact (Klug and Baerwald 2010, Rydell et al., 2010) or pressure shock (barotrauma) entering the area of reduced air pressure behind the wind turbine wing (Baerwald et al., 2008).

The described impacts will be negative, direct, permanent and local. Sensitivity to the impact was assessed as low, but the significance of the Baltic East OWF impact during the operation phase was assessed as **insignificant** due to the low activity of bats found during the surveys carried out in the seasonal migration period.

5.1.2.11 Impact on the areas and facilities protected under the Act of April 16, 2004 on nature conservation

At the operation phase of the planned project, there will be no direct threat to the areas subject to protection under the Act of April 16, 2004 on nature conservation (consolidated text: Journal of Laws of 2023, item 1336).

No risk of impact of the project in question was identified for the identified protected areas located onshore where plant communities are protected (within which no significant populations of protected and valuable bird species were recorded).

Potential OWF impacts on onshore protected natural areas will be the greatest in the context of impacts on birds. In this context, it is necessary to examine, first of all, the issue of the project impact on the population size of birds present in these areas. Such negative impact may potentially occur if there is a wildlife corridor within the wind farm – a route of avifauna passage to/between these areas. Indirect impacts may be of two types: there may be an effect of scaring away avifauna by operating rotors, resulting in a route change and finally selecting another area as a destination, or there may be a collision of avifauna with the blades of operating wind turbines, which will result in losses in the population size (protected species) that will arrive in the identified protected areas.

Because most areas valuable for ornithofauna species overlap with the designated Natura 2000 sites, these issues were analysed in detail in the next sub-chapter. Similarly, the impacts of the Baltic East OWF on marine protected areas (located within the Baltic Sea) may only apply to identified Natura 2000 sites and are described in the next sub-chapter.

During this phase, the only impacts that may indirectly affect protected areas are those resulting from quantitative changes in populations of protected species in these areas.

Given the location of the Baltic East OWF at a significant distance from the protected area of the Słowiński National Park, similarly as during the implementation phase, no significant impact on this area will occur during the operation phase, including any compartment for which it was established, i.e. biodiversity, resources, objects and components of inanimate nature and landscape values of the Park.

Annex to the disposition of the Minister of Climate of December 23, 2019 on protective tasks for the Słowiński National Park for the years 2020–2022 (Journal of Laws of the Ministry of Climate of 2019, item 4, as amended), in which the existing and potential internal and external hazards and the methods of elimination or reduction of these hazards and their effects were identified and assessed, classified the hazard resulting from an increase of areas for the construction of wind farms in the municipalities adjacent to the park in the category of existing external hazards. It was stated under the category of potential external threats that only the construction of wind farms in the buffer zone of the park constitutes a potential external threat and, consequently, it should be stated that the Baltic East OWF, due to its location, will not pose a threat to the Słowiński National Park.

Given that protected areas may be classified as receptors of remarkably high sensitivity, and at the same time given the scale of impact on them at the Baltic East OWF operation phase as insignificant, the significance of this impact is of low importance.

5.1.2.12 Impact on the protected Natura 2000 sites

The identification and assessment of impact on areas protected under the European ecological network Natura 2000 are presented in Subsection 5.3.

5.1.2.13 Impact on wildlife corridors

Due to the same pre-conditions in terms of knowledge about wildlife corridors in maritime areas and the spatial scale of the Baltic East OWF area in relation to the size of the Baltic Sea, including the constant effect of space development, it was assessed that the impact of the Baltic East OWF considered separately in the operation phase, similarly as in the implementation phase, on migration routes of migratory species will be negligible.

5.1.2.14 Impact on biodiversity

Phytobenthos and macrozoobenthos

During the Baltic East OWF operation phase, structures permanently submerged in water will be embedded in the environment, creating favorable conditions for the development of animal and plant epiphyte organisms. On a local scale, within the range of structural components, there will be an increase in species diversity, although the nature of natural value of this habitat may be ambiguous. This results from the fact that, on the one hand, epiphyte associations will be a new biocenosis component of this area, additionally increasing the food base for fish, birds and, incidentally, for marine mammals. On the other hand, this location may favor the spread of foreign species, which lowers the ecological quality of this micro-habitat.

Ichthyofauna

The artificial reef effect present during the operation phase will probably result in an increase in biodiversity due to the appearance of a new habitat providing favorable conditions for the living and reproduction of many fish species. The results of the research of the long-term impact of the Horns Rev 1 OWF on the population and taxonomic composition of fish showed that the artificial reef effect was significant enough to cause an increase in the population of fish that prefer a hard substrate and, at the same time, too small to cause a decrease in the population of fish that prefer a sandy substrate (Fisher et al., 1988).

Possible reduction or cessation of fishing in the OWF area caused by legal regulations or navigation restrictions may have a positive impact on diversity. Probably, the artificial reef effect will have only a local impact, without increasing diversity in a larger area.

Marine mammals

The Baltic East OWF operation phase should not have a negative impact on the biodiversity of marine mammals in the OWF area and adjacent waters. It is worth noting that an artificial reef effect may contribute to an increase in the population of fish living in the surveyed area and, consequently, to an increase in the population of marine mammals.

Seabirds

The analysis of possible impacts resulting from the operation of the OWF indicates that their effects in terms of changes in biological diversity of seabirds will be local.

They will involve a potentially increased mortality as a result of collisions with wind turbines or vessels. The highest mortality occurs in the case of wind farms located on feeding grounds and on regular flight routes. The risk of collision also depends on the species of bird. Large seabird species, such as swans, are more vulnerable to collisions with wind turbines due to difficulties in carrying out rapid mid-air maneuvers (Brown et al., 1992).

Moreover, another identified threat to biodiversity is scaring away and displacing some part of seabirds from their habitats in the water region occupied by the wind turbines and in the adjacent water strip that will be approximately 2 or even 4 km wide. The degree and area of birds displacement from this sea basin and its surroundings will depend on the bird species. During the operation phase, it will cause a direct negative impact on seabirds of local range (for long-tailed duck of regional range, due to possible impact on the biogeographical population of the species). Another scaring factor is the emission of light and noise. In the first season of operation, birds will gradually get used to the situation in which the water region intended for the project becomes inaccessible to them (known as “habituation”), which will result in changes in their distribution. Therefore, this period can be treated as a transition one and the scale of impact of the Baltic East OWF on the seabirds staying in this region will stabilize only in the second year after the total project construction completion. However, the habituation will not cause the birds to return to the area occupied by the wind farm.

The barrier created by the Baltic East OWF applies primarily to migratory birds. However, a part of seabirds migrating through the OWF Area may target nearby Natura 2000 sites, where they may have their landing sites, and overwintering areas. The creation of a barrier in this area may hinder the movement of those populations between the closest similar wintering sites being the Słupsk Bank, the South Middle Bank and the Hoburgs Bank. Currently, there are no scientific data on the significance of the links between these areas, but they cannot be excluded based on the precautionary principle. Seabirds clearly avoid the area occupied by wind turbines and their population decreases in the vicinity of wind turbines – e.g. for the long-tailed duck within a radius of up to 2, and even up to 4 km (Christensen 2003; Leopold 2004; Petersoen 2006). The only exceptions are European herring gulls and great cormorants, which often use structures protruding above water as resting sites, so that their number may even increase. This impact may be significant for species of seabirds sensitive to them, which may have a negative impact on biological diversity in the Baltic East OWF area.

To sum up, the impact of the Baltic East OWF on biodiversity in terms of seabirds largely coincides with the effect of the loss of their habitats.

5.1.3 Decommissioning phase

5.1.3.1 Impact on geological structure, seabed topography and availability of raw materials and deposits

Impacts during the project decommissioning phase will be similar to impacts present during the construction phase, but they will be less intense. The extent of seabed interference works will not be as large as for driving foundation piles or support structures. A part of structural components may be left on and in the seabed. Transmission cables may be completely or only partially removed or left in the seabed.

Changes within the seabed related to the impact during the project decommissioning phase will occur locally and, at the scale of the entire area occupied by the project, will be irrelevant for the general nature of the seabed and its structure.

Depending on its structure, the seabed may exhibit different **sensitivity** to the project impact during its decommissioning phase. A clay bottom and a clay bottom with a stony cover is difficult to wash out and changes in its morphology. A sandy, sandy and silty, and silty seabed is more susceptible to the washout and material displacement over it, e.g. in the form of sandy waves. Thus, the OWF components left in the seabed may be uncovered or backfilled both as a result of natural processes displacing rock material along the seabed and as a result of this transport being disturbed by the remaining OWF components and changes in the seabed topography resulting from the removal of the OWF components.

The Project decommissioning phase may cause the following impacts on the seabed:

- local changes in the seabed topography related to the removal of OWF components such as cables, foundation components or support structures,
- pits forming in the seabed at the anchoring locations of vessels used for OWF decommissioning,

these will be direct, local, momentary impacts.

The overall impact of the project decommissioning phase may be assessed as negligible.

The scale of the identified impact, sensitivity of the receptor and assessment of the significance for the geological structure and the seabed topography during the Baltic East OWF decommissioning phase are included in Table (Table 99).

No mineral deposit and mining area (igs.pgi.gov.pl; geolog.pgi.gov.pl) were recorded in the surveyed area and in its immediate vicinity prior to the preparation of this EIA Report, therefore the project impact on this issue at the decommissioning phase was not analysed.

In the case of possible exploration of raw material deposits in the Baltic East OWF Area, access to raw material deposits in this area at the decommissioning phase will be impossible or significantly limited in accordance with the provisions of the Maritime Spatial Plan for Polish Sea Areas (MSPPSA) "in the entire sea basin (PSA.46.E), the performance of functions (for prospecting and exploration of mineral deposits and extraction of minerals from deposits) is limited to methods that do not affect linear components of technical infrastructure; that do not threaten the ecological function of spawning grounds and survival of early development stages of fish (eggs and larvae) of commercial species; in the entire sea basin, the extraction of minerals from deposits is limited to projects agreed with the competent investor of offshore wind farms." Because the basic function in the sea basin is to generate energy from renewable sources, and other functions, including those related to prospecting and extraction of minerals from deposits, are subordinate, its impact on raw materials and deposits during the decommissioning phase will be of negligible significance.

Given the results of the impact assessment and possible technologies during Project decommissioning, it is not indicated that it is necessary to apply measures minimising the negative impact of the Baltic East OWF on the geological structure and the seabed topography, as well as the availability of raw materials and deposits.

5.1.3.2 Impact on the quality of sea waters and seabed sediments

The OWF decommissioning process is complex and is carried out in the opposite way to the construction process. At the current stage, decommissioning assumes leaving the farm infrastructure components for which there is no obligation to completely remove them. It is assumed that the following will be left in the seabed:

1) parts of foundations located under the seabed surface,
2) and cable lines.

If some components are left on the seabed, as is the case for the Baltic East OWF, relevant tests should be carried out to determine whether the remnants of the OWF will not interfere with vessel traffic and will not have a negative impact on biotic and abiotic features of the environment. It should be ensured that the left behind parts of the structure do not start to move under the influence of waves, tides, currents or storm surges, causing a hazard to maritime navigation.

At this stage, there is no risk related to the increase in sediments temperature as a result of disconnection of the inter-array cables of cable lines or the risk of impact in the form of contamination with compounds from corrosion protection agents.

During the Baltic East OWF decommissioning, identical impacts on the discussed receivers (water and bottom sediments) are expected to occur as during the OWF implementation phase.

- **Release of pollutants and biogenic compounds from sediments into water**

During disassembly of support structures and towers, disturbance of the bottom sediments will be observed due to anchoring of vessels. The anchoring process itself is short-term, affects a small area (spot) to a depth of approx. 3 m, so the volume of disturbed sediments will be small.

If foundations and/or support structures and cables are left in the bottom sediments, the impact on sediments and water quality will be negligible.

Release of pollutants and biogenic substances from the sediments into water during the decommissioning phase is a direct, negative, local and temporary impact.

The significance of this impact during the decommissioning phase in the APV and RAV was assessed as negligible for the quality of sea waters and bottom sediments.

- **Contamination of water and bottom sediments with petroleum substances during normal operation of vessels and in case of failure**

As a result of intensive traffic of ships and vessels during the OWF decommissioning, small oil spills and failures or collisions may occur.

The description of this impact is the same as in the implementation phase and is presented in detail in Section **5.1.1.2**.

Contamination of sea waters or seabed sediments with petroleum products released during normal operation of vessels constitute a direct, negative impact of local range, temporary or short-term.

The **significance** of this **impact** during the decommissioning phase in the APV was assessed as negligible for the quality of sea waters and bottom sediments.

The pollution of water or bottom sediments with petroleum substances released during an emergency forms a direct, negative, short-term impact of regional range.

The **significance** of this **impact** at the decommissioning phase in the APV due to random and sporadic nature of failures and collisions was assessed for the quality of sea waters and bottom sediments to be of low importance or as moderate.

- **Contamination of water and seabed sediments with anti-fouling agents**

The description of this impact is the same as in the implementation phase and is presented in detail in Section **5.1.1.2**.

Pollution of water and/or bottom sediments with anti-fouling substances during the decommissioning phase is a direct, short-term negative impact of local range.

The **significance** of this **impact** in the decommissioning phase in the APV for sea water quality and bottom sediments was determined as of little importance.

- **Contamination of water and seabed sediments by an accidental release of nutrients together with waste or (raw) wastewater**

The description of this impact is the same as in the implementation phase and is presented in detail in Section **5.1.1.2**.

Pollution of water and/or bottom sediments with waste or wastewater is a direct, temporary, negative, reversible impact of local range.

The **significance** of this **impact** during the decommissioning phase in the APV was assessed as negligible for the quality of sea waters and bottom sediments.

- **Contamination of water and bottom sediments with accidentally released chemicals and waste from the offshore wind farm decommissioning**

During the OWF decommissioning, it seems inevitable that water and bottom sediments will become contaminated with waste from the process. The scale of this impact will depend on the adopted method of performing these works.

Waste should be neutralized in accordance with the applicable regulations concerning industrial waste.

The description of this impact is the same as in the implementation phase and is presented in detail in Section **5.1.1.2**.

Pollution of water and/or bottom sediments related to the OWF decommissioning is a direct, short-term or temporary, reversible, negative impact of local range.

The significance of this impact at the decommissioning phase in the APV was assessed as negligible for the quality of sea waters and as of low importance for bottom sediments.

The characteristics and scale of impact and the assessment of significance of impact on the quality of waters and bottom sediments during the Baltic East OWF decommissioning phase are presented in Tables [Table 99, Table 100].

Table 99 Characteristics of impacts on the quality of waters and bottom sediments during the Baltic East OWF decommissioning phase [source: own study]

IMPACT CHARACTERISTICS	TYPE OF IMPACT			SPATIAL RANGE			DURATION					TYPE	
	Direct	**Indirect**	**Secondary**	**Transboundary**	**Regional**	**Local**	**Long-term**	**Medium-term**	**Short-term**	**Temporary**	**Permanent**	**Positive**	**Negative**
Release of pollutants and biogenic substances from sediments into water (for water)	x					x				x			x
Release of pollutants and biogenic substances from sediments into water (for sediments)	x					x				x			x
Contamination of water and seabed sediments with petroleum products (normal decommissioning of the OWF and operation of vessels)	x					x			x				x
Contamination of water and seabed sediments with petroleum products (emergency situations and collisions)	x				x			x					x

IMPACT CHARACTERISTICS	TYPE OF IMPACT			SPATIAL RANGE			DURATION					TYPE	
	Direct	Indirect	Secondary	Transboundary	Regional	Local	Long-term	Medium-term	Short-term	Temporary	Permanent	Positive	Negative
Contamination of water and bottom sediments with accidentally released anti-fouling agents	x					x			x				x
Contamination of water and seabed sediments by an accidental release of nutrients together with waste or wastewater	x					x				x			x
Contamination of water and seabed sediments with accidentally released chemicals	x					x			x				x

Table 100 Assessment of the significance of impacts on the quality of waters and bottom sediments during the Baltic East OWF decommissioning phase [source: own study]

IMPACT	SCALE OF IMPACT	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
Release of pollutants and biogenic substances from the sediments into water (for water and sediments)	Low	Insignificant	Negligible (n)
Contamination of water and seabed sediments with petroleum products (normal decommissioning of the OWF and operation of vessels)	Low	Low	Negligible (N)
Contamination of water and seabed sediments with petroleum products (emergency situations and collisions)	High	Moderate	Moderate (N)
Contamination of water and seabed sediments with anti-fouling agents	Moderate	Low	Low (N)
Contamination of water and seabed sediments by an accidental release of nutrients together with waste or wastewater	Low	Insignificant	Negligible (N)
Contamination of water and seabed sediments with accidentally released chemicals	Low	Moderate	Low (N)

It is expected that the possible impact significance on the quality of sea water and bottom sediments during the decommissioning phase will be negligible to moderate.

Given the results of the impact assessment, limited information on the far-off decommissioning of the Baltic East OWF and possible technologies and organization of works, it is not indicated that it is necessary to apply measures minimising the negative impact of the Baltic East OWF on the quality of sea waters and bottom sediments.

5.1.3.3 Impact on ambient air quality, including climate and greenhouse gas emissions

It was assumed that the impact on atmospheric air quality, including on climate and greenhouse gas emissions, during the Baltic East OWF decommissioning phase will be similar to that expected for the implementation phase. It was assumed that the decommissioning phase will not affect the climate and air purity status of maritime and onshore areas. It is expected that the emission generated during the OWF decommissioning will be minimal – coming mainly from demolition works and from units performing disassembly works – therefore, a small emission of gas and dust pollutants can be assumed.

During the decommissioning phase, there may be a slight increase in greenhouse gas emissions during disassembly works and as a result of fuel combustion by vessels handling the OWF demolition. Nevertheless, the scale of impact of the Baltic East OWF decommissioning in this period on climate and greenhouse gas emissions will be negligible.

The impact of the decommissioning phase on air quality (similarly as described for the implementation phase) will be direct, negative, local, temporary and will disappear when the works come to an end. Due to an open, obstacle-free sea area, pollution will quickly disperse. Therefore, the impact significance of the Baltic East OWF decommissioning phase on meteorological conditions, climate and air quality will be negligible.

5.1.3.4 Impact on systems using EMF

Due to the long time horizon of the Baltic East OWF decommissioning and justified difficulties resulting from the lack of knowledge about which communication systems will actually be used in the future in the PSA, prior to the commencement of the Baltic East OWF decommissioning, analyses will be carried out on the impact of the decommissioning of facilities and equipment within the Baltic East OWF and related to its operation. The applicant's actions will be adapted to future results and requirements in agreement with competent administration authorities. The significance of impact of the Baltic East OWF on systems using EMF, such as radar, communication and radar systems during the decommissioning phase will be of little importance since, as in the case of both the implementation and operation phases, appropriate technical solutions may be applied to avoid, mitigate or compensate for them and ensure proper operation of communication systems.

The key activities during the project decommissioning phase that may have an impact on systems using the EMF will be the decommissioning of facilities and equipment, in particular those ensuring proper functioning of communication systems if they are installed in connection with the Baltic East OWF project.

Impacts may consist in the occurrence of difficulties in transmission of communication signals as a result of removal of system components (if installed earlier). These may be direct and cumulative impacts. The impact range may be regional as the communication equipment is located outside the Baltic East OWF area, these may be long-term and permanent impacts. The nature of the impact will be negative.

The sensitivity of communication systems to potential impacts during the project decommissioning phase can be assessed as very high.

Due to the need to ensure uninterrupted communication of the operating systems of different operators, the scale of impact should be considered very large.

Impact significance in accordance with the adopted methodology of preparation of the EIA Report will be significant. It is assumed that in accordance with the legal requirements applicable in the future, possible impacts will be identified in relevant expert surveys prior to the commencement of decommissioning of Baltic East OWF components and equipment and as part of arrangements with competent administration authorities, the procedure specified for the Applicant will be determined. The applicant will apply the specified measures and methods aimed at avoiding, preventing, mitigating or compensating for possible negative impacts of the decommissioning of Baltic East OWF components or facilities on systems using EMF.

As a result of the conducted analysis, the project impact on the systems using EMF at the project decommissioning phase was determined to be of low importance, provided that mitigation or compensatory measures are applied if they result from expert surveys or arrangements with competent administrative authorities.

5.1.3.5 Impact on cultural values, monuments and archaeological sites and facilities

The impacts during the decommissioning phase within the Baltica East OWF will be similar to those occurring during the implementation phase.

The sites of cultural importance identified so far will be taken into account during the preparation for project decommissioning. The applicant's actions will be carried out in accordance with the collected data in agreement with the Pomorskie Voivodeship Heritage Conservation Officer, and further proceedings will be carried out in accordance with the conservation requirements.

Works related to the removal of above-water components and foundations and the removal of power cables during the OWF decommissioning will disturb the structure of bottom sediments. Such disturbances will also be caused by the anchoring of vessels. A direct consequence of disturbance of the bottom sediments structure will be lifting and propagation of suspended matter in the water column and consequently its redeposition on the seabed. Falling of sediments disturbed during decommissioning works may have positive effects by covering the site with an additional protective layer.

The density may change or the soil in which monuments or archaeological material may be present may settle during the Baltic East OWF decommissioning. The impact on cultural heritage sites is local, short-term, indirect and negative.

Based on the conducted analysis, it was found that the impact significance of the project in question at the decommissioning phase on monuments and/or archaeological sites may be negligible.

5.1.3.6 Impact on the use and management of the sea basin and tangible property

During the Baltic East OWF decommissioning phase project, when it comes to the use and development of the sea basin and material assets, the following expected activities that may cause impacts on the analysed receptors were identified:

- Decommissioning of some Baltic East OWF components or facilities;
- Decommissioning of the entire Baltic East OWF.
- The impacts expected as a result of these activities are:
- movement of vessels carrying out OWF decommissioning and transporting disassembled components ashore,
- disassembled components remaining in the sea basin until the decommissioning is carried out,
- difficulties for aviation related to the structure decommissioning,
- damage to or limitation of access to property located in the sea basin.

The table below presents impacts including the assessment of the impact significance on the use and development of the sea basin and tangible assets during the Baltic East OWF decommissioning phase [Table 101].

Table 101 Assessment of the significance of impacts on the use and development of the sea basin and tangible assets during the Baltic East OWF decommissioning phase [source: own study]

IMPACT	SCALE OF IMPACT	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
Movement of vessels carrying out OWF decommissioning and transporting disassembled components ashore	Moderate	Moderate	Low (N)
Disassembled components remaining in the sea basin until decommissioning is carried out	Moderate	Moderate	Low (N)
Difficulties for aviation related to the structure decommissioning	Moderate	Moderate	Low (N)
Damage to or limitation of access to property located in the sea basin	Low	Low	Negligible (N)

The sensitivity of receivers for most impacts is moderate. Impacts will be negative, direct and indirect, medium-term and long-term, temporary. The impact range will be local or regional.

Currently, the Baltic East OWF Area is not used intensively by fishing, therefore, the release of the area as a result of the OWF decommissioning will be of minor importance for this sector. When the Baltic East OWF decommissioning has been completed, it will be possible to carry out the exploitation of raw material deposits in this sea basin. Therefore, the impact significance was assessed mainly as insignificant and negligible. The impact on maritime transport both within the sea basin and on navigation routes of vessels carrying out the decommissioning phase was assessed as insignificant. A similar result of the impact significance assessment, i.e. insignificant, was demonstrated for aviation.

5.1.3.7 Impact on landscape, including the cultural landscape

The OWF impact on the landscape in the Baltic East OWF decommissioning phase will be similar to the impacts in the implementation phase, but the order will be reversed. First, the structures and systems will be dismantled, then collected by vessels and transported ashore. Impacts on the landscape during this phase will decrease as the decommissioning works progress.

Depending on the adopted foundation technology, it may be necessary to leave parts of the structure under water, e.g. due to the fact that they will form an artificial reef. In this case they will be properly protected and marked for safety reasons.

After complete decommissioning of the OWF, the landscape on the sea surface within the OWF will return to the condition from before the implementation of the project, whereas there may be a permanent change in the underwater landscape which will be available only to divers or underwater vehicles equipped with cameras allowing ongoing observation or subsequent restoration. Such places may also become tourist attractions.

The significance of the impact of the Baltic East OWF on the landscape, including the cultural landscape, at the decommissioning phase is assessed to be negligible.

5.1.3.8 Impact on population, health and living conditions of people

Decommissioning of the OWF in marine conditions will be a complex, long-term task with increased risk for the vessels disassembling the OWF and for other users of the sea basins. It should be expected that, in the period when it will be necessary to decommission the OWF, the intensity of navigation will be much higher than currently on navigation routes in the OWF area, and the number of additional cruises of technical vessels of various sizes involved in the dismantling of wind turbines and other structures of the Baltic East OWF will be close to those involved in the construction.

At the same time, it should be emphasized that the routes of these additional cruises of technical vessels dedicated to decommissioning of the OWF, moving between the Baltic East OWF and small ports of the central coast and Tricity will cross the routes of the vessels moving on navigation routes of the South Baltic Sea.

In the same way as during the construction, fishing activities in part of the fishing squares O8 and P8 will be limited.

The impact at the project implementation phase will be regional, positive, medium-term, in terms of employment during the project decommissioning, including transport. There will be negative, direct or indirect, medium-term impacts of a regional scale related to changes in navigation, as well as possible emergency and hazardous situations during the Baltic East OWF decommissioning.

The impact significance of the Baltic East OWF during the decommissioning phase on the population, health and living conditions of people was estimated to be negligible despite the high significance of the resource itself. This results from the fact that, during the decommissioning phase, all users of the sea will be already familiar with the restrictions related to the existence of the Baltic East OWF, and its gradual decommissioning will only increase the availability of the Baltic East OWF sea basin for other forms of use.

5.1.3.9 Impact on biotic components in the offshore area

5.1.3.9.1 Impact on phytobenthos

Disassembly of the structure during the Baltic East OWF decommissioning phase will involve removal of the underwater parts of macroalgae communities overgrowing (direct impact) and preventing further development of epiphytes in the analysed area (permanent impact). In the context of this impact, the sensitivity of macroalgae should be considered very high. After completion of the decommissioning phase, the natural conditions prevailing before Project implementation will be restored. Given the several decades of development and presence of macroalgae communities in the area where they did not previously occur and their important status in the context of the component of local biocenoses, which is described in more detail in Chapter **5.1.2.10.1**, this impact should be considered direct, permanent, negative, of local range.

Removal of several dozen underwater structures from the maritime area, if they were overgrown by macroalgae in the euphotic zone, causes permanent loss of biodiversity in local terms. This impact was found to be **negative impact of low importance** due to its local range**.**

5.1.3.9.2 Impact on macrozoobenthos

During the Baltic East OWF decommissioning phase, assuming that the structure disassembly takes place up to the seabed level, it is planned to have impacts on macrozoobenthos resulting from the removal of artificial substrates of underwater wind turbine systems from the marine environment, and thus the removal of artificial reef.

The sensitivity of macrozoobenthos is given in Table (Table 62) in Chapter 5.1.1.9.2.

During the Baltic East OWF decommissioning phase, it is considered to leave those components that are located in the seabed. The method of removal of underwater OWF components is of key importance in the impact on the environment and its biotic features, including benthic fauna.

Removal of artificial underwater substrates of a part of the wind turbine structure from the marine environment will result in irreversible, permanent elimination of the periphyton communities of the artificial reef, destruction of benthos around each foundation and reconstruction of the qualitative and quantitative structure of the macrozoobenthos association that has settled the seabed for dozen years of OWF operation. At the current state of knowledge, it is difficult to clearly predict how quickly the environment will return to the state from before the impact of the factor and what nature of this impact will prevail, negative or positive. Based on the experience started in the last few years of decommissioning of OWF foundations, and above all oil and natural gas production platforms, some scientists claim that leaving underwater systems with an artificial reef will be more beneficial for the environment by maintaining biodiversity here and not wasting new resources of ecological value (positive importance of benthos in the trophic network) or even commercial value (fish). It should be kept in mind that these scenarios apply to environmental conditions from, among others, sea basins with higher salinity than the Baltic Sea, with reference to jacket foundations (Sommer et al., 2016; Flower et al., 2018; Topham et al. 2019b). The monitoring of benthos on underwater components of the Baltic East OWF carried out during operation will provide validated information for the above-mentioned arguments. It is currently known that in connection with the removal of artificial substrates, biodiversity will be reduced and the resources of zoobenthos will be locally reduced, which can be an additional food base for fish and seabirds in local terms. On the other hand, the original natural status of seabed habitats in the OWF Area will be restored. In the case of this impact, very high sensitivity and very significant significance were given to periphyton fauna and accompanying fauna association.

To sum up, this negative, direct, local and permanent impact will be of **little** importance.

5.1.3.9.3 Impact on ichthyofauna

The analysis of impacts emerging during the decommissioning phase is hindered by the lack of experience in decommissioning, as well as the lack of possibility to predict which technologies will be available in the perspective of twenty years and more, when the OWF will be demolished (OSPAR 2008). The list and nature of the impacts on ichthyofauna related to Baltic East OWF decommissioning should be similar to those occurring during the implementation phase.

- **Emission of noise and vibration**

The noise source will be works related to the removal of the OWE structure and increased traffic of vessels. The intensity of the impact depends to a large extent on the propagation of sound, depending on the seabed morphology, as well as the distance between the receiver and the noise source. Fatal effect for ichthyofauna may occur up to several dozen meters from the sound source, while damage to hearing and tissues up to several hundred meters from the sound source (Wilhelmsson, 2010). The avoidance reaction by ichthyofauna may appear even at a distance of several tens of kilometres, extending beyond the Baltic East OWF Area. The effects of the impact on ichthyofauna are similar to those in the implementation phase. According to Wilhelmsson et al. (2010), blasting or cutting noise can cause death or severe injury to nearby fish. Therefore, it is necessary to avoid blasting of structural members as the most harmful method. The aforementioned lack of experience makes it difficult to assess the risks posed by the impact related to the removal of the Baltic East OWF components from the environment. However, it seems that the time needed for their disassembly will be shorter than the time of their construction, which in combination with a possible reduction of the intensity of works in the spawning season should limit any impact.

The OWF Area is neither a cod spawning ground nor a deep-water spawning ground of the European flounder dominant in this area. Its depth is also limited by herring spawning. Ichthyological surveys found sprat spawning, but the sea basin is small in comparison with the large area of spawning grounds of this species. No adult stages were found in the case of fish protected during surveys carried out in 2022–2023. However, numerous larval stages of sand goby and single individuals of common seasnail larvae and straightnose pipefish were present. Emission of noise during spawning of fish may lead to an increase in their mortality, but the range of such impact should be very small.

Emission of noise and vibrations generated during the OWF disassembly will directly affect the ichthyofauna. These will be short-term and regional impacts.

Emission of noise and vibrations during removal of the OWF foundation piles may directly affect the ichthyofauna. These will be negative, direct, short-term, and regional impacts.

The significance of the impact is assessed to be negligible for all investigated fish species.

- **Increased suspended matter concentration**

Sediments will be disturbed during the works related to disassembly of the Baltic East OWF components, causing an increase in suspended matter concentration in the water column and a decrease in water transparency. The sensitivity of ichthyofauna to such impact is specific to the species and life stage; the scale of impact depends on the suspended matter content, the time of exposure of ichthyofauna and the nature of suspended matter particles. Roe backfilling, change in roe buoyancy, gas exchange difficulties, breathing difficulties, reduced visibility may adversely affect reproduction processes and may increase susceptibility to predation, slow growth rate, physiological disturbances, avoidance reaction. For most of these impacts, it should be assumed that they will be more important for early development stages than for adult fish. However, such impacts will probably apply to relatively small areas in relation to the entire area of spawning and feeding grounds of fish present in the Baltic East OWF area.

The OWF area is neither a cod and herring spawning ground nor a deep-water spawning ground of the European flounder dominant in this area. In the project area there was sprat spawning, but the sea basin is small in comparison with the large area of spawning grounds of this species. Numerous occurrences of larvae subject to partial protection of sand goby were found in the Baltic East OWF Area during the surveys. An increase in mortality caused by an increased concentration of suspended matter may adversely affect the effectiveness of reproduction of sand goby. However, due to the short-term and probably small range of this impact, this effect will be only local.

The impact related to the increase of suspended matter content will be negative, direct, local, and short-term.

The significance of the impact is assessed to be negligible for all investigated fish species.

- **Release of pollutants from sediments**

During the dismantling works, the sediments will be disturbed and pollutants will be released, i.a. heavy metals, chlorinated biphenyls, pesticides, petroleum substances, and the biogenic substances will be released from the sediments into the body of water.

Exposure of ichthyofauna to an increased concentration of impurities and biogens may cause increased mortality and diseases, e.g. skin disease, liver and gill damage. Wilhelmsson et al. (2010) assess the risk of adverse effects as small and spatially confined.

Assuming that the cleanliness of sediments will not deteriorate in the future, the risk of release of larger amounts of harmful chemicals from sediments is low due to their low concentrations found in sediments of the southern Baltic Sea (Dąbrowska et al., 2013; Polak-Juszczak, 2013; Szlinder-Richert et al., 2012). Also, surveys carried out between 2022 and 2023 in the Baltic East OWF Area in most cases confirm low concentrations of harmful substances in the sediments. An exception is the identified concentration of lead, which in sediments samples collected in the surveyed area exceeded the threshold value adopted for good environmental status (GES).

The impact on ichthyofauna related to releasing pollutants and biogenic substances from the sediments into the body of water will be negative, direct, local and short-term. Sensitivity to impact was assessed to be moderate for all studied fish species. The significance of the impact is assessed to be negligible for all investigated fish species.

- **Habitat change**

During the OWF decommissioning, a significant part of the artificial reef will be destroyed, which provides the places of living, feeding, shelter and reproduction for many fish living there. This may result in a decrease in the abundance and diversity of ichthyofauna. At this stage, it is difficult to determine whether this will also apply to the facilities located on the seabed surface, such as anti-erosion protection of foundations or stone rip-raps protecting cables. Leaving these structures could partially reduce the negative impact, maintaining a part of the habitat together with the organisms living there. Baltic East OWF decommissioning will enable fishing in this area. This may cancel out the beneficial impact that the cessation of fishing activities would potentially have on ichthyofauna during its exploitation.

The impact related to the change of habitat will be negative, direct, local, long-term and permanent.

- **Barrier creation**

It can be assumed that the impacts related to the works carried out at the decommissioning phase will be similar to those expected for the implementation phase. The impact related to the creation of the barrier will be a negative, direct, local and short-term impact on all fish species.

A summary of the impact of the Baltic East OWF decommissioning phase on ichthyofauna is presented in the Table [Table 102] below.

Table 102 Significance of impact on ichthyofauna during the Baltic East OWF decommissioning phase

IMPACT	IMPACT DESCRIPTION	SPECIES	SCALE OF IMPACT	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
Noise and vibrations	Mortality	Cod	Insignificant	High	Negligible (N)
	Reduction in spawning processes		Insignificant	Moderate	Negligible (N)
	Reduction in foraging		Insignificant	Moderate	Negligible (N)
	Mortality	Herring	Insignificant	High	Negligible (N)
	Reduction in spawning processes		Insignificant	Moderate	Negligible (N)
	Reduction in foraging		Insignificant	Moderate	Negligible (N)
	Mortality	Sprat	Insignificant	Moderate	Negligible (N)
	Reduction in spawning processes		Insignificant	Moderate	Negligible (N)
	Reduction in foraging		Insignificant	Moderate	Negligible (N)
	Mortality	European flounder	Insignificant	Moderate	Negligible (N)
	Reduction in spawning processes		Insignificant	Moderate	Negligible (N)
	Reduction in foraging		Insignificant	Moderate	Negligible (N)
	Mortality	Protected species	Insignificant	High	Negligible (N)
	Reduction in spawning processes		Insignificant	High	Negligible (N)
	Reduction in foraging		Insignificant	High	Negligible (N)
		Cod	Insignificant	High	Negligible (N)

IMPACT	IMPACT DESCRIPTION	SPECIES	SCALE OF IMPACT	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
Increase in the concentration of suspended solids in the water depth	Increased mortality, reduced growth rate, susceptibility to diseases	Herring	Insignificant	Moderate	Negligible (N)
		Sprat	Insignificant	Moderate	Negligible (N)
		European flounder	Insignificant	Moderate	Negligible (N)
		Protected species	Insignificant	Moderate	Negligible (N)
Release of pollutants and biogens from sediments	Morphological and physiological changes, reproductive and developmental disorders, most vulnerable maturing females, young embryos, larvae just after resorption of the yolk sac and early larval stages	Cod	Insignificant	Moderate	Negligible (N)
		Herring	Insignificant	Moderate	Negligible (N)
		Sprat	Insignificant	Low	Negligible (N)
		European flounder	Insignificant	Low	Negligible (N)
		Protected species	Insignificant	Moderate	Negligible (N)
Habitat change	Temporary or permanent loss of habitat, reduction in food base, deterioration of spawning conditions	Cod	Low	Moderate	Low (N)
		Herring	Low	Moderate	Low (N)
		Sprat	Insignificant	Low	Negligible (N)
		European flounder	Low	Moderate	Low (N)
		Protected species	Low	High	Low (N)
Barrier creation	Physical barrier to fish migration	Cod	Insignificant	Moderate	Negligible (N)
		Herring	Insignificant	Moderate	Negligible (N)
		Sprat	Insignificant	Moderate	Negligible (N)
		European flounder	Insignificant	Moderate	Negligible (N)
		Protected species	Insignificant	Moderate	Negligible (N)

The significance of all impacts, except for the habitat change, is assessed as negligible for all investigated fish species. Impacts related to habitat change were assessed as insignificant for cod, herring, European flounder and protected species.

5.1.3.9.4 Impact on marine mammals

It is assumed that some impacts related to the Baltic East OWF decommissioning phase will be similar to the implementation phase and may include increased traffic of vessels generating underwater noise, as well as habitat changes and loss of food base. The sensitivity of marine mammals to the aforementioned factors will most probably be the same as at the construction stage.

Moreover, in the case of removal of monopiles, it is assumed to cut them at the seabed level. This process may be a source of underwater noise with a potential impact on porpoises and seals.

The impact of activities related to the removal of piles driven into the seabed has not been investigated well so far in relation to marine mammals, and there are few data available in this respect. There are several surveys where noise generated during the cutting of piles from wind farms and during drilling in the seabed (from a vessel and from drilling rigs) was measured. These measurements showed mainly low frequency noise formation (Richardson et al., 1998; Kyhn et al., 2011; Erbe and McPherson 2017; Hinzmann et al., 2017). Therefore, it can be assumed that the processes related to the removal of monopiles will locally increase the intensity of acoustic background in the environment, mainly in relation to low-frequency sounds. Presumably, these conditions will result in an avoidance reaction by porpoises and seals. Changes in the behavior of animals will probably be short-term and limited to the time of decommissioning works.

A summary of the impact of the Baltic East OWF decommissioning phase on marine mammals is presented in Tables [Table 103-Table 104].

Table 103 Characteristics of impacts on marine mammals forecasted during the Baltic OWF decommissioning phase [source: own study]

ANIMAL SPECIES/GROUP	TYPE OF IMPACT	TYPE OF IMPACT			SPATIAL RANGE			DURATION					TYPE	
		Direct	Indirect	Secondary	Transboundary	Regional	Local	Long-term	Medium-term	Short-term	Temporary	Permanent	Positive	Negative
Common porpoise	Noise level increase – vessel traffic	x					x			x				x
	Noise level increase – drilling and cutting of piles	x					x			x				x
	Change of habitat and food base		x				x		x					x
Seals	Noise level increase – vessel traffic	x					x			x				x
	Noise level increase – drilling and cutting of piles	x					x			x				x
	Change of habitat and food base		x				x		x					x

Table 104 Assessment of the significance of impacts of the Baltic East OWF decommissioning phase on marine mammals [source: own study]

ANIMAL SPECIES/GROUP	IMPACT	SCALE OF IMPACT	SENSITIVITY OF THE RECEPTOR	IMPACT SIGNIFICANCE
Harbor porpoise	Noise level increase – vessel traffic	Low	Moderate	Low (N)
	Noise level increase – drilling and cutting of piles	Low	Moderate	Low (N)

ANIMAL SPECIES/GROUP	IMPACT	SCALE OF IMPACT	SENSITIVITY OF THE RECEPTOR	IMPACT SIGNIFICANCE
	Change of habitat and food base	Low	High	Low (N)
Seals	Noise level increase – vessel traffic	Irrelevant	Low	Negligible (N)
	Noise level increase – drilling and cutting of piles	Low	Moderate	Low (N)
	Change of habitat and food base	Low	Moderate	Low (N)

The impact significance on marine mammals during the decommissioning phase was assessed as insignificant.

5.1.3.9.5 Impact on birds

5.1.3.9.5.1 Seabirds

The impact on marine avifauna during the Baltic East OWF decommissioning phase will be similar as in the implementation phase. It was assumed that the medium-term project impact will be similar for vessel traffic, for increased noise level related to vessel traffic and to the removal of structural components, for lighting of the demolition site and for disturbances in benthic communities. The nature of this impact will be local, indirect, negative and short-term.

The specific impact of the decommissioning phase is the gradual disappearance of the tall OWF structures resulting in the disappearance of a barrier blocking access to rich benthic communities that will develop in the OWF Area during its operation. With the gradual removal of wind turbines, the impact of deterring birds from the area occupied by high protruding structures will decrease. Increased traffic of vessels and noise related to the dismantling of the wind farms and substations will still be scarring birds away. However, it should be expected that after the complete removal of all wind turbines, this area will attract birds from the group of diving benthophagus species because during the period of Baltic East OWF operation, zoobenthos associations are going to form at the seabed of the area occupied by wind turbines and they will become a food for these birds. Benthophagus species have a very strong impact on the population of its prey, leading to a significant reduction in their population and biomass (Guillemette et al., 1996; Lewis et al., 2007). A decrease in the number of birds in the area occupied by the Baltic East OWF during its operation will cause the zoobenthos biomass to be high, as their populations will not be used as much by the birds as in their normal presence in this sea basin. This effect will probably be of periodic nature, although it is difficult to predict how long the area after the Baltic East OWF will constitute an attractive feeding ground for this group of birds.

5.1.3.9.5.2 Migratory birds

It is assumed that the impact on birds during the decommissioning phase will be similar to the impact estimated during the implementation phase. There is insufficient knowledge of the impacts in the decommissioning phase, as most OWFs are still in operation. Some conclusions can be drawn from the example of the Lely wind farm in the Netherlands (https://www.4coffshore.com/windfarms/lely-netherlands-nl27.html), although the nature of that project was different (the wind farm was built on the Ijsselmeer Lake). Available report on the decommissioning phase of OWF Vindeby in 2016 (Nicolaisen et al., 2016) shows negligible impacts on birds. Given the significance of the impacts for the operation phase as a reference point, a much smaller scale of impacts during the decommissioning phase should be expected. Given that the decommissioning phase is not a permanent impact, the barrier in the form of the wind turbines to be decommissioned will decrease, and due to the decreasing number of wind turbines, the collision risk will gradually decrease. Moreover, the turbines will not be operated during the decommissioning period, which further reduces the risk of collision caused by the movement of the turbine blades. On this basis, the significance of impacts during the Project's decommissioning phase is assessed as in the case of the construction phase as negligible and insignificant.

The barrier effect and collisions with vessels and erected structures were classified as direct impacts because the presence of erected structures as well as construction vessels may directly affect the change of flight trajectory of migratory birds or cause collisions. The range of these impacts was considered local because if impacts occur, they will be limited to a small area where decommissioning works are carried out at a given moment. The time range of the barrier effect was considered temporary and the collisions were considered short-term. The barrier effect has reversible features, which cease to exist upon conclusion of construction works, but collisions were considered irreversible due to 100% mortality of birds in the case of collisions. Based on the analysis of impacts during the construction phase, the size of the barrier effect was considered low and the size of collisions with vessels was considered moderate.

A summary of the impact of the Baltic East OWF decommissioning phase on migratory birds is presented in the Table [Table 105] below.

Table 105 Assessment of the significance of impacts on migratory birds during the Baltic East OWF decommissioning phase [source: own study]

ENGLISH NAME	LATIN NAME	IMPACT	RECEPTOR VALUE	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
Common scoter	*Melanitta nigra*	Barrier effect	Moderate	Low	Negligible (N)
		Risk of collision	Moderate	Low	Low (N)
Velvet scoter	*Melanitta fusca*	Barrier effect	Moderate	Insignificant	Negligible (N)
		Risk of collision	Moderate	Insignificant	Low (N)
		Barrier effect	Low	Insignificant	Negligible (N)

ENGLISH NAME	LATIN NAME	IMPACT	RECEPTOR VALUE	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
Eurasian wigeon	*Mareca penelope*	Risk of collision	Low	Insignificant	Low (N)
Long-tailed duck	*Clangula hyemalis*	Barrier effect	Moderate	Low	Negligible (N)
		Risk of collision	Moderate	Low	Low (N)
Anatini ducks	*Anatini*	Barrier effect	Low	Insignificant	Negligible (N)
		Risk of collision	Low	Insignificant	Low (N)
Divers	*Gaviidae*	Barrier effect	Moderate	Insignificant	Negligible (N)
		Risk of collision	Moderate	Insignificant	Low (N)
Crane	*Grus grus*	Barrier effect	Moderate	Moderate	Negligible (N)
		Risk of collision	Moderate	Moderate	Low (N)
Auks	*Alcidae*	Barrier effect	Low	Insignificant	Negligible (N)
		Risk of collision	Low	Insignificant	Low (N)
Great cormorant	*Phalacrocorax carbo*	Barrier effect	Low	Insignificant	Negligible (N)
		Risk of collision	Low	Low	Low (N)
Geese	*Anserini*	Barrier effect	Moderate	Low	Negligible (N)
		Risk of collision	Moderate	Low	Low (N)
Lesser black-backed gull	*Larus fuscus*	Barrier effect	Moderate	Low	Negligible (N)
		Risk of collision	Moderate	Insignificant	Low (N)
Little gull	*Hydrocoloeus minutus*	Barrier effect	Moderate	Low	Negligible (N)
		Risk of collision	Moderate	Low	Low (N)
Swans	*Cygnus spp.*	Barrier effect	Low	Insignificant	Negligible (N)
		Risk of collision	Low	Insignificant	Low (N)
Passerine	*Passeriformes*	Barrier effect	Low	Insignificant	Negligible (N)
		Risk of collision	Low	Insignificant	Low (N)
Terns	*Sternidae*	Barrier effect	Low	Insignificant	Negligible (N)
		Risk of collision	Low	Insignificant	Low (N)
Charadriiformes	*Charadriidae*	Barrier effect	Low	Low	Negligible (N)
		Risk of collision	Low	Low	Low (N)

The significance of impacts on migratory birds during the decommissioning phase was considered **negligible or insignificant** for both impacts.

5.1.3.9.6 Impact on bats

The impact of the Baltic East OWF decommissioning phase will be similar to that during the implementation phase. Similarly, any impact of works performed under the water surface may be disregarded. Works and activities carried out on the sea surface may have a potential impact on bats. The Baltic East OWF decommissioning will certainly involve an increased presence of vessels. The impact resulting from the disassembly works carried out and the presence of vessels will be negative, local, direct and short-term. The impact significance was assessed as insignificant.

5.1.3.10 Impact on the areas and sites protected under the Act of 16 April 2004 on nature conservation

The impacts of the decommissioning phase will be similar to those occurring during the project implementation phase – there will be increased acoustic impacts, water vibrations caused by the performed works and increased vessel traffic. Depending on the adopted tower disassembly technology, also light effects connected with vibrations and noise might be generated as a result of disassembly of structural components.

Due to the long distance from marine protected areas, the Baltic East OWF will not directly affect the integrity of any of the identified marine and onshore protected areas.

All impacts will be temporary – short or medium-term, most often of local range (limited to the direct area/site of works). However, it is possible that impacts (acoustic/vibrations/light flashes) caused by the conducted works and the movement of transport machines/vessels will cause a scaring effect for marine animals moving in the OWF area. This is important in the context of marine protected areas since it may change the direction or route of movement of fish and marine mammals, and in extreme situations, as a result, disturbances in the species and quantitative composition of populations within these areas. Possible scaring away from possible feeding grounds within the OWF may have similar consequences. It is expected that all impacts described for this phase will be generated within a maximum period of up to two years, and since disassembly works will be carried out gradually, these impacts will be individually smaller and will not be continuous.

Project impacts at the decommissioning stage with respect to onshore protected areas will be significantly smaller than for maritime areas – varying depending on the location, protected site, importance of a given area and valuable bird species present there (as they are the animals most exposed to potential impacts).

As a result of the conducted analysis, in relation to the identified areas protecting the landscape, it was found that there may be a medium-term impact related to the disturbance of the existing landscape as a result of introduction of machines used for OWF decommissioning (vessels and vehicles used for works and transport of disassembled components). Additionally, as a result of disassembly works, the coastal landscape will be restored to its original condition – which means that the final impact will be positive in this context.

With reference to other forms of nature protection identified onshore (i.e. natural monuments, documentation sites, local nature conservation sites), due to the nature of the works and location project (at a distance of more than 20 km from the land), it was found that the only potential impact/hazard may occur only in emergency. This means that the **impact significance is negligible and they do not constitute a significant portion in the context of the conducted environmental impact analysis.**

5.1.3.11 Impact on the protected Natura 2000 sites

The identification and assessment of impact on areas protected under the European ecological network Natura 2000 are presented in Subsection 5.3.

5.1.3.12 Impact on wildlife corridors

With respect to seabirds, the impact of the OWF decommissioning process on wildlife corridors will have an effect contrary to that of the construction phase. As individual structural elements are removed from the space, the possibility of free migration of birds will increase.

5.1.3.13 Impact on biodiversity

Phytobenthos and macrozoobenthos

With the removal of artificial substrates, the plant and animal periphyton communities present on these structures will be destroyed and (habitat and taxonomic) biodiversity will decrease and the resources of macrozoobenthos being the feeding base for fish and seabirds will decrease locally. On the other hand, the original natural status of seabed habitats in the Baltic East OWF Area will be restored (subject to the possibility of leaving fragments of monopiles that do not threaten the navigational safety, if they constitute valuable habitats).

Ichthyofauna

Works related to the decommissioning of the wind farm may have a negative impact on species diversity, and the nature of this impact should be similar to the one observed during the construction. After the decommissioning phase, the ichthyocenosis can be expected to return to the original state.

Marine mammals

According to the current knowledge, the decommissioning phase of the wind farm should not have a significant impact on the biodiversity of marine mammals in the surveyed area and in adjacent waters.

Seabirds

The analysis of possible impacts resulting from the demolition activities performed at the OWF decommissioning phase shows that their effects will in most cases be short-term, local and reversible. This applies to all types of emissions (noise, suspended solids, release of biogenic substances from seabed sediments). The intensity of environmental impact will decrease as the distance from their source increases. Mobile species (fish, marine mammals, birds) will avoid spaces in which they find their optimum conditions to deteriorate. As the effect of scaring these species away is limited in time and the space of the marine environment is of a large capacity, the species (fish, marine mammals) will return to the area from which they were scared, or will use the adjacent areas, after the emissions cease and the living space conditions are back to what they were before. Demolition works will result in restoration of the original conditions in the habitat which are changed as a result of the construction of the OWF. Therefore, it is expected that the structure of the zoobenthos will be renewed in terms of its quality and quantity to achieve the pre-investment condition.

There will be direct or indirect destruction of benthic and pelagic habitats following the decommissioning works performed which could, as a consequence, lead to the extinction of the species living there. As a result of the works performed, no physical barriers will be created which marine organisms could not overcome.

Considering the above, it can be stated that the decommissioning phase of the OWF may lead to a short-term change in the number of species present in the development area. Individual species may be temporarily scared off to the adjacent areas where they will not be exposed to disturbances. However, such a movement of individuals does not mean a change of biodiversity at the species level. The works carried out will also not lead to changes in the level of ecosystem and genetic diversity.

The Project impact on biodiversity can be considered insignificant.

5.2 Determination of the Project's expected environmental impact and description of the expected significant environmental impacts of the Reasonable Alternative Variant (RAV)

5.2.1 Implementation phase

5.2.1.1 Impact on geological structure, seabed topography and availability of raw materials and deposits

Differences between the APV and the RAV are irrelevant for geological issues, as the parameters differentiating the options do not affect the nature of these impacts. The assessment of the significance of the impact of wind turbines in the OWF area on the seabed in the APV is the same as in the RAV. Changes within the seabed associated with the Project impact in the implementation phase would be local and within the entire area occupied by the project and insignificant for the overall nature of the seabed and its structure.

The scope of impacts and the assessment of their significance are identical to the analysis results for the APV,

Changes in the nature of the seabed topography and surface sediments will apply to the seabed for the foundation of up to 69 wind turbines, three substations and 160 km of the cable line strip, which constitutes approximately 5% of the development area. The impact on the geological structure, seabed topography and surface sediments will be negligible.

It should be noted that although the impact significance is the same as in the APV, the scale of this impact will, while still maintaining this assessment, be higher in the RAV due to a larger occupation of the seabed for foundations and a larger volume of sediments being moved.

5.2.1.2 Impact on the quality of sea waters and seabed sediments

Seawater and bottom sediments as receptors that may be affected by the Project in terms of physical and chemical interactions were considered jointly.

This sub-chapter examines the OWF impacts on the quality of waters and bottom sediments during the RAV implementation identical to that in Chapter **5.1.1.2**.

Release of pollutants and biogenic compounds from sediments into water

During the Baltic East OWF implementation phase, bottom sediments will be disturbed as a result of installation of foundations and/or support structures and laying of cable lines, which will lead to agitation of sediments and pollutants and biogenic substances present therein and the possibility of their penetration into the water column. For monopile foundations, the seabed will be prepared by removing stones, leveling the substrate, locally replacing it before installation at the location of jack-up vessels. The impact will occur during preparatory and construction works at the stage of preparation of the seabed and installation of foundations and/or support structures. Broader descriptions common for the APV and RAV are included in Chapter **5.1.1.2**.

The sediments around the driven piles will float as a result of vibrations caused by the operation of the hammer.

During the placement of 72 monopile foundations with a diameter of 12 m under 69 wind turbines and 3 offshore substations (OSS) (RAV), approx. 7 100 m^3 of bottom sediments will be disturbed.

The maximum volume of disturbed sediments during cable laying with the use of the plowing technology will be 13.5 m^3 sediments per 1 m of cable running length and at a length of 160 km in the RAV, it will amount to 2 160 000 m^3 of disturbed sediments.

If the method of creating a trench using simultaneous lay and burial (SLB) is used, a trench width of maximum 6 m and a depth of 3 m were assumed with simultaneous trench construction and cable burial. It is assumed that this method has the greatest potential for generating suspended solids. The trench width refers to the situation of simultaneous trench construction and cable burial. The volume of disturbed sediments during cable laying using the plowing technology (SLB) will amount to 9.0 m^3 sediments per 1 linear meter of the cable and at a length of 160 km in the APV it will amount to 1 440 000 m^3 disturbed sediments.

Moreover, during the installation of foundations and/or support structures and installation of wind turbines, stirring of the bottom sediments will be observed due to anchoring of vessels. The anchoring process itself is short-term, affects a small area (spot) to a depth of approx. 3 m, so the volume of disturbed sediments will be small.

Based on the above assumptions and concentrations of pollutants and biogenic substances found in the OWF area (see Chapter 3.2.2), their release into water in the APV and RAV was estimated.

The calculations assume an average sediment volumetric density of 1.6 $g \cdot cm^{-3}$ (1600 $kg \cdot m^{-3}$) and an average sediment moisture content of 20.42%. For the calculations, the cubic volume of sediments necessary to be removed/disturbed in order to correctly install the foundation and/or support structure, i.e. for a monopile with a diameter of 12 m – 98 m^3 and jackets with a maximum of four piles with a diameter of 4 to 44 m^3 (APV and RAV) was assumed.

The estimate of the amount of heavy metals, pollutants and biogenic substances that may be released in the RAV during the Project implementation phase is presented in Tables (Table 106, Table 107).

Envelope calculations were also conducted in the case of the seabed preparation prior to the installation of jack-up vessels. This will involve the replacement of surface sediments with rock aggregate bedding. Such replacement will be necessary for each of the four to six supports of the jack-up vessel, if in a given location of the wind turbine or OSS, the bearing capacity of soils is not sufficient for the foundation of the supports on the seabed. For each leg, sediments of a volume of 14 000 m^3 will be agitated.

It was assumed that potentially approx. 25% of all wind turbine locations will require the removal (replacement) of the seabed. Below are calculations covering the volume of sediments disturbed both for monopile foundations of wind turbines, substations and during laying inter array cables for RAV (implementation phase), including the disturbance of the seabed for a jack-up vessel [Table 108].

In the case of indicators whose concentration during the conducted environmental surveys was below the lower limit of quantification (LOQ) of the test methods used for load calculations (for reference purposes), the values of this limit were assumed (in the table marked with the sign "<"). The tables also include, for comparative purposes, the loads transported annually to the Baltic Sea with the rivers of Poland and with atmospheric precipitation (Uścinowicz 2011; GUS 2023); the results of the National Environmental Monitoring carried out by the Chief Inspectorate of Environmental Protection in 2003–2012 were also used. Estimates of remobilization of individual indicators were shown to be insignificant.

Table 106 Comparison of the weight of pollutants and biogenic substances that may be released into water during sediment disturbance, during the installation of foundations for wind turbines and OSSs in the RAV (implementation phase) with the load introduced into the Baltic Sea with rivers and wet precipitation [source: internal materials]

PARAMETER	ONE 12 M DIAMETER MONOPILE FOUNDATION	RAV (69 MONOPILE FOUNDATIONS +3 OSS FOUNDATIONS)	ONE JACKET FOUNDATION 4 X PILE WITH DIAMETER 4 M	RAV (69 JACKET FOUNDATIONS +3 OSS FOUNDATIONS)	ANNUAL LOAD BROUGHT BY RIVERS INTO THE BALTIC SEA	ANNUAL LOAD BROUGHT BY WET PRECIPITATION INTO THE BALTIC SEA
Volume of disturbed sediment	98 m^3	7,056 m^3	44 m^3	3,168 m^3	No data available	No data available
Weight of disturbed sediment	124 Mg	8,984 Mg	56 Mg	4,034 Mg	No data available	No data available
Dry weight of disturbed sediment	99 Mg	7,150 Mg	45 Mg	3,210 Mg	No data available	No data available
Lead (Pb)	0.18 kg	13.16 kg	0.08 kg	5.91 kg	12,700 kg	200,000 kg
Copper (Cu)	0.05 kg	3.65 kg	0.02 kg	1.64 kg	112,000 kg	No data available
Chromium (Cr)	0.06 kg	4.50 kg	0.03 kg	2.02 kg	No data available	No data available
Zinc (Zn)	0.34 kg	24.45 kg	0.15 kg	10.98 kg	122,000 kg	No data available
Nickel (Ni)	0.08 kg	5.65 kg	0.04 kg	2.54 kg	84,900 kg	No data available
Cadmium (Cd)	<0.005 kg	<0.36 kg	<0.002 kg	<0.16 kg	300 kg	7,100 kg
Mercury (Hg)	<0.001 kg	<0.7 kg	<0.0004 kg	<0.03 kg	400 kg	3,400 kg
Arsenic (As)	<0.124 kg	<8.94 kg	<0.06 kg	<4.01kg	No data available	No data available
Congeners representing PCBs	0.0001g	0.01 g	0.00004 g	0.003 g	260,000 g	715,000 g
Analytes representing PAHs	0.31 g	22.52 g	0.14 g	10.11 g	No data available	No data available
Available phosphorus (P)	8.3 kg	598 kg	3.73 kg	268 kg	6 400 000 kg (total P)	163 000 000 kg
Nitrogen (N)	<1.9 kg	<143 kg	<0.89 kg	<64 kg	136 000 000 kg (total N)	5,700,000 kg

Table 107 Comparison of the weight of pollutants and biogenic substances that may be released into water during sediment disturbance, during the construction of cable lines in the RAV (implementation phase) with the load introduced into the Baltic Sea with rivers and wet precipitation [source: internal materials]

PARAMETER	1 KM OF CABLE (BURIAL USING THE JET TRENCHING METHOD, JETTING) PLB	RAV CABLE ROUTE LENGTH (160 KM)	1 KM OF CABLE (SIMULTANEOUS LAY AND BURIAL) SLB	RAV CABLE ROUTE LENGTH (160 KM)	ANNUAL LOAD BROUGHT BY RIVERS INTO THE BALTIC SEA	ANNUAL LOAD BROUGHT BY WET PRECIPITATION INTO THE BALTIC SEA
Volume of disturbed sediment	9,000 m^3	1,440,000 m^3	13,500 m^3	2,160,000 m^3	No data available	No data available
Weight of disturbed sediment	11,460 Mg	1,718,928 Mg	17,189 Mg	1,833,523 Mg	No data available	No data available

PARAMETER	1 KM OF CABLE (BURIAL USING THE JET TRENCHING METHOD, JETTING) PLB	RAV CABLE ROUTE LENGTH (160 KM)	1 KM OF CABLE (SIMULTANEOUS LAY AND BURIAL) SLB	RAV CABLE ROUTE LENGTH (160 KM)	ANNUAL LOAD BROUGHT BY RIVERS INTO THE BALTIC SEA	ANNUAL LOAD BROUGHT BY WET PRECIPITATION INTO THE BALTIC SEA
Dry weight of disturbed sediment	9,119 Mg	1,367,923 Mg	13,679 Mg	1,459,118 Mg	No data available	No data available
Lead (Pb)	16.8 kg	2,517 kg	25.2 kg	2,685 kg	12,700 kg	200,000 kg
Copper (Cu)	4.7 kg	698 kg	7.0 kg	744 kg	112,000 kg	No data available
Chromium (Cr)	5.7 kg	862 kg	8.6 kg	919 kg	No data available	No data available
Zinc (Zn)	31 kg	4,678 kg	46.8 kg	4,990 kg	122,000 kg	No data available
Nickel (Ni)	7.2 kg	1,081 kg	10.8 kg	1,153 kg	84,900 kg	No data available
Cadmium (Cd)	<0.5 kg	<68 kg	<0.7 kg	<73 kg	300 kg	7,100 kg
Mercury (Hg)	<0.09 kg	<14 kg	<0.14 kg	<14,.6 kg	400 kg	3,400 kg
Arsenic (As)	<11.4 kg	<1,710 kg	<17.1 kg	< 1,824kg	No data available	No data available
Congeners representing PCBs	0.009 g	1.37 g	0.014 g	1.46 g	260,000 g	715,000 g
Analytes representing PAHs	28.7 g	4,309 g	43 g	4,596 g	No data available	No data available
Available phosphorus (P)	762 kg	114,358 kg	1,144 kg	121,982 kg	6 400 000 kg (total P)	163,000,000 kg
Nitrogen (N)	<182 kg	<27,358 kg	<274 kg	<29,182 kg	136 000 000 kg (total N)	5,700,000 kg

Table 108 Comparison of the weight of pollutants and biogenic substances that may be released into the water during the disturbance of bottom sediments during the installation of wind turbine and OSS foundations, construction of cable lines, including the disturbance of sediment during the removal of the bottom sediment in the place of installation of jack-up vessels in the RAV with the load introduced into the Baltic Sea with rivers and wet precipitation [source: internal materials]

PARAMETER	APO (FOUNDATIONS OF 69 WIND TURBINES AND 3 OSSS, CONSTRUCTION OF CABLE LINES AND REPLACEMENT OF THE BOTTOM SEDIMENTS BEFORE INSTALLATION OF JACK-UP VESSELS)	ANNUAL LOAD BROUGHT BY RIVERS INTO THE BALTIC SEA	ANNUAL LOAD BROUGHT BY WET PRECIPITATION INTO THE BALTIC SEA
Volume of disturbed sediment	2,444,032 m^3	No data available	No data
Weight of disturbed sediment	3,111,937 Mg	No data available	No data
Dry weight of disturbed sediment	2,476,479 Mg	No data available	No data
Lead (Pb)	4,557 kg	12,700 kg	200,000 kg

PARAMETER	APO (FOUNDATIONS OF 69 WIND TURBINES AND 3 OSSS, CONSTRUCTION OF CABLE LINES AND REPLACEMENT OF THE BOTTOM SEDIMENTS BEFORE INSTALLATION OF JACK-UP VESSELS)	ANNUAL LOAD BROUGHT BY RIVERS INTO THE BALTIC SEA	ANNUAL LOAD BROUGHT BY WET PRECIPITATION INTO THE BALTIC SEA
Copper (Cu)	1,263 kg	112,000 kg	No data
Chromium (Cr)	1,560 kg	No data available	No data
Zinc (Zn)	8,470 kg	122,000 kg	No data
Nickel (Ni)	1,956 kg	84,900 kg	No data
Cadmium (Cd)	<124 kg	300 kg	7,100 kg
Mercury (Hg)	<25 kg	400 kg	3,400 kg
Arsenic (As)	<3,096 kg	No data available	No data
Congeners representing PCBs	2.48 g	260,000 g	715,000 g
Analytes representing PAHs	7,801 g	No data available	No data
Available phosphorus (P)	207,034 kg	6,400,000 kg (total P)	163,000,000 kg
Nitrogen (N)	<49,530 kg	136,000,000 kg (total N)	5,700,000 kg

It was assumed that all sediments removed from the (monopile) foundation construction sites and/or support structures (jacket structure, tripod structure) during seabed preparation will be left in the Baltic East OWF area. If it is decided otherwise and the removed sediments are transported onshore, the level of release of heavy metals, pollutants and biogenic substances will be lower.

However, the processes of disturbing bottom sediments may slightly improve their quality (increase in oxygenation and decrease in the amount of pollutants and nitrogen compounds in the sediments due to their transfer to water). Better oxygenation of sediments may, in turn, reduce phosphorus transfer from sediments, as this process takes place under anaerobic (reducing) conditions (Alloway and Ayres, 1999).

The **sensitivity** of sea waters was determined as moderate and of bottom sediments as low.

Release of pollutants and biogenic substances from bottom sediments during the implementation phase is a direct negative, short-term impact of regional range.

The **significance** of this impact during the decommissioning phase in the RAV was assessed to be of low importance for the quality of sea waters and as negligible for bottom sediments.

Other identified types of impacts in the RAV, i.e.:

- contamination of water and seabed sediments with petroleum products,
- contamination of water and seabed sediments with anti-fouling agents,
- contamination of water and seabed sediments with accidentally released waste or wastewater,
- pollution of water and bottom sediments with accidentally released chemicals,

are identical as in the APV.

The characteristics of the identified impact and the assessment of the scale of the identified impact and the assessment of the significance of impact on the quality of waters and bottom sediments during the Baltic East OWF implementation phase are included in Tables [Table 109, Table 110].

Table 109 Characteristics of impacts on the quality of waters and bottom sediments during the Baltic East OWF implementation phase for the RAV [source: own study]

IMPACT CHARACTERISTICS	TYPE OF IMPACT			SPATIAL RANGE			DURATION					TYPE	
	Direct	Indirect	Secondary	Transboundary	Regional	Local	Long-term	Medium-term	Short-term	Temporary	Permanent	Positive	Negative
Release of pollutants and biogenic substances from	x				x				x				X

IMPACT CHARACTERISTICS	TYPE OF IMPACT			SPATIAL RANGE			DURATION					TYPE	
	Direct	Indirect	Secondary	Transboundary	Regional	Local	Long-term	Medium-term	Short-term	Temporary	Permanent	Positive	Negative
sediments into water – for water													
Release of pollutants and biogenic substances from sediments into water – for sediments	x				x				x			x	
Contamination of water and seabed sediments with petroleum products during normal operation of vessels	x					x			x				x
Contamination of water and seabed sediments with petroleum products in the case of emergency situations and collisions	x				x			x					x
Contamination of water and seabed sediments with anti-fouling agents	x					x			x				x
Contamination of water and seabed sediments by an accidental release of nutrients together with waste or (raw) wastewater	x					x				x			x
Pollution of water and bottom sediments by accidentally released chemicals and waste	x					x				x			x

Table 110 Assessment of the significance of impacts on the quality of waters and bottom sediments during the Baltic East OWF implementation phase for the RAV [source: own study]

IMPACT	SCALE OF IMPACT	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
Release of pollutants and biogenic substances from sediments into water – (for water)	Moderate	Moderate	Low (N)
Release of pollutants and biogenic substances from sediments into water – (for sediments)	Low	Low	Negligible (P)
Contamination of water and seabed sediments with petroleum products (during normal operation of vessels)	Low	Insignificant	Negligible (N)
Contamination of water and seabed sediments with petroleum products (emergency situations and collisions)	High	Moderate	Moderate (N)
Contamination of water and seabed sediments with anti-fouling agents	Moderate	Moderate	Insignificant (N)
Contamination of water and seabed sediments by an accidental release of nutrients together with waste or (raw) wastewater	Low	Insignificant	Negligible (N)
Contamination of water and seabed sediments with accidentally released chemicals	Low	Moderate	Low (N)

The significance of impact on the receptor, i.e. the quality of sea waters and bottom sediments, is negligible or insignificant. Only in case of emergencies or collision and oil spill may it become a moderate impact.

Given the results of the impact assessment, the limited area of the Project and the possible technologies of its implementation, it is not indicated that it is necessary to apply measures minimising the negative impact of the Baltic East OWF on the quality of sea waters and bottom sediments.

5.2.1.3 Impact on ambient air quality, including climate and greenhouse gas emissions

During the Baltic East OWF implementation phase in the RAV, an increased emission of pollutants introduced into the atmosphere could be expected, which would be related to an increased traffic of vessels involved in the Project implementation. During this phase, the significance of the proposed Project impact on climate and greenhouse gases will be negligible, as there will be no factors that could have a noticeable impact on their change. The scope of impacts and the assessment of their significance are the same as the results of the analysis for the APO.

5.2.1.4 Impact on systems using EMF

The scope of impacts and the assessment of their significance are the same as the results of the analysis for the APO.

5.2.1.5 Impact on cultural values, monuments and archaeological sites and facilities

The scope of impacts and the assessment of their significance are the same as the results of the analysis for the APO.

5.2.1.6 Impact on the use and management of the sea basin and tangible property

The scope of impacts and the assessment of their significance are the same as the results of the analysis for the APO.

5.2.1.7 Impact on landscape, including the cultural landscape

The scope of impacts and the assessment of their significance are the same as the results of the analysis for the APO.

5.2.1.8 Impact on population, health and living conditions of people

Differences between the APV and the RAV regarding the issue of population, health and living conditions of people are minor at the Project implementation stage and may result from an extension of the construction works duration due to a larger number of wind turbines – this will mainly affect people performing works and people located in the vicinity of the Project area. More wind turbines involve greater seabed footprint for foundations, extension of the construction stage, and thus greater emission of noise, waste, wastewater and other.

As a result of the analysis conducted, it was determined that the Project impact on the population, health and living conditions of people will be significant or moderate and, in the case of fishery, insignificant. The Project impact in the implementation phase will be of moderate significance, it will be positive, medium-term, direct and indirect of local and regional range in terms of employment of employees in the production of Baltic East OWF components and elements in onshore plants and ports and people working at sea during the Project implementation, including transportation. At the same time, mainly significant importance will be demontrated by negative, direct, or indirect impacts of local and regional scale, medium-term; these will be impacts on human health and living conditions in the place of production and works and related to changes in transportation and fishery, as well as possible emergency and hazardous situations both during the Baltic East OWF implementation and during transportation.

5.2.1.9 Impact on biotic components in the offshore area

5.2.1.9.1 Impact on phytobenthos

The scope of impacts and the assessment of their significance are the same as the results of the analysis for the APO.

5.2.1.9.2 Impact on macrozoobenthos

For the implementation phase in the RAV, the same impacts on the soft- and hard-bottom macrozoobenthos were identified and the same significance and sensitivity to individual impacts was assigned as for the implementation phase in the APV.

The Baltic East OWF most important technical parameters, which are important from the point of view of the assessment of the Project impact on macrozoobenthos during the implementation phase in the RAV, are presented in the Table below [Table 111].

Table 111 List of the Baltic East OWF most important technical parameters in the APO for the assessment of the impact on macrozoobenthos during the implementation phase

PARAMETER	VALUE FOR THE RAV
Baltic East OWF Area	111.7 km^2
Maximum number of wind turbines	69
Maximum number of offshore substations (OSS)	3
Maximum seabed surface occupied by 72 monopile and 12 m diameter offshore substation support structures	8142.48 m^2
Maximum seabed surface occupied by 72 tripod support structures and offshore substation on three 4 m diameter pile supports	2714.16 m^2
Maximum surface area of seabed scour protection for all foundations	140,000 m^2
Maximum gravel bed/rip-rap footprint	325,000 m^2
Seabed surface area covered by removed primary material/seabed replacement material	130,000 m^2
Seabed surface covered and flattened by the sediment generated when drilling under monopiles	101,781 m^2
Maximum length of cable routes of the systems inside the OWF	160 km
Average width of the seabed strip covered by works related to the construction of a single cable line	20 m
Maximum seabed surface destroyed during the laying of power cables	3,200,000 m^2
Construction of rip-raps for spudcans of one jack-up	12,000 m^2
Surface area of rip-raps for the inner array cables (IAC)	400,000 m^2
Removal/relocation of rocks and boulders deposited on the seabed, removal of unexploded ordnance from the seabed and other potentially hazardous materials deposited on the seabed	

Taking into account the characteristics of impacts, the most important of them for the disturbance of the seabed sediment structure will be the range of this negative and direct impact on macrozoobenthos. In the RAV, physical destruction or burying of macrozoobenthos and its high mortality will occur from the moment of seabed preparatory works necessary for installation of the wind turbine foundations selected (removal or displacement of stones and boulders deposited on the seabed, removal of sediments and their levelling elsewhere within the OWF area, replacement of the seabed, levelling on the seabed of a 2-meter layer of material excavated from the boreholes under monopiles, differing in composition from the natural seabed sediments) or necessary for stabilisation of the seabed for this type of foundations and protection of inter array cables (arranging different subbases on the seabed, e.g. erosion protection against scour around foundations, gravel embankments, rip-raps for vessel jack-ups, rip-raps protecting inner array cables), and then by subsequent installation of wind turbine foundations (monopiles or jacket foundations) and inner array cables connecting wind turbines and offshore substations. Among these works, the most unfavourable for macrozoobenthos will be the construction of cable lines, which will cover 3.2 km^2, and then the seabed preparatory and stabilising works, as they will destroy macrozoobenthos on the surface of 1.9 km^2, taking into account the values of parameters from **Table 61**. The installation of foundations alone will, in comparison to the above works, have a negative impact on an area of 0.01 km^2 of the seabed, in relation to monopiles which, among the types of foundations selected for the Project, will cover the largest area of the seabed occupied. In total, macrozoobenthos destruction will cover at least 4.8 km^2 of the seabed, which constitutes 4.6% of the Baltic East OWF Area. Although it is a local impact, it will cover a relatively large seabed area where long-term changes in the macrozoobenthos population structure will take place.

A summary of the characteristics of impacts on the soft- and hard-bottom macrozoobenthos associations is presented in tables [Table 112, Table 113].

Table 112 Assessment of the scale of impacts on the soft-bottom macrozoobenthos association during the implementation phase for the RAV [source: internal materials]

IMPACT CHARACTERISTICS	TYPE OF IMPACT			SPATIAL RANGE			DURATION					TYPE	
	Direct	Indirect	Secondary	Transboundary	Regional	Local	Long-term	Medium-term	Short-term	Temporary	Permanent	Positive	Negative
Seabed interference – disturbance of the seabed sediment structure	x						x						x
Agitation of sediments – increase in the concentration of suspended solids in the water depth	x								x				x
Sediment redeposition – sedimentation of suspended solids on the seabed	x								x				x
Redistribution of pollutants from the sediment into the water depth	x								x				x

Table 113 Assessment of the scale of impacts on the hard-bottom macrozoobenthos association during the implementation phase for the RAV [source: internal materials]

IMPACT CHARACTERISTICS	TYPE OF IMPACT			SPATIAL RANGE			DURATION					TYPE	
	Direct	Indirect	Secondary	Transboundary	Regional	Local	Long-term	Medium-term	Short-term	Temporary	Permanent	Positive	Negative
Seabed interference – disturbance of the seabed sediment structure	x						x						x
Agitation of sediments – increase in the concentration of suspended solids in the water depth	x								x				x

IMPACT CHARACTERISTICS	TYPE OF IMPACT			SPATIAL RANGE			DURATION					TYPE	
	Direct	Indirect	Secondary	Transboundary	Regional	Local	Long-term	Medium-term	Short-term	Temporary	Permanent	Positive	Negative
Sediment redeposition – sedimentation of suspended solids on the seabed	x								x				x
Redistribution of pollutants from the sediment into the water depth	x								x				x

Table 114 Assessment of the significance of impacts on soft-bottom macrozoobenthos during the Baltic East OWF implementation phase in the RAV [source: internal materials]

IMPACT	SCALE OF IMPACT	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
Seabed interference – disturbance of the seabed sediment structure	Insignificant	Moderate	Negligible (N)
Agitation of sediments – increase in the concentration of suspended solids in the water depth	Insignificant	Low	Negligible (N)
Sediment redeposition – sedimentation of suspended solids on the seabed	Irrelevant	Low	Negligible (N)
Redistribution of pollutants from the sediment into the water depth	Insignificant	Low	Negligible (N)

Table 115 Assessment of the significance of impacts on hard-bottom macrozoobenthos during the Baltic East OWF implementation phase in the RAV [source: internal materials]

IMPACT	SCALE OF IMPACT	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
Seabed interference – disturbance of the seabed sediment structure	Low	High	Low (N)
Agitation of sediments – increase in the concentration of suspended solids in the water depth	Insignificant	High	Low (N)
Sediment redeposition – sedimentation of suspended solids on the seabed	Insignificant	Moderate	Negligible (N)
Redistribution of pollutants from the sediment into the water depth	Insignificant	Moderate	Negligible (N)

The impact assessment carried out for both macrozoobenthos associations during the implementation phase for the Baltic East OWF indicates that both physical interference of the seabed by disturbing the seabed sediment structure and agitation of sediments causing an increase in the concentration of suspended solids in the water depth will be of **low importance** for the hard-bottom macrozoobenthos association and negligible for the soft-bottom macrozoobenthos association. All other types of impacts will be negligible for both macrozoobenthos associations.

5.2.1.9.3 Impact on ichthyofauna

It is expected that the impacts related to the implementation of the Reasonable Alternative Variant (RAV) will not differ significantly from those specified for the Applicant Proposed Variant (APV). A larger number of turbines expected for the RAV may extend the construction works duration and related impacts, including mainly noise. However, this should not affect the final impact assessment.

5.2.1.9.4 Impact on marine mammals

It is expected that during the Baltic East OWF implementation phase, the impact on marine mammals will be similar for the APV and RAV scenarios. A slight difference may be related to the duration of underwater noise impact due to a larger number of turbines in the RAV option (69 turbines compared to 64 in the APV), indicating a longer period of construction works. In the case of the RAV, marine mammals will be exposed to piling noise and noise related to increased vessel traffic for a longer period than in the APV scenario. However, these differences do not affect the overall impact assessment.

5.2.1.9.5 Impact on birds

The Reasonable Alternative Variant (RAV) provides for a larger number of wind turbines (by 5 pcs.) with lower power output. Due to a greater number of wind turbines, the footprint surface area in habitats (by 8%) and the duration of the implementation phase will also increase.

Seabirds

In general, it should be assumed that the negative impact of the RAV on seabirds will be greater compared to the Applicant Proposed Variant (APV). However, the aforementioned changes between the options, taking into account the criteria assumed in the assessment methodology, will be insignificant in the case of seabirds. The type and kind of impacts on birds during the implementation phase, their range, and degree of reversibility will remain unchanged. The duration of the implementation phase, adopted in the number of years or vegetation cycles in the context of construction of additional wind turbines, will also remain unchanged.

Moreover, the most significant impacts on seabirds in the RAV, i.e. their scaring by the mere presence of wind turbines and construction vessels, as well as the occupation of habitats, will still occur.

To sum up, it should be assumed that the negative impact on seabirds in the RAV during the implementation phase will be slightly higher compared to the APV. However, due to the criteria adopted in the assessment methodology, the significance of impacts of the Baltic East OWF on birds in the RAV will be similar to the APO.

Migratory birds

During the implementation phase, the impact on migratory birds resulting from the barrier effect and the risk of collision with construction vessels will not differ significantly in the RAV from the proposed APV1 and APV2.

The significance of impacts on migratory birds during the implementation phase was considered negligible in the case a barrier effect and of low importance in the case of collisions with construction vessels, as in the case of the Applicant Proposed Variant [**Table 80**].

5.2.1.9.6 Impact on bats

It is estimated that in the case of implementation of the Reasonable Alternative Variant (RAV), the impact will be comparable to the impact of the Applicant Proposed Variant (APV). For the Reasonable Alternative Variant, a greater number of wind turbines was planned. Therefore, it can be assumed that the implementation phase would be extended in time. However, this does not change the fact that the works would be carried out in the same area, which, as the pre-investment monitoring showed, was not characterised by high activity of bats.

5.2.1.10 Impact on protected areas including the Natura 2000 sites

Given the location of the Baltic East OWF at a significant distance from the sites protected on the basis of the Act of 16 April 2004 *on nature conservation*, there will be no significant impact on such sites, including none of the elements for the conservation of which they were established, i.e. biodiversity, resources, objects, and elements of inanimate nature and the landscape values.

The identification and assessment of impact on areas protected under the European ecological network Natura 2000 are presented in Subsection 5.3.

5.2.1.11 Impact on wildlife corridors

Given the lack of information on the occurrence, functioning and significance of wildlife corridors in sea areas, it was conservatively assumed that the value of this resource is medium. Taking into account the spatial scale of the Baltic East OWF Area in relation to the size of the Baltic Sea, including the increasing effect of spatial development, it was assessed that the Baltic East OWF impact in the RAV during the implementation phase on the potential migration routes of migratory species will be negligible.

5.2.1.12 Impact on biodiversity

Taking into account the nature of impacts during the Baltic East OWF implementation phase and animal species present in the area, including the role played by this area for them, it can be assumed that in that Project phase there may be a short-term change in the number of species present in the development area. Individual species may be temporarily scared off to the adjacent areas where they will not be exposed to disturbances. However, such a movement of individuals does not mean a change of biodiversity at the species level. The works carried out will also not lead to changes in the level of ecosystem and genetic diversity. Therefore, the Project impact on biodiversity was considered to be of low importance.

5.2.2 Operation phase

5.2.2.1 Impact on geological structure, seabed topography and availability of raw materials and deposits

Changes within the seabed associated with the Project impact in the RAV would be local and within the entire area occupied by the Project – insignificant for the overall character of the seabed and its structure. It is not expected that there could be any changes in the seabed structure during the Project operation phase. The overall impact of the Project in the operation phase can be assessed as negligible.

5.2.2.2 Impact on the dynamics of sea waters

As a result of the presence of the Baltic East OWF structural components, water flow rates and directions as well as water pressure in the immediate vicinity of each structure could change, which will manifest itself in a local increase in water flow velocity due to narrowing of the flow stream and formation of whirlpools around the structure. This means that overlapping of these impacts should not be expected and disturbances would be only local. The resulting modifications of the wave motion could be noticed only in the close vicinity of individual offshore wind turbines. However, they would be of local nature and should not be present outside the Baltic East OWF Area. The impact of wind turbines on the wave field and sea current field would not have a key impact on these elements.

The Baltic East OWF impact on the wave field and sea current field will be local and will not have a key impact on these elements. The significance of its impact on the dynamics of sea waters in this area was assessed as negligible.

5.2.2.3 Impact on the quality of sea waters and seabed sediments

It was found that during the operation phase the Baltic East OWF may cause different types of impacts on the discussed receptors (water and seabed sediments). These are:

- release of pollutants and biogenic compounds from sediment into water,
- contamination of water and seabed sediments with petroleum products,
- contamination of water and seabed sediments with anti-fouling agents,
- contamination of water and seabed sediments by an accidental release of nutrients together with waste or (raw) wastewater,

- contamination of water and seabed sediments with accidentally released chemicals,
- contamination of water and seabed sediments with compounds from anti-corrosion agents,
- change in seabed sediments and water temperature as a result of heat emission from inter array cables.

In the operation phase, the impact of the Project on the quality of sea waters and seabed sediments is insignificant or negligible, except for the contamination of seabed sediments and sea waters with petroleum products as a result of oil spills during collisions or emergency situations, which was assessed as moderate.

5.2.2.4 Impact on ambient air quality, including climate and greenhouse gas emissions

The scope of impacts and the assessment of their significance are the same as the results of the analysis for the APO.

5.2.2.5 Impact on systems using EMF

The scope of impacts and the assessment of their significance for the RAV are the same as the results of the analysis for the APO.

5.2.2.6 Impact on cultural values, monuments and archaeological sites and facilities

The scope of impacts and the assessment of their significance for the RAV are the same as the results of the analysis for the APO.

5.2.2.7 Impact on the use and management of the sea basin and tangible property

The footprint surface area of the wind turbine and OSS support structures as well as inter array cable route on the seabed will be greater in the RAV, as more wind turbines will be located above the water surface in the RAV.

Therefore, the spatial scope of the impact on the use and development of the sea basin will increase in the RAV, but this does not affect the impact significance, which was assessed as identical to the analysis results for the APV.

5.2.2.8 Impact on landscape, including the cultural landscape

During the Baltic East OWF operation phase in the RAV, potential impacts of the Project on the landscape, including the cultural landscape, resulting from the presence of marine structures and vessels were identified. In the RAV, the maximum height of wind turbines will be 256 m (above the average sea level), and the rotor diameter will be 236 m, therefore it will be smaller than in the APV, however, due to the distance from land (at least 22.5 km), this difference is not significant and does not change the assessment of the impact significance.

Objectively, the landscape within the OWF will be industrial, but its impact will be subjective and will depend on individual characteristics of the observer and may be perceived negatively, positively or neutrally.

In the RAV, the Project operation impact on landscape, including cultural landscape, will be moderate, and occasional traffic of service vessels in the landscape will be of negligible significance. The impact range will be smaller by approximately 10 km than in the APV.

5.2.2.9 Impact on population, health and living conditions of people

The scope of impacts and the assessment of their significance for the RAV are the same as the results of the analysis for the APO.

5.2.2.10 Impact on biotic components in the offshore area

5.2.2.10.1 Impact on phytobenthos

The scope of impacts and the assessment of their significance are the same as the results of the analysis for the APO.

5.2.2.10.2 Impact on macrozoobenthos

The scope of impacts and the assessment of their significance are the same as the results of the analysis for the APO.

5.2.2.10.3 Impact on ichthyofauna

Impacts occurring during the operation phase in the Reasonable Alternative Variant (RAV) should not differ significantly from those expected for the Applicant Proposed Variant (APV) and their final assessment will be the same as that specified for the APV.

5.2.2.10.4 Impact on marine mammals

It is forecast that during the Baltic East OWF operation phase, the impact on marine mammals will be similar for the APV and the RAV. A larger number of wind turbines in the RAV scenario is unlikely to have a significant impact on the degree of noise impact on marine mammals.

5.2.2.10.5 Impact on birds

The RAV provides for a larger number of wind turbines (by 5 pcs.) with lower power output Due to a greater number of wind turbines, their footprint surface area in habitats will increase (by 8%), as will the risk of collision of flying birds with the wind turbines. The RAV also assumes a slightly smaller clearance between the lower rotor blade position and the water surface. However, a clearance of 20 m will still be provided to ensure the safety of birds migrating low above the surface of the water table.

Seabirds

The most significant impacts on seabirds in the RAV, i.e. their scaring by the mere presence of wind turbines, occupation of habitats and creation of a barrier, resulting in an increased risk of collision with wind turbines, will still take place.

In general, it should be assumed that the negative impact of the RAV on seabirds will be slightly higher compared to the APV. However, the aforementioned changes between the options, taking into account the criteria assumed in the assessment methodology, will be insignificant in the case of seabirds. The type and kind of impacts on birds during the operation phase, their range, and degree of reversibility will remain unchanged. The OWF operation period will also remain unchanged.

To sum up, it should be assumed that the negative impact on seabirds in the RAV during the operation phase will be slightly higher compared to the APV. However, due to the criteria adopted in the assessment methodology, the significance of impacts of the Baltic East OWF on birds in the RAV will be similar to the APO.

Migratory birds

Parameters that differ between the proposed Baltic East OWF options and which are important for collision modeling, such as the clearance between the **rotor** lower range and the water surface and the diameter of the rotor, did not significantly affect the number of collisions. Among all species included in the analysis, the impact significance resulting from collision was assessed as insignificant for most species and groups of species [**Table 51**]. The impact in the form of collision risk was assessed as moderate for the common crane. The impact in the form of collision risk, i.e. bird mortality resulting from collision with elements of the Baltic East OWF in the RAV, does not differ significantly from the results obtained for APV1 and APV2.

The importance of **impact in the form of a barrier effect and a collision risk** in the RAV was assessed as the same as in the case of the APV. A forced route change to bypass the Baltic East OWF will be the same for the RAV. The significance of the barrier effect impact for all bird groups and species included in the analysis was considered insignificant and negligible.

5.2.2.10.6 Impact on bats

If the Reasonable Alternative Variant is implemented, more wind turbines would be constructed, and consequently the risk of mortality as a result of collision or barotrauma would be higher. However, in both options, the same Project implementation area is considered, where pre-execution monitoring showed a relatively low activity of bats, but only increased activity during the autumn migration period (from mid August to mid September). The significance of the Baltic East OWF impact during the operation phase was assessed as insignificant.

5.2.2.11 Impact on protected areas, including the Natura 2000 sites

Given the location of the Baltic East OWF at a significant distance from the sites protected on the basis of the Act of 16 April 2004 *on nature conservation*, during the operation phase, there will be no significant impact on such sites, including none of the elements for the conservation of which they were established, i.e. biodiversity, resources, objects, and elements of inanimate nature and the landscape values.

As a result of the conducted proper assessment of the impact [subsection 5.3] of the Baltic East OWF in the RAV, it can be concluded that the proposed Project will not cause significant impacts on the Natura 2000 sites analysed.

Given that protected areas may be classified as receptors of very high sensitivity, and at the same time, given that the scale of impact on them at the Baltic East OWF operation stage can be considered as insignificant, the significance of this impact is of low importance.

5.2.2.12 Impact on wildlife corridors

Due to the same presumptions in terms of knowledge about wildlife corridors in sea areas and the spatial scale of the Baltic East OWF Area in relation to the size of the Baltic Sea, including the constant effect of space development, it was assessed that the impact of the Baltic East OWF in the operation phase on migration routes of migratory species will be negligible.

5.2.2.13 Impact on biodiversity

During the Baltic East OWF operation phase in the RAV, structures permanently submerged in water would be erected in the environment, creating favourable conditions for the development of animal and plant periphyton organisms. On a local scale, within the range of structural components, there would be an increase in species diversity, although the character of the natural value of this habitat may be ambiguous. This results from the fact that, on the one hand, periphyton associations would be a new biocenosis component of this area, additionally increasing the food base for fish, birds and, incidentally, for marine mammals. On the other hand, this location could favour the spread of alien species, which would lower the ecological quality of this micro-habitat.

An artificial reef would create favourable conditions for the living and reproduction of many fish species. A long-term reduction or cessation of fishing in the Baltic East OWF Area could have a positive impact on biodiversity. Probably, the artificial reef effect would have only a local impact, without increasing diversity in a larger area.

In the case of seabirds, as a result of scaring away and displacement from habitats, there could be changes in the distribution of birds in the Baltic East OWF Area. After the disturbance period, birds would gradually become accustomed to the new situation. In the case of species sensitive to the presence of wind turbine structures, the Baltic East OWF Area could be clearly avoided and thus the biodiversity of this area could be reduced.

5.2.3 Decommissioning phase

During the decommissioning phase, most of the Baltic East OWF facilities in the RAV would most likely be removed from the seabed, in accordance with international regulations. These regulations define the conditions for removal of components and installations of wind farms. Decommissioning works should be carried out in such a manner that they do not hinder navigation and do not adversely affect the marine environment. These standards also define exceptional situations in which there is no obligation to completely remove the OWF infrastructure components. It is possible to leave such structures, among others, when:

- removal of the components is technically impossible or too expensive;
- there is a threat to the life of the OWF decommissioning personnel;
- decommissioning involves an unacceptable risk of the marine environment polluting.

If some components are left on the seabed, relevant surveys and analyses should be carried out to determine whether the remnants of the OWF will not interfere with vessel traffic and will not have a negative impact on biotic and abiotic elements of the environment. It should be ensured that the structure parts left behind do not start to move under the influence of waves, tides, currents or storm surges, causing a hazard to maritime navigation.

The Baltic East OWF decommissioning process in the RAV would start in several dozen years. During this time, experiences will be collected from the decommissioning of other OWFs. This will allow for the development of a detailed plan for the OWF decommissioning, taking into account all environmental aspects, including determining how much of the structural elements will be removed from the environment. There is no doubt that all above-water components will be removed, transported onshore and disposed of on land. To a large extent, the underwater parts will also be removed. Most probably, parts of foundations in the seabed will remain in the environment, as their total extraction will involve too much effort and resources, and at the same time their removal could cause significant environmental impact.

When assessing the impact of the proposed activities during the Baltic East OWF decommissioning phase in the RAV, no higher significance of these impacts on individual assessed elements of the environment was found than during the implementation or operation phase.

As a result of the Baltic East OWF decommissioning process in the RAV, the condition of biocenotic balance created during the several decades of operation would be disturbed. Removal of structural components from water would lead to removal of the substrate necessary for the development of periphyton fauna and flora. Periphyton associations living on these structures will be destroyed. This applies in particular to plant organisms which, without the OWF structure, did not occur in the Baltic East OWF Area. As a last resort, depending on the scale of decommissioning, a new state of biocenotic balance, closer to the current one, would be created. This balance will also be affected by natural processes taking place in the Southern Baltic.

The release of the marine space from the structural components of the Baltic East OWF will enable its re-use by the existing users, in particular for navigation. The possibility of using this area in terms of fishing will depend on the degree of removal of structural components from water.

5.3 Impact on Natura 2000 sites

5.3.1 Description of the impact assessment method used

The assessment of the Baltic East OWF impact on the Natura 2000 sites was carried out in accordance with the guidelines of the European Commission *"Assessment of plans and projects significantly affecting Natura 2000 sites. Methodological guidance on the provisions of Article 6[3] and [4] of the Habitats Directive 92/43/EEC [2021/C 437/01]" and "Managing Natura 2000 sites. The provisions of Article 6 of the Habitats Directive 92/43/EEC [2019/C 33/01]."*

5.3.2 Impact assessment criteria

The primary objective of the Natura 2000 sites conservation is to maintain or restore the proper conservation status of species and natural habitats which are subject to protection and for the protection of which these sites have been designated.

The main reasons for concluding whether the proposed Project may have impacts on the Natura 2000 site are the distance between this area and the Project implementation area and the range of the impacts. Due to the specific nature of the Natura 2000 sites functioning and possible functional connections between these sites, it is also important to locate the Project in relation to the Natura 2000 sites.

The Baltic East OWF Project is not directly related to or necessary for the management of the Natura 2000 sites. It follows from these premises that it is necessary to carry out an assessment of the impact on these areas.

5.3.3 Impact assessment including a comparison of options

3.11.2 presents detailed information on the Natura 2000 sites in a direct or further vicinity of the Baltic East OWF Area.

An essential element of the preliminary assessment of the Baltic East OWF impact on the Natura 2000 sites is to determine whether a particular Natura 2000 site is located within the range of the Baltic East OWF potential impacts. The Baltic East OWF Area against the background of the location of Natura 2000 sites is presented in the figure [Figure 67].

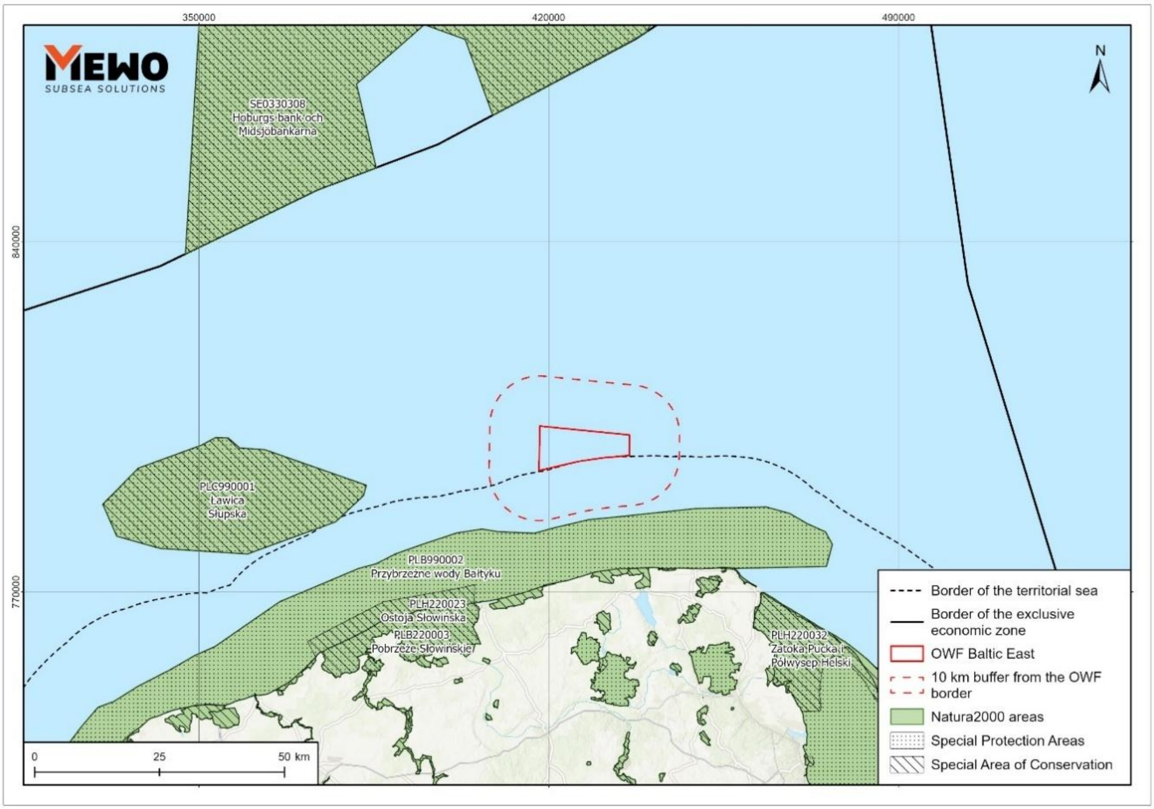

Figure 67 Baltic East OWF Area against the European ecological Network Natura 2000 sites [Source: internal materials]

Table [Table 116] shows distances (understood as distances from the nearest points of both sites) of Natura 2000 sites from the Baltic East OWF Area and a list of the subjects of protection present in these sites.

Table 116 Marine and coastal Natura 2000 sites located closest to the Baltic East OWF [Source: internal materials]

SITE NAME/CODE	DISTANCE FROM THE BALTIC EAST OWF AREA [KM]	SUBJECTS OF PROTECTION IN THE SITE		
		Marine habitats	Species of marine animals	Bird species
Przybrzeżne wody Bałtyku [Coastal Waters of the Baltic Sea] (PLB990002)	11.83	-	-	**Long-tailed duck (A064)** Common scoter (A065) **Velvet scoter (A066)** **European herring gull (A184)** Razorbill (A200) **Black guillemot (A202)**
Ostoja Słowińska [Słowińska Refuge] (PLH220023)	26.22	Rocky seabed, reefs (1170)	Sea lamprey (1095) European river lamprey (1099) Twait shad (1103) Salmon (1106)	-

SITE NAME/CODE	DISTANCE FROM THE BALTIC EAST OWF AREA [KM]	SUBJECTS OF PROTECTION IN THE SITE		
		Marine habitats	Species of marine animals	Bird species
			Porpoise (1351) Grey seal (1364) Sichel (2522)	
Ławica Słupska [Słupsk Bank] (PLC990001)	34.66	Sandy submarine banks (1110) Rocky seabed, reefs (1170)	-	**Long-tailed duck (A064)** **Black guillemot (A202)** **Velvet scoter (A066)**
Hoburgs bank och Midsjöbankarna (SE0330308)	61.26	Sandy submarine banks (1110) Rocky seabed, reefs (1170)	**Porpoise (1351)**	Common eider (A063) **Long-tailed duck (A064)** **Black guillemot (A202)**

Table [Table 116] distinguishes the species of birds and other marine animals which are subjects of protection in at least two sites. The species identified include the harbour porpoise (1351) and four bird species: the long-tailed duck (A064), the European herring gull (A184), the velvet scoter (A066) and the black guillemot (A202). Assigning these animal species as subjects of protection to the Natura 2000 sites indicates that these sites constitute important places for their residence and, at the same time, that these species are likely to travel between these sites. In view of the aforementioned, it can be assumed that the long-tailed duck and the black guillemot are more likely to fly between the following sites: *Przybrzeżne wody Bałtyku* (PLB990002), *Ławica Słupska* (PLC990001) and *Hoburgs bank och Midsjöbankarna* (SE0330308). The velvet scoter (A066) may also fly between the *Przybrzeżne wody Bałtyku* (PLB990002) and *Ławica Słupska* (PLC990001) sites. In the case of the European herring gull, which is protected in the *Przybrzeżne wody Bałtyku* (PLB990002) site, and is not a subject of protection in other Natura 2000 sites analysed, a lesser probability of migration of this species between the coastal water zone and the sea basins located north of it may be assumed.

The porpoise (1351) is not a migratory species. It uses its site of residence in connection to foraging and reproduction. This site may change but there is no migration between these sites. Therefore, there is a small link between the various Natura 2000 sites which would require an assessment of the impact on the network of links between the sites [Teilmann 2008; Dietz 2003].

5.3.3.1 Determination of the Project impact ranges

The Baltic East OWF Area is located outside the European ecological network Natura 2000 sites [Table 116]. Therefore, when determining the Project impact on the Natura 2000 sites, impacts that go beyond the Baltic East OWF Area were assumed.

Identification and assessment of the impacts on individual elements of the environment in individual phases of the Project are presented in subsections **5.1** and **5.2**.

Table [Table 117] shows the impacts that may extend beyond the Baltic East OWF Area and protected elements of the Natura 2000 sites that may be affected by these impacts, with the Project phase of their occurrence indicated.

Table 117 List of impacts and elements of the Natura 2000 sites that can be affected by them [Source: internal materials]

IMPACT	PROJECT PHASE	ELEMENT OF THE NATURA 2000 SITES
Increased concentration of suspended solids in water and their sedimentation	Implementation phase; Decommissioning phase	Subjects of protection: fish species and habitats
Underwater noise	Implementation phase; Operation phase; Decommissioning phase	Subjects of protection: species of marine mammals and fish
Space disturbance	Implementation phase; Operation phase; Decommissioning phase	Subjects of protection: bird species, integrity of the *Przybrzeżne wody Bałtyku* (PLB990002) site and network coherence

5.3.3.1.1 Suspended solids and their sedimentation

When determining the impact range of the increase in the suspended solids content in water and the resulting sedimentation, the following assumptions were made as a result of modeling:

- the maximum range of the suspended solids with a concentration of 5 mg dm^{-1} is 9.7 km from the place of their generation;
- the maximum range of the suspended solids sedimentation area with a thickness of 1 mm does not exceed 4.3 km from the place of their generation.

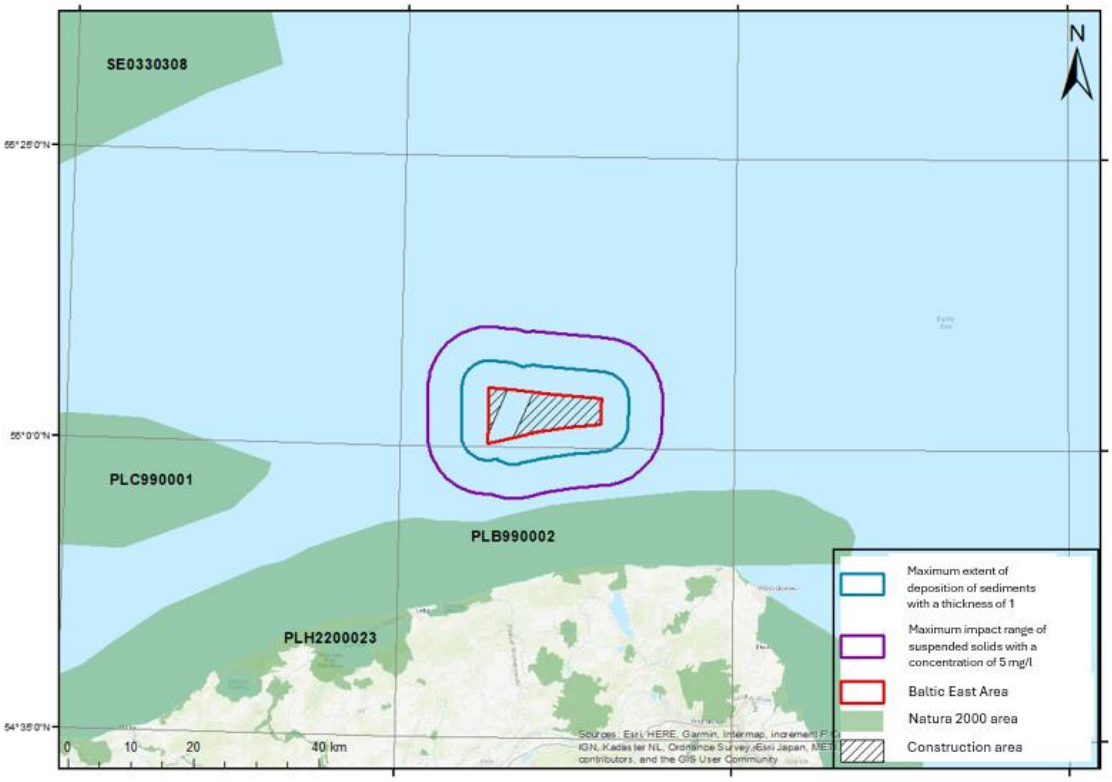

Table 118 Range of impact of the increase in suspended solids content and the resulting sedimentation for the Baltic East OWF [Source: internal materials]

The issues of the impact of the increase in the suspended solids content on biotic elements are described in subsections **5.1.1.9.2** and **5.1.3.9.3**. Only in the case of fish egg stages and juvenile forms, literature data are available indicating suspended solids contents at which significant impacts may occur. The values specified therein, beyond which there is a significant negative impact on the organisms described, are 10–12 mg dm^{-1}, and already at the suspended solids content of 3–5 mg dm^{-1} avoidance responses are observed. Therefore, using a conservative approach, it was assumed that the limit of significant impact is the increase of the suspended solids content up to 5 mg dm^{-1}.

The destruction of benthic organisms could indirectly deteriorate the food base for birds. To determine the range of significant impact of suspended solids sedimentation, a conservative value of 1.5 mm of deposited sediment was used, assuming that dissolved oxygen reaches the depth of 2 mm inside the sediment in the diffusion process [Hinchey 2006].

The increase in concentration of suspended solids and their sedimentation due to the maximum range of those phenomena will not impact the following habitats: Sandbanks which are slightly covered by sea water all the time (1110) and Reefs (1170) in the *Ławica Słupska* (PLC990001) site, as well as Reefs (1170) in the *Ostoja Słowińska* (PLH220032) site. Changes in the morphology of the seabed will be caused by works related to the erection of the OWF monopiles and activities related to cable laying within the Baltic East OWF Area. They will be local and limited to the places where these activities are carried out. Taking into account the distance of the Baltic East OWF nearest structures from the boundaries of the aforementioned habitats and the maximum range of suspended solids sedimentation, the boundaries of the habitat will not change. For the same reason, i.e. a significant distance of the protected habitats (receptors) from the source of impact, the increase in suspended solids content and their sedimentation will not result in fragmentation of these habitats, nor will it affect their structure and function.

5.3.3.1.2 Underwater noise

To determine the ranges of impact of underwater noise on marine mammals and fish, numerical modeling of noise propagation was performed. The calculations were performed for noise generated as a result of single piling in the Baltic East OWF Area and as a result of simultaneous piling within the following OWFs: Baltic Power, Baltica 2, Baltica 3, Bałtyk II, Bałtyk III, FEW Baltic II and BC-Wind (when at least one piling takes place in the Baltic East OWF Area). The modeling took into account three wind turbine locations considered as the worst-case scenario.

Detailed methodology of determining the range of impact of underwater noise is described in **Appendix No. 3** to the EIA Report.

The Noise Reduction System, which is an integral part of the Baltic East OWF at the implementation stage, is aimed at limiting underwater noise generated during piling to such an extent that it is insignificant for marine organisms, i.e. it does not exceed the TTS values within the Natura 2000 sites where these organisms are subject to protection.

The 1 hour cumulative TTS value was assumed as the boundary of significant impact of underwater noise on organisms. In the case of the organisms' behavioural response to underwater noise, its impact is discontinuous, short-term, and does not cause such changes as the 1 hour cumulative TTS. Moreover, the behavioural response is used to deter animals from the area of significant impact, therefore, possible inclusion of the Natura 2000 site in the scope of behavioural response as part of the EIA Report was not treated as a manifestation of a significant negative impact on this site. The underwater noise threshold values for marine mammals and fish are presented in subsections **5.1.3.9.4** and **5.1.3.9.3**.

Therefore, on the basis of model studies, the ranges of cumulative TTS were examined, taking into account the Natura 2000 sites where the species of marine mammals are protected, to determine the scenarios in which the ranges of TTS exceed the boundaries of the relevant Natura 2000 sites. In the case of porpoises, two sites were taken into account: one from the Polish Natura 2000 network – *Ostoja Słowińska* (PLH220032) and one Swedish site – *Hoburgs bank och Midsjobankarna* (SE0330308), whereas for seals, the *Ostoja Słowińska* was taken into account, where the subject of protection is the gray seal.

The results of the analyses showed that in the case of piling in a single location, the limit of cumulative TTS for porpoises will not be exceeded at the boundary of the Swedish and Polish Natura 2000 sites in the summer season, even if mitigation measures are not applied. However, the results show that during the winter season, the cumulative TTS threshold may be exceeded at the boundary of both Natura 2000 sites if noise mitigation measures are not applied. The results further show that the use of NRS can effectively reduce noise levels in protected areas.

In the case of piling in several locations without the use of noise mitigation measures, the TTS and PTS threshold values at the boundary of both discussed Natura 2000 sites in the summer season will not be exceeded. In the winter season, the threshold values may be exceeded in both Natura 2000 sites if noise mitigation measures are not applied. However, with the application of at least one of the mitigation measures considered, the thresholds will not be exceeded. The impact ranges for porpoises are presented in Figures [Figure 68-Figure 69].

The analyses conducted for the seals indicated that in all scenarios under consideration using NRS (both single and double), the cumulative TTS impact was not recorded in the Natura 2000 sites. The impact ranges for seals are presented in Figures [Figure 70-Figure 71].

For fish without and with swim bladders, the cumulative TTS range (in scenarios with the NRS) did not cross the boundary of any of the two previously mentioned Natura 2000 sites. The impact ranges for seals are presented in Figures [Figure 72-Figure 73].

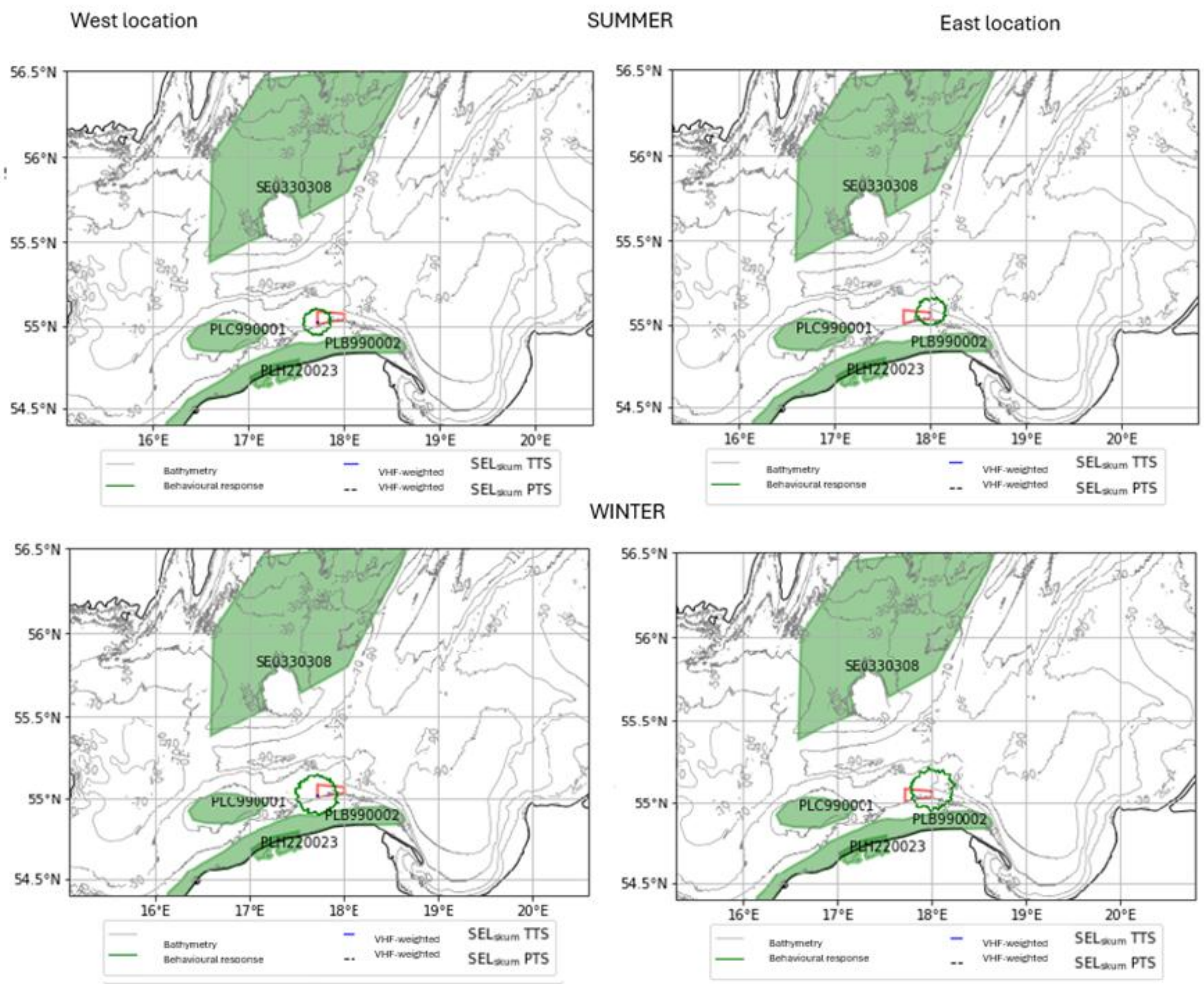

Figure 68 *Weighted SEL noise propagation map within the Baltic East OWF Area and impact ranges for porpoises for a single piling with the application of the BBC in the summer (upper map) and winter (lower map) seasons for two locations of the modeled noise source*

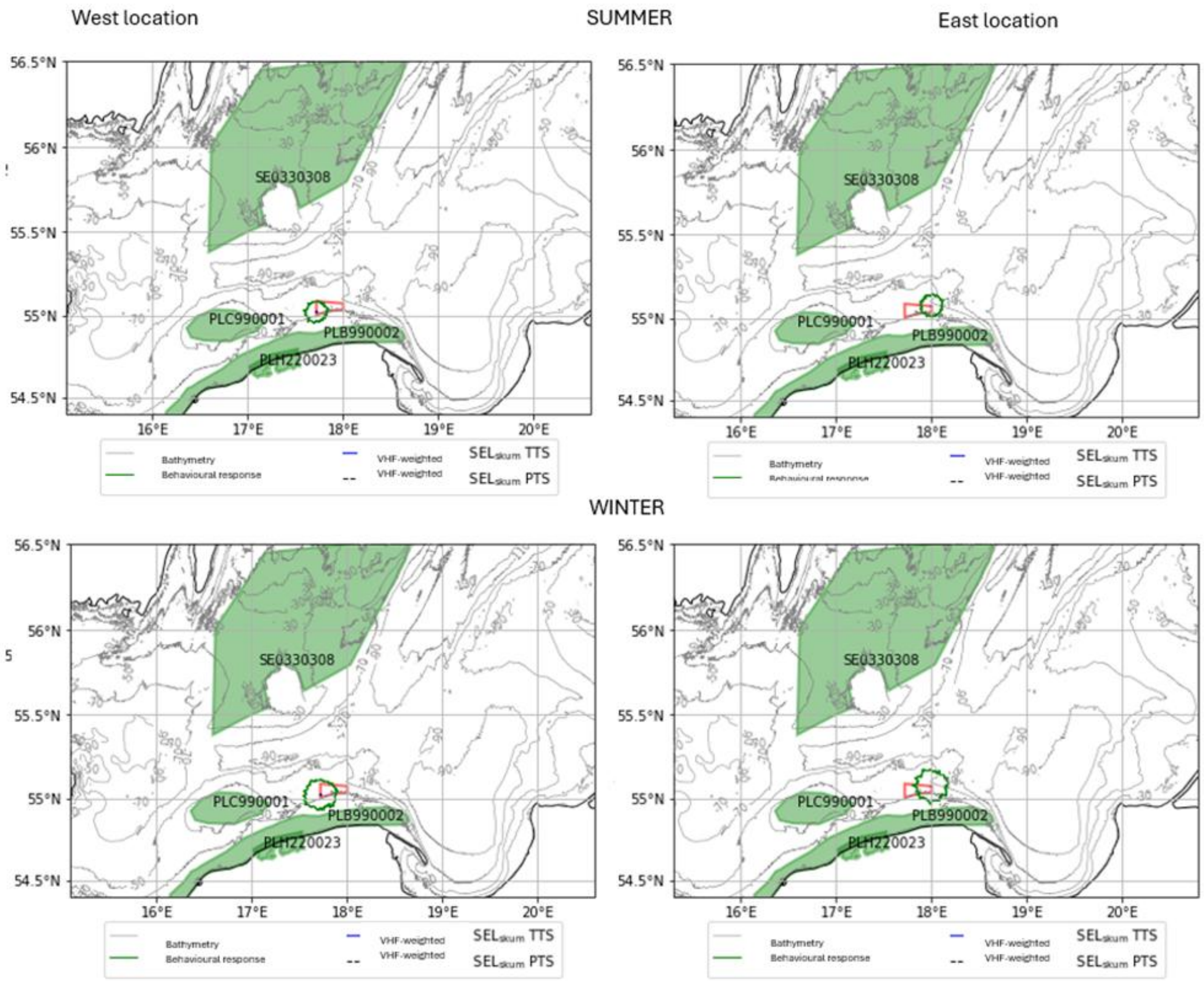

Figure 69 *VHF-weighted SEL noise propagation map within the Baltic East OWF area and impact ranges for porpoises for a single piling with the application of the HSD+DBBC in the summer (upper map) and winter (lower map) seasons for two locations of the modeled noise source*

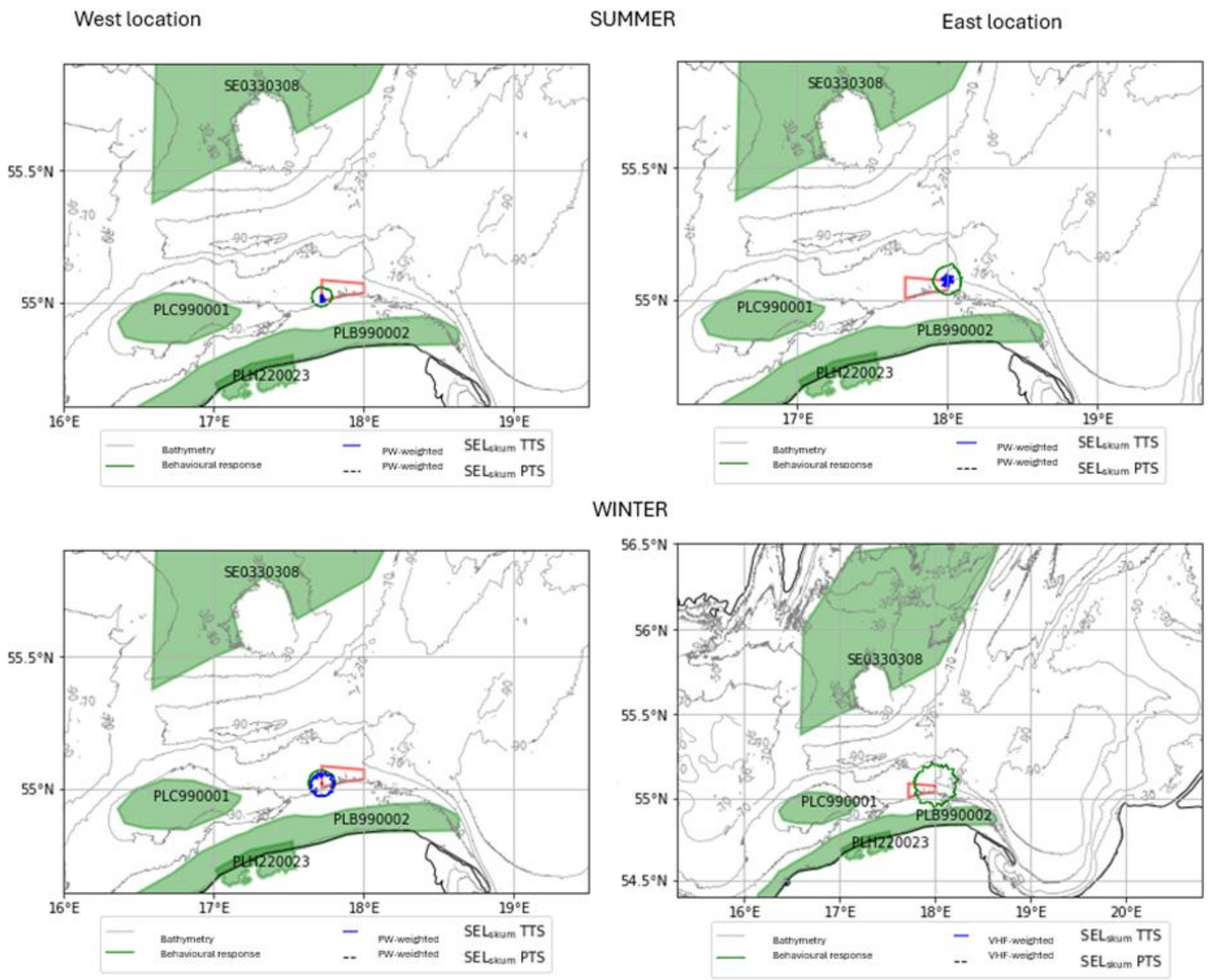

Figure 70 Weighted SEL noise propagation map for single piling within the Baltic East OWF Area and impact ranges for porpoises for a single piling with the application of the BBC in the summer (upper map) and winter (lower map) seasons for two locations of the modeled noise source

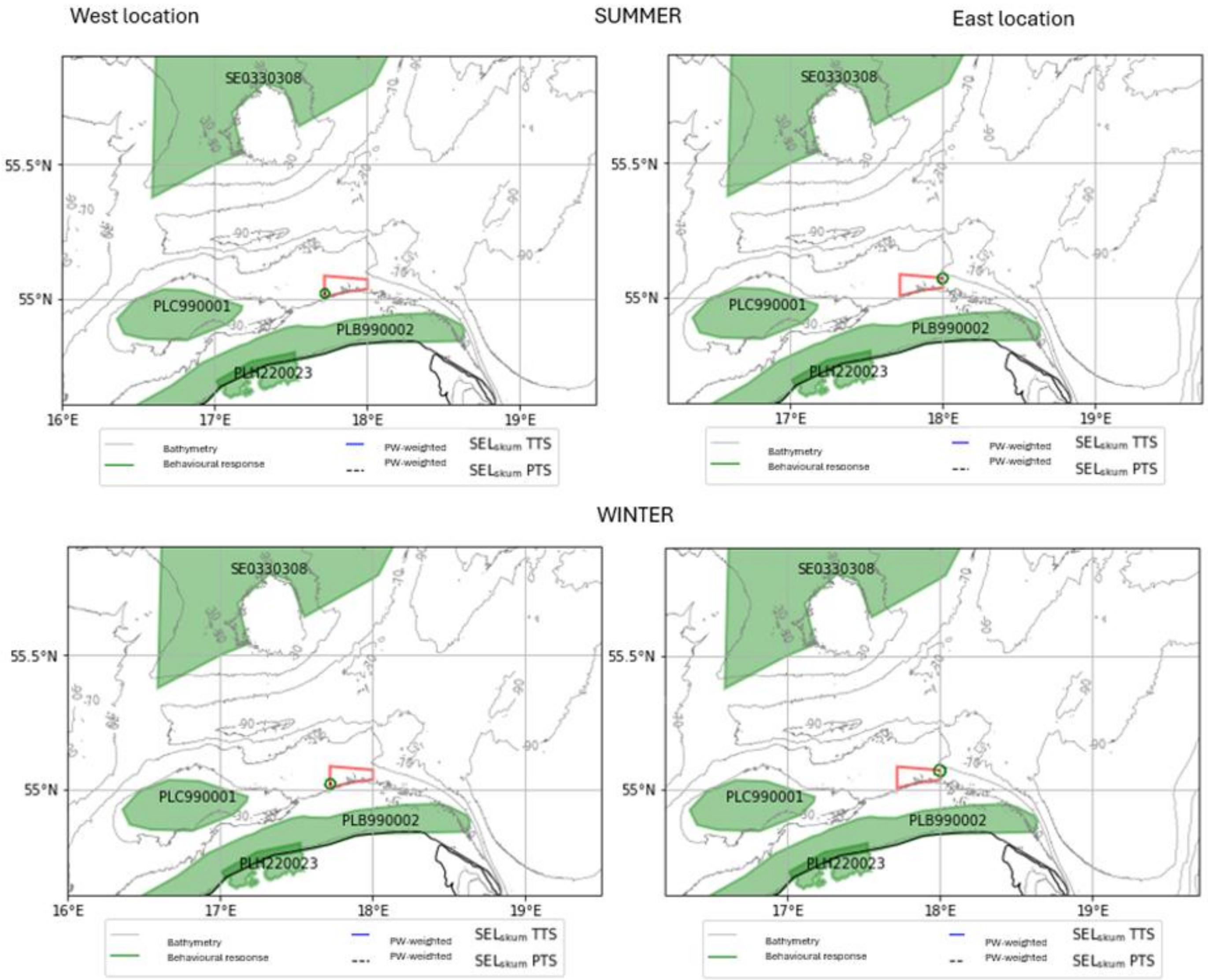

Figure 71 SEL weighted noise propagation map for a single piling in the Baltic East OWF Area and impact ranges for gray and harbor seals with the application of HSD + DBBC in summer (upper map) and winter (lower map) for two locations of the modeled noise source

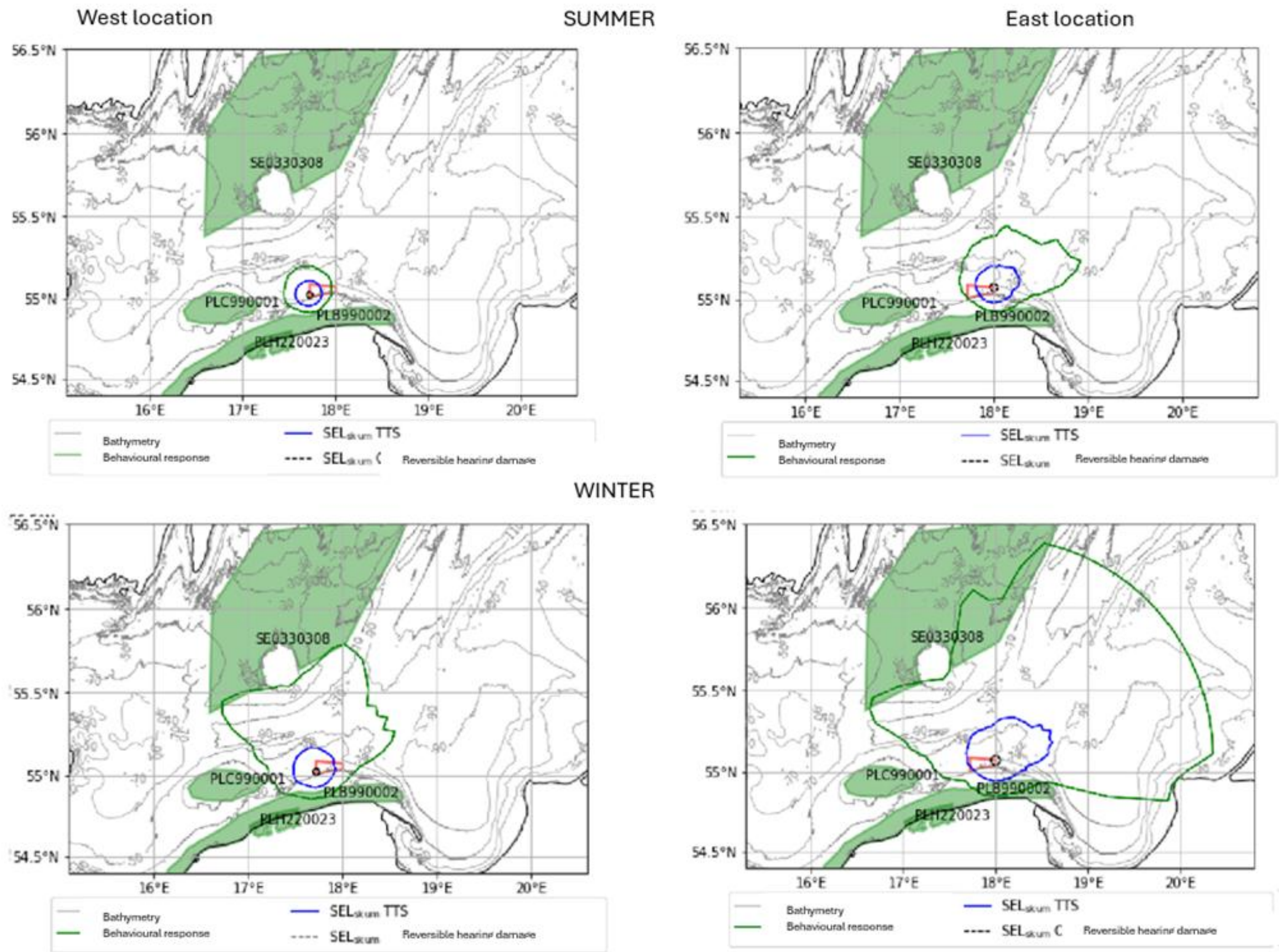

Figure 72 *Propagation map of unweighted SEL noise above the ambient noise for single pilling within the Baltic East OWF Area and impact ranges for fish with a swim bladder with the application of the BBC in the summer (upper map) and winter (lower map) seasons for two locations of the modeled noise source*

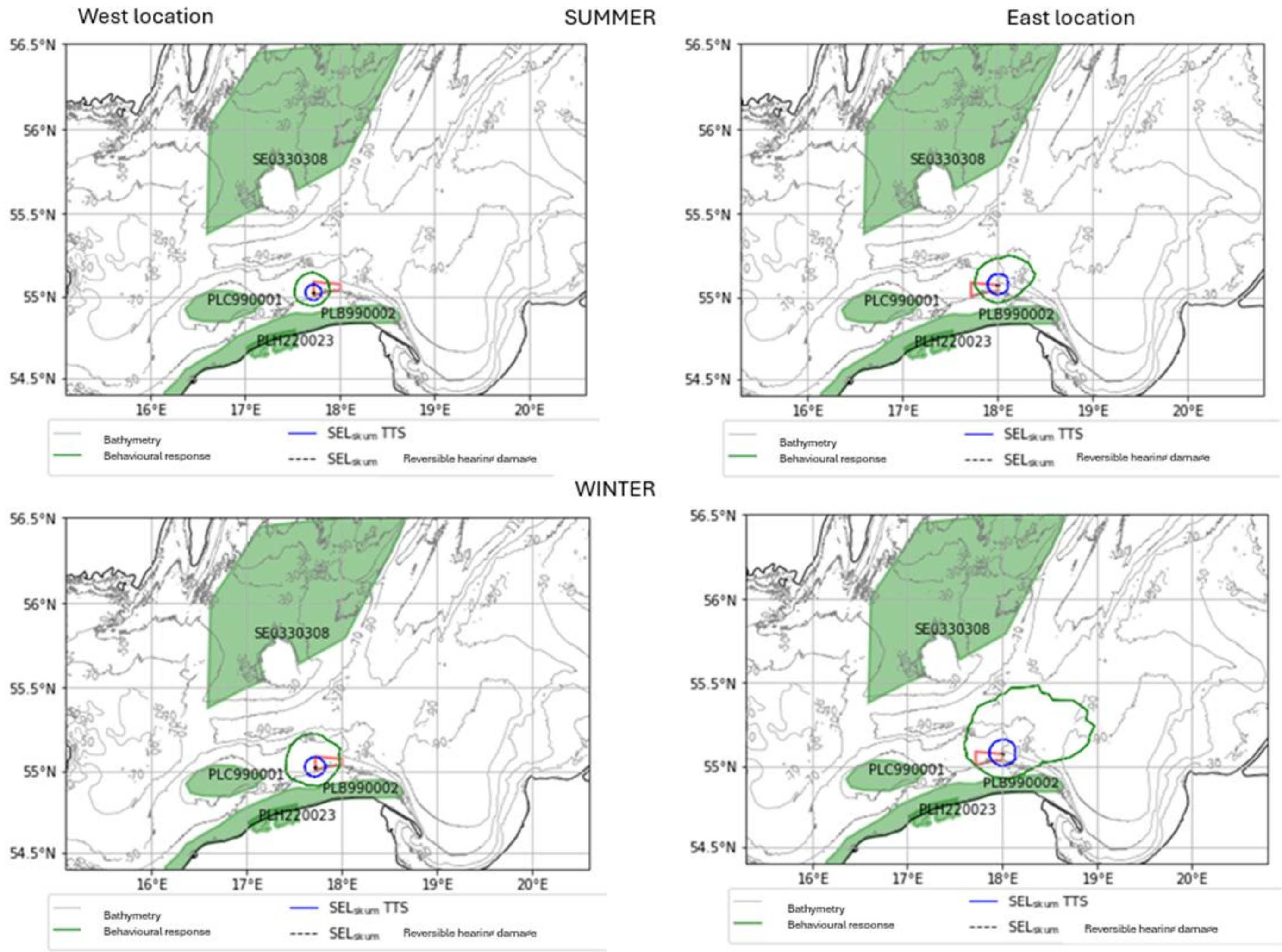

Figure 73 *Map of unweighted SEL noise above the ambient noise within the Baltic East OWF Area and impact ranges for fish with a swim bladder with the application of the HSD+DBBC in the summer (upper map) and winter (lower map) seasons for two locations of the modeled noise source*

5.3.3.1.3 Space disturbances

As a result of the Baltic East OWF implementation, large-size structures will be built on the currently undeveloped marine and air space above the sea area. The height of wind turbines will be up to 347.5 MASL and the rotor diameter will be up to 310 m. In the APV, the number of wind turbines will be up to 64, while the number of additional structures will be 2.

Compared to the current situation (initial state), construction of such a number of large-size structures in the environment may result in a disturbance of the coastal space within the Baltic East OWF Area. All constructed structures will not form a uniform barrier. The distances between individual wind turbines will be approximately 1 km.

When comparing these two areas, they will be occupied to a greater extent within the airspace above the sea area. The diameter of submerged structures connecting the monopiles with the wind turbine towers will be 12 m, whereas the rotor diameter will be 310 m. The occupation of airspace above the sea area will also vary at different altitudes of the structure. The area from the sea surface to the altitude of 22.5 m will not be occupied (excluding parts of the wind turbine towers).

The maritime space, understood as the sea surface including the water depth, is used by fish, marine mammals and birds sitting on water. Observations carried out in the Danish OWF areas indicate that, due to the possibility of fish active movement, the construction of structural components in the maritime space does not significantly disturb their migration processes [Leonhard *et al.*, 2011]. A similar situation will occur in the case of marine mammals for which the possibility of active movement will not be limited by the sparse arrangement of structural components in the maritime area and will not significantly affect their previous behaviour. In the case of birds sitting on water, given the minimum distance of the rotor tips from the water surface (22.5 m), the limitation of space to be used will also be negligible, just like for the submarine space for fish and marine mammals.

The airspace above the sea area is used by migratory birds or sea birds both in seasonal migrations and in local flights between feeding grounds. Disturbances of these flights may affect the populations of birds subject to protection in Natura 2000 sites – *Przybrzeżne wody Bałtyku* (PLB990002) and *Ławica Słupska* (PLC990001). In the event of the significant impact of the OWF on birds caused by a disturbance of the airspace, the coherence of the Natura 2000 network could be compromised.

5.3.3.2 Summary of the preliminary assessment

As a result of the preliminary assessment of the proposed Project impact on the Natura 2000 sites, given the ranges and nature of impacts, both the Baltic East OWF and, in the case of the cumulative impact with impacts from other projects, it was indicated that none of the Natura 2000 sites is within the range of significant impacts. The absence of impacts applies in particular to the subjects of protection (species and habitats) within the sites for which protection was established.

In view of the above, the proper assessment of the Baltic East OWF impact on the Natura 2000 sites covered the aspect related to the probable impact caused by the disturbance of the airspace over the Baltic East OWF development area in the context of integrity of the *Przybrzeżne wody Bałtyku* (PLB990002) and coherence of the Natura 2000 network.

5.3.4 Proper assessment for the APV

The Baltic East OWF operation phase was included in the proper assessment due to the nature of the impact. During this phase, the airspace above the maritime area will be occupied as much as possible by the structures of both wind turbines and substations, so the impact will be the greatest in relation to the remaining phases of the project. During the implementation phase, the effect of airspace disturbance will increase from the initial undisturbed state to the maximum state, lasting throughout the entire operation phase. During the Project decommissioning phase, the situation will be reversed – from the maximum state to the undisturbed state.

5.3.4.1 Coherence of the Natura 2000 network sites

In the context of protection of the seabird populations within the Natura 2000 network, the following are important features of the *Ławica Słupska* (PLC990001) and the *Przybrzeżne wody Bałtyku* (PLB990002) sites:

- the location of these sites along the migration route of the Eurasian seabird populations to their wintering sites;
- the availability of these sites for the populations of wintering birds and resting birds during migration;
- appropriate habitat conditions that make these sites attractive as wintering grounds or resting places during seabird autumn or spring migration.

In the context of maintaining the coherence as part of the Natura 2000 network, it is important above all to maintain the possibility of dislocation of seabird populations between the sites without the risk of significant depletion of the population or significant energy expenditures that could affect the ecology and biology, including the survivability of the specimens of those populations.

Currently, prior to the construction of the Baltic East OWF and other OWF projects in the Polish Sea Areas, the conservation status of birds wintering and migrating in the areas of the *Ławica Słupska* (PLC990001) and the *Przybrzeżne wody Bałtyku* (PLB990002) is appropriate.

The assessment of the Baltic East OWF impact on the Natura 2000 sites with respect to birds used the results of ornithological surveys performed for the EIA Report, information from Standard Data

Forms for the *Ławica Słupska* (PLC990001) and *Przybrzeżne wody Bałtyku* (PLB990002) sites, as well as recommendations of the European Commission's Guide “Wind energy developments and Natura 2000”.

The results concerning the maximum abundance of selected bird species in the Baltic East OWF Area and Natura 2000 sites are presented in Table and Figure [Table 119, Figure 74]. The results of modeling of abundance during the seabird wintering period were used for comparison, according to accepted standards, since long-distance movements of birds during winter are less likely than in other phenological periods.

Therefore, the assessment covered the suitability and importance for seabirds of the Baltic East OWF Area and the neighboring Natura 2000 *Ławica Słupska* (PLC990001) and *Przybrzeżne wody Bałtyku* (PLB990002) sites [Table 119].

Table 119 Comparison of the abundance of seabirds wintering in the Baltic Power OWF Area and Natura 2000 sites

SPECIES	ABUNDANCE OF BIRDS WINTERING IN THE SITES [IND.]			
	Baltic East OWF Area	**Ławica Słupska (PLC990001)**	**Part of the *Przybrzeżne wody Bałtyku* (PLB990002) site**	**Total**
Long-tailed duck Clangula hyemalis	524	56,656	26,151	83,331
Velvet scoter Melanitta fusca	33	28,386	40,957	69,376
Razorbill Alca torda	207	51	545	803
European herring gull Larus argentatus	36	164	819	1,019
Black guillemot Cepphus grylle	3*	21*	0	24
Common scoter Melanitta nigra	0*	0*	19*	19
Total	803	85,278	68,491	154,572

*Field survey results

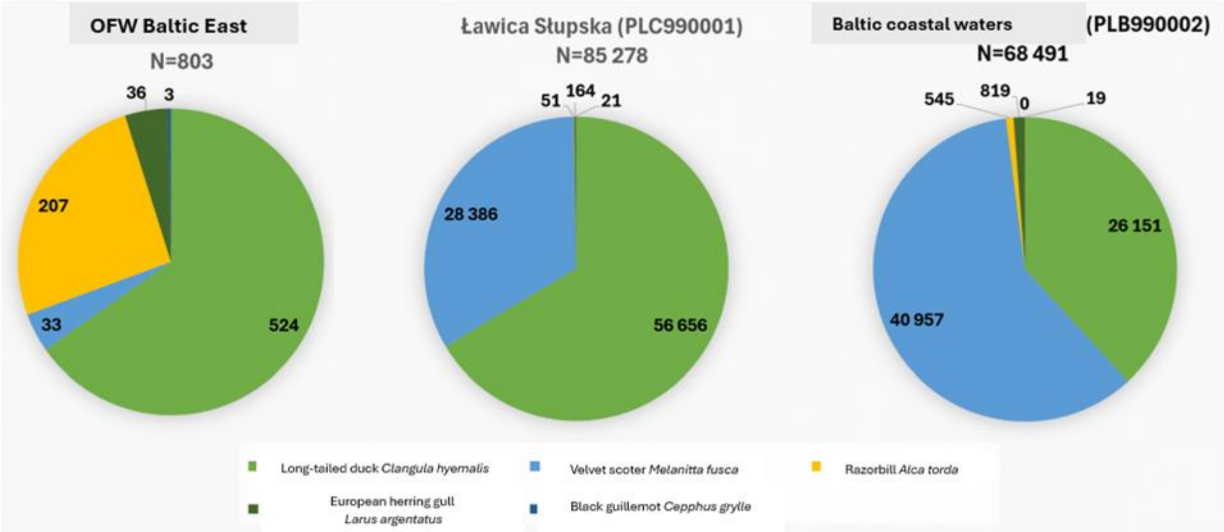

Figure 74 Species structure of seabirds covered by the assessment within the Baltic East OWF Area and the Natura 2000 sites [source: Baltic Neptun VIII Sp. z o.o. data]

The results of modeling of maximum abundances of wintering seabirds that are subjects of protection in the Natura 2000 sites: the long-tailed duck, velvet scoter, razorbill, and European herring gull performed as part of the EIA Report were used for comparison. The assessment included also the black guillemot and the common scoter. The black guillemot is subject to protection in the *Ławica Słupska* (PLC990001) and *Przybrzeżne wody Bałtyku* (PLB990002) sites, but its abundance in the Baltic East OWF Area was very low. In total, only three individuals were recorded during winter survey campaigns. No black guillemot was observed in the *Przybrzeżne wody Bałtyku* (PLB990002) site, and 21 individuals were recorded in the *Ławica Słupska* (PLC990001) site. It should be noted that these abundances refer only to the individuals observed along the survey cruise route and are not identical to the total number of black guillemots present in these sites.

The common scoter is subject to protection in the *Przybrzeżne wody Bałtyku* (PLB990002) site, but its population in winter in this survey area was very low and amounted to 19 individuals found along the survey cruise route, and it was not recorded within the Baltic East OWF Area.

The winter period was considered representative as long-distance movements of birds in the winter period are much less likely than in other phenological periods and the abundance of birds is the highest. The *Ławica Słupska* (PLC990001) and *Przybrzeżne wody Bałtyku* (PLB990002) sites are located on the migration route of the Eurasian seabird populations to their wintering sites. The local distribution and abundance of birds results mainly from the availability of food. From the point of view of habitat conditions that make these sites attractive, the obtained results clearly show that the Baltic East OWF Area, in relation to the compared Natura 2000 sites, is used by birds to a much lesser extent. This confirms the value and importance of the Natura 2000 sites. These seabirds show strong attachment to the wintering site and are reluctant to move over longer distances [Iverson, Esler 2006; Kirk *et al.* 2008; Oppel *et al.* 2008]. This fact is also confirmed by supplementary surveys carried out in 2022 as part of migrations of local wintering birds. Radar surveys of migratory birds showed that passing birds which winter in this part of the Baltic Sea move in all directions without a clear pattern, which is indicative of short flights to feeding grounds rather than long-distance movements. It was found that at observation points located along the *Przybrzeżne wody Bałtyku* site, birds fly more frequently in the west-south and north-east directions, i.e. along the coastline. The most recorded flights were documented in the strip between the *Ławica Słupska* and *Przybrzeżne wody Bałtyku* Natura 2000 sites.

Although the availability of the Baltic East OWF Area for the populations of birds wintering and resting during migration and subject to protection in the neighboring Natura 2000 sites will be limited, this impact was assessed as negligible for the long-tailed duck, velvet scoter, alcids and the common scoter, and there will be no impact for the European herring gull and the black guillemot.

The European herring gulls focus on the open sea in the area where fishing vessels operate. If fishing is limited in this sea basin during the implementation or subsequent operation of the Baltic East OWF, the gulls may move to other sites where fishing will be carried out or use new structures protruding from the sea as resting places. Underwater parts of these structures will act as an artificial reef constituting a hard substrate for the macrozoobenthos, which constitutes food for birds.

Long-tailed ducks, velvet scoters and razorbills staying in the Baltic East OWF Area before the commencement of implementation works will mostly permanently leave this area, moving to the neighbouring ones. Populations wintering so far in the *Ławica Słupska* (PLC990001) and *Przybrzeżne wody Bałtyku* (PLB990002) sites, where better habitats are located, are not at risk due to the significant distance of these sites from the Baltic East OWF Area. The possibility of increase in the density of the long-tailed duck, the velvet scoter and the razorbill populations in both Natura 2000 sites as a result of the movement of birds previously present in the sea basin of the proposed Project will not have a negative impact on them. Within the OWF area, these species occupied suboptimal habitats, mainly due to the food-diving depth being too great, whereas in the Natura 2000 sites, the feeding conditions for the above-mentioned species are optimal, which is indicated by very high values of their density.

Moreover, the existence of a corridor (an area free from development) in the central-western part of the Baltic East OWF, between the Baltic Power OWF and the BC-Wind OWF and between the Baltica 2 OWF and the Baltica 3 OWF will significantly increase the possibility of migrating birds flying within offshore wind farms in this area.

To sum up, it should be concluded that given a low abundance of seabirds in the proposed Project area, no significant negative impacts of the Baltic East OWF consisting in the displacement of bird species subject to protection from habitats within the *Ławica Słupska* (PLC990001) and the *Przybrzeżne wody Bałtyku* (PLB990002) sites is expected.

5.3.4.2 Integrity of a Natura 2000 site

Due to the location of the Baltic East OWF, the issue of the impact of the proposed Project on the integrity of a Natura 2000 site could be considered in the context of the nearest network site, i.e. *Przybrzeżne wody Bałtyku* (PLB990002).

The key impact of the Baltic East OWF on the long-tailed duck is its scaring off and loss of significant habitats where the species winters. As stated by Petersen *et al.* [2006], many years of pre-implementation and post-implementation surveys at the Nysted OWF in Denmark show that the long-tailed duck avoids the area of the constructed wind farm. It is also largely displaced from the 2 km zone, and to a lesser extent also from the 2–4 km zone around the boundaries of the area in which the wind turbines are built. The decrease in abundance in the 2–4 km zone was no longer statistically significant.

In this context, the area of the *Przybrzeżne wody Bałtyku* (PLB990002) is at a large distance from the Baltic East OWF Area (more than 11 km) and, at the same time, these birds will not be scared away from their habitats located in the *Przybrzeżne wody Bałtyku* (PLB990002). Moreover, due to the large distances between them and the presence of other suitable habitats at a similar distance, it should not be expected that a large number of birds displaced from the Baltic East OWF Area will move to the *Przybrzeżne wody Bałtyku* (PLB990002). Therefore, it is unlikely that in the *Przybrzeżne wody Bałtyku* (PLB990002) site, there will be negative impacts of the OWF associated with the increase in bird density, especially as the population of avifauna in the Baltic East OWF Area is low. As a result, negative impacts on the *Przybrzeżne wody Bałtyku* (PLB990002) site due to the long-tailed duck scaring and displacement from habitats may be excluded.

To sum up, it should be concluded that the Baltic East OWF is not expected to cause significant negative impacts consisting in the displacement of bird species subject to protection from the habitats within the *Przybrzeżne wody Bałtyku* (PLB990002) site.

5.3.4.3 Summary of the relevant assessment

As a result of the proper assessment of the Baltic East OWF impact on the bird species subject to protection in the *Ławica Słupska* (PLC990001) and *Przybrzeżne wody Bałtyku* (PLB990002) sites, on the integrity of the *Przybrzeżne wody Bałtyku* (PLB990002) site and coherence of the Natura 2000 network, it can be concluded that the Project in the APV will not cause any significant impacts on the Natura 2000 sites analysed.

Considering that the Natura 2000 sites may be classified as receptors of very high sensitivity, and at the same time taking into account the scale of impact of the Baltic East OWF on them, the significance of this impact is moderate.

5.3.5 Preliminary assessment for the RAV

The primary objective of the Natura 2000 sites conservation is to maintain or restore the proper conservation status of species and natural habitats which are subject to protection and for the protection of which these sites have been designated.

The Baltic East OWF Project in the RAV is not directly related to or necessary for the management of the Natura 2000 sites. It follows from these premises that it is necessary to carry out an assessment of the impact on these areas.

An essential element of the preliminary assessment of the Baltic East OWF impact in the RAV on the Natura 2000 sites is to determine whether a given Natura 2000 site is within the range of the Baltic East OWF potential impacts.

The main reasons for concluding whether the proposed Project may have impacts on the Natura 2000 protected area are the distance between this site and the Project implementation area and the range of the impacts. Due to the specific nature of the Natura 2000 sites functioning and possible functional connections between these sites, it is also important to identify the location the Project area in relation to the Natura 2000 sites.

The Baltic East OWF Area in the RAV is located outside the European ecological network Natura 2000 sites. Therefore, when determining the impact of the proposed Project on the Natura 2000 sites, impacts that go beyond the Baltic East OWF Area were assumed, i.e.: (i) increased concentration of suspended solids in water and its sedimentation, (ii) underwater noise, and (iii) space disturbance.

Taking into account that in the RAV, from the nearest structures of the Baltic East OWF, the source of suspended solids generation, to the boundaries of the protected habitats, the distance is many times larger than the maximum range of suspended solids sedimentation, there will be no impacts on these habitats, both in the context of changing their boundaries, fragmentation or on their structure and function.

The Noise Reduction System, which is an integral part of the Baltic East OWF in the construction phase in the RAV, is aimed at limiting underwater noise generated during piling to such an extent that it does not exceed the TTS values within the Natura 2000 sites where these organisms are subjects of protection. It is assumed that in order to avoid significant impacts on the Natura 2000 sites for other OWFs, the prerequisite for implementation of these projects will be to meet the underwater noise levels safe for organisms subject to protection in these areas.

As a result of the preliminary assessment of the impact of the proposed Project on the Natura 2000 sites, given the ranges and nature of impacts, both the Baltic East OWF in the RAV and, in the case of a cumulative impact with impacts from other projects, it was indicated that none of the Natura 2000 sites is within the range of the impacts – (i) increased concentration of suspended solids in water and its sedimentation, and (ii) underwater noise. The absence of these impacts applies in particular to the subjects of protection (species and habitats) within the sites for which protection was established.

The proper assessment of the Baltic East OWF impact in the RAV on the Natura 2000 sites covered the aspect related to the probable impact caused by the disturbance of the airspace over the Baltic East OWF Development Area in the context of integrity of the in the *Przybrzeżne wody Bałtyku* (PLB990002) site and coherence of the Natura 2000 network.

5.3.6 Proper assessment for the RAV

The operation phase of the Baltic East OWF in the RAV was included in the proper assessment due to the nature of the impact. During this phase, the airspace above the maritime area will be occupied as much as possible by the structures of both wind turbines and substations, so the impact will be the greatest in relation to the remaining phases of the project.

In the context of the protection of seabird populations within the Natura 2000 network, the following are important features of the *Ławica Słupska* (PLC990001) and *Przybrzeżne wody Bałtyku* (PLB990002) sites: (i) the location of these areas along the migration route of birds, (ii) appropriate habitat conditions, and (iii) the availability of these sites for the populations of wintering birds and birds resting during migration.

In the context of maintaining the coherence as part of the Natura 2000 network, it is important above all to maintain the possibility of dislocation of bird populations between the sites without the risk of significant depletion of the population or significant energy expenditures that could affect the ecology and biology of those populations.

Although the availability of the Baltic East OWF Area in the RAV for the populations of birds wintering and resting during migration and subject to protection in the neighbouring Natura 2000 sites will be limited, but this impact was assessed as negligible for the long-tailed duck, velvet scoter, and razorbill, and there will be no impact for the European herring gull, black guillemot and the common scoter. Moreover, the presence of a corridor (an area free from development) in the central part of the Baltic East OWF, between the Baltic Power OWF and the BC-Wind OWF in the RAV, and between the Baltica 2 OWF and the Baltica 3 OWF will significantly increase the possibility of migrating birds flying within offshore wind farms in this area.

Due to the location of the Baltic East OWF in the RAV, the issue of the proposed Project impact on the integrity of a Natura 2000 site could be considered in the context of the nearest network site, i.e. *Przybrzeżne wody Bałtyku* (PLB990002). The Baltic East OWF in the RAV is not expected to cause significant negative impacts, such as displacement of bird species subject to protection from the habitats within the *Przybrzeżne wody Bałtyku* (PLB990002) site.

As a result of the proper assessment of the Baltic East OWF impact on the bird species subject to protection in the *Ławica Słupska* (PLC990001) and *Przybrzeżne wody Bałtyku* (PLB990002) sites, the integrity of the *Przybrzeżne wody Bałtyku* (PLB990002) site and coherence of the Natura 2000 network, it can be concluded that the proposed Project, both in the RAV, will not cause any significant impacts on the Natura 2000 sites analysed.

Considering that the Natura 2000 sites may be classified as receptors of very high sensitivity, and at the same time taking into account the scale of impact of the Baltic East OWF on them, the significance of this impact is moderate.

6 CUMULATIVE IMPACTS OF THE PROPOSED PROJECT

6.1 Introduction

Pursuant to Article 66(1)(3b) of the EIA Act, the EIA Report contains 'the information on relations to other projects, in particular on the accumulation of impacts of the implemented, completed or planned projects, for which a decision on environmental conditions has been issued, located in the area where the Project is planned to be implemented and in the area of the Project impact or the impacts of which fall within the area of the proposed Project – to the extent to which their impacts may lead to the accumulation of impacts with the proposed Project'. The analysis in this regard is limited to those impacts that are likely to be cumulative.

In accordance with the above requirements, in terms of the cumulative impact resulting from the implementation, operation and decommissioning of the Baltic East OWF in relation to other projects, the implemented, completed or planned projects for which a decision on environmental conditions was issued were taken into account. This enabled the comparison of the impact assessment conducted for the Baltic East OWF with the results of assessments carried out for the remaining projects in terms of the possible cumulative effect of these impacts.

No other projects that may cause cumulative impacts are being implemented nor will be implemented in the Baltic East OWF Area. The implementation of the Baltic East OWF in all its phases, due to the correct and safe functioning of this Project, prevents carrying out other activities in the same area. Therefore, the impacts that may possibly accumulate with the impacts of the Baltic East OWF will have their sources outside its area.

6.2 Existing, implemented, and planned projects functionally unrelated to the proposed Project for which decisions on environmental conditions have been issued

Within the PSA, there are projects completed, being implemented or planned which are connected to **the extraction of hydrocarbon from under the seabed and the production of hydrogen** [Figure 76] for which the decisions on environmental conditions have been issued, i.e.:

- The extraction of crude oil and co-occurring natural gas from Deposit B3 in the sea area of the Republic of Poland – exploited deposit – concession no. 108/94 of 29 July 1994, as amended (decisions on environmental conditions: ref. RDOŚ-22-WOO.6670/62-5/09/AT of 19 October 2009, ref. RDOŚ-Gd-WOO.4211.8.2013.ER.9 of 30 September 2013, ref. RDOŚ-Gd-WOO.4211.36.2013.ER.4 of 9 January 2014, ref. RDOŚ-Gd-WOO.4211.3.2016.ER.10 of 26 July

2016) (hereinafter referred to as: Deposit B3), along with the offshore pipeline DN100 form Deposit B3 to Władysławowo, operating since 2023;

- The extraction of natural gas from subsea hydrocarbon Deposits B4 and B6 and its transmission to the installations of the electrical and heating power station in Władysławowo – unexploited deposits – concession no. 6/2007 for Deposit B4 of 11 May 2007, as amended and concession no. 2/2006 of 7 November 2006, as amended (decision on environmental conditions ref. RDOŚ-Gd-WOO.4211.12.2014.ER.8 of 16 May 2014) (hereinafter referred to as: Deposits B4 and B6), including the planned offshore pipeline DN250;
- The extraction of crude oil and co-occurring natural gas from Deposit B8 located in the Polish EEZ of the Baltic Sea – exploited deposit – concession no. 1/2006 of 5 September 2006, as amended (decisions on environmental conditions: ref. Śr/Ś.II.6618/482-4/2005 of 11 July 2006, ref. RDOŚ-22-WOO.6670/46-6/09/AT of 27 July 2009, ref. RDOŚ-Gd-WOO.4211.16.2015.ER.6 of 11 August 2015, ref. RDOŚ-Gd-WOO.4211.4.2016.ER.KSZ.11 of 12 August 2016, along with the rectifying resolution ref. RDOŚ-Gd-WOO.4211.4.2016.ER.KSZ.14 of 7 September 2016 (hereinafter referred to as: Deposit B8), along with the offshore pipeline DN100 from Deposit B8 to Władysławowo, operating since 2021;
- Research and development project for the production of hydrogen from seawater at the Lotos Petrobaltic drilling platform and the exploration of the possibility of using hydrogen to decarbonise the assets of GL Lotos Petrobaltic S.A. (located on Deposit B8) (decision on environmental conditions ref. RDOŚ-Gd-WOO.420.13.2024.Aj.4 of 24 May 2024);
- Prospecting and exploration of crude oil and natural gas deposits in the area *Gaz Południe*, located in the eastern part of the Polish sea area – unexploited deposit – concession no. 34/2001/p of 14 December 2001, as amended (decisions on environmental conditions: ref. ŚR.II.AT.6670/27-4/07 of 9 November 2007, ref. ŚR.II.ER.6670/21-4/08 of 10 July 2008, ref. RDOŚ-22-WOO.6670/3-5/10/AT of 29 April 2010, ref. RDOŚ-Gd-WOO.4211.17.2014.AT.9 of 30 October 2014) (hereinafter referred to as: Deposit B21);
- Prospecting and exploration of crude oil and natural gas deposits in the Gotland area (part of concession blocks no. E9 and E10) – concession no. 36/2001/p, as amended (decisions on environmental conditions: ref. ŚR.II.AT.6670/26-4/07 of 22 October 2007, ref. ŚR.IIER.6670/18-4/08 of 10 July 2008), and the decision to convert to concession no. 36/2001/Ł for the prospecting and exploration of crude oil and natural gas deposits and for the extraction of crude oil and natural gas from the deposits in the Gotland area (part of concession blocks no. E9 and E10), as amended (decision on environmental conditions ref.

RDOŚ-Gd-WOO.420.60.AT.6 of 30 March 2021) (hereinafter referred to as: Gotland Concession);

- Prospecting and exploration of crude oil and natural gas deposits in the area *Łeba* located in the eastern part of the Polish sea area – concession no. 37/2001/p, as amended (decisions on environmental conditions: ref. ŚR.II.AT.6670/28-4/07 of 22 October 2007, ref. ŚR.II.ER.6670/19-4/08 of 10 July 2008, ref. RDOŚ-Gd-WOO.4211.5.2013.IB.18. of 9 October 2013, ref. RDOŚ-Gd-WOO.4211.38.2013.IB.11. of 19 May 2014) and the decision to convert to concession no. 37/2001/Ł for the prospecting and exploration of crude oil and natural gas deposits and for the extraction of crude oil and natural gas from the deposits in the area *Łeba* (concession block no. E49 and part of concession block E29), as amended (resolution ref. RDOŚ-Gd-WOO.400.34.2020.IB.1 of 18 June 2020 expressing the position that the conditions for the project implementation are up to date) (hereinafter referred to as: Łeba Concession);
- Prospecting and exploration of crude oil and natural gas deposits in the area *Rozewie* located in the eastern part of the Polish sea area – concession no. 38/2002/p, as amended (decisions on environmental conditions: ref. ŚR.II.AT.6670/25-4/07 of 22 October 2007, ref. ŚR.II.ER.6670/20-4/08 of 10 July 2008, ref. RDOŚ-Gd-WOO.4211.4.2013.IB.18. of 9 October 2013) and the decision to convert to concession no. 38/2001/Ł for the prospecting and exploration of crude oil and natural gas deposits and for the extraction of crude oil and natural gas from the deposits in the area *Rozewie* (part of concession blocks nos E39 and E50), as amended (decision on environmental conditions: ref. RDOŚ-Gd-WOO.420.29.2020.IB.4. of 28 August 2020) (hereinafter referred to as: Rozewie Concession).

Other **offshore wind farms** are planned to be launched in the vicinity of the Baltic East OWF. Currently, eight permits for the construction and use of artificial islands, structures and devices in the sea areas for the OWFs nearest to the Baltic East Area remain in force [Figure 75]:

- FEW Baltic II (permit no. MFW/5a/13);
- Bałtyk Środkowy II (Bałtyk II) (permit no. MFW/2a/13);
- Baltica 2 (permit no. MFW/4/12);
- Baltica 2+ (permit no. MFW/45.E.1);
- Bałtyk Środkowy III (Bałtyk III) (permit no. MFW/2/12);
- Baltica 3 (permit no. MFW/5/12);
- Baltic Power (permit no. MFW/6/12);
- C-Wind (permit no. MFW/13/11);
- B-Wind (permit no. MFW/10/11).

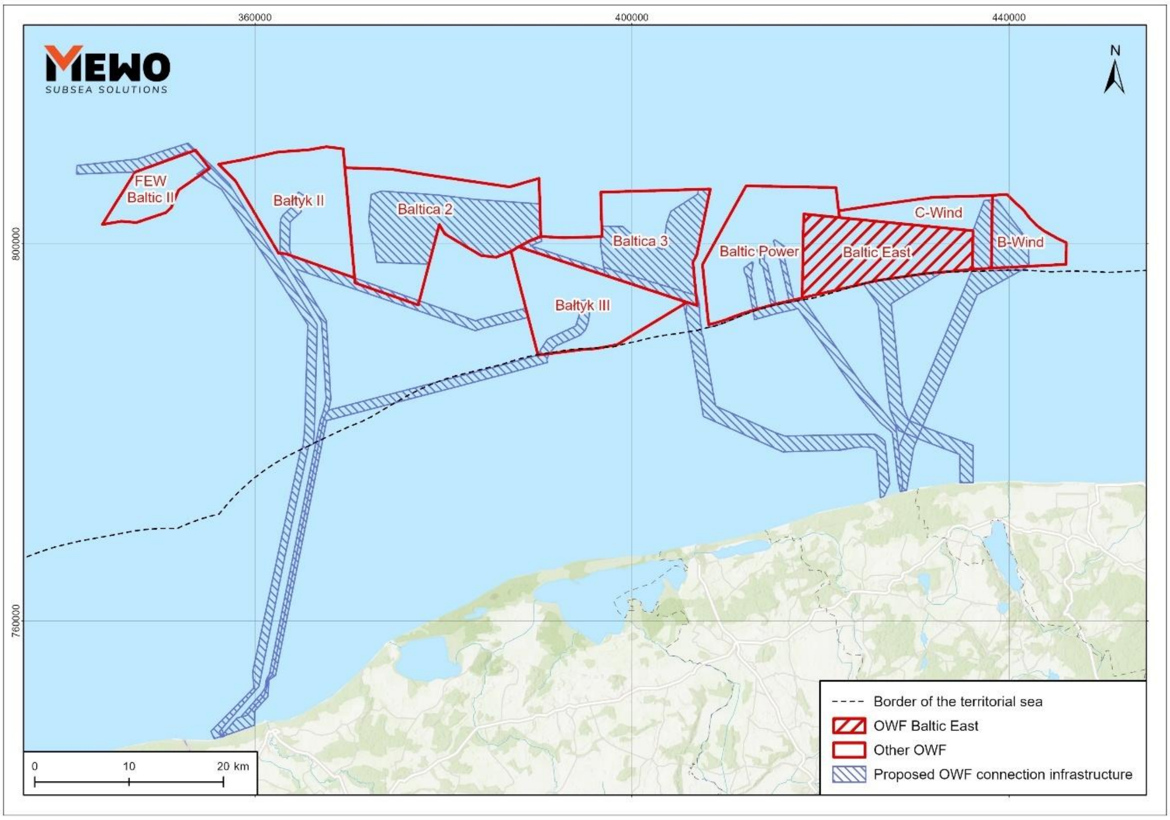

Figure 75 Location of the planned offshore wind farms near the Baltic East OWF Area [Source: SIPAM]

At present, none of the above-mentioned projects have been implemented. These projects are at various stages of development.

The following projects related to the construction of OWFs and connection infrastructure, for which the decisions on environmental conditions have been issued, are planned in the PSA [Figure 76]. These are:

- The construction of the FEW Baltic II offshore wind farm (decision ref. WONS-OŚ.420.20.2020.KK.30 of 30 November 2021) (FEW Baltic II);
- The construction of the Bałtyk II OWF (decision ref. RDOŚ-Gd-WOO.4211.26.2015.KSZ.20 of 27 March 2017, amended by the decision ref. RDOŚ-Gd-WOO.420.3.2021.KSZ.14 of 26 October 2021) (Bałtyk II);
- Baltica Offshore Wind Farm (decision ref. RDOŚ-Gd-WOO.4211.21.2017.MJ.PW.AJ.37 of 24 January 2020, amended by the decision ref. RDOŚ-Gd-WOO.420.29.2023.AJ.8 of 21 August 2023) (Baltica 2 and Baltica 3);
- The construction of the Bałtyk Środkowy III OWF (decision ref. RDOŚ-Gd-WOO.4211.12.2015.KP.22 of 07 July 2016, amended by the decision ref. RDOŚ-Gd-WOO.420.41.2022.AM.6 of 08 November 2022) (Bałtyk III);

- Baltic Power Offshore Wind Farm (decision ref. DDOŚ-WDŚZOO.420.59.2021.SP.10 of 29 June 2022, amended by the decision ref. DDOŚ-WDŚZOO.420.32.2022.SP.12 of 01 March 2023);
- BC-Wind Offshore Wind Farm (decision ref. RDOŚ-Gd-WOO.420.50.2021.KSZ.AM.10. of 16 September 2022) (B-Wind and C-Wind);
- FEW Baltic II connection infrastructure (decision ref. RDOŚ-Gd-WOO.420.9.2022.AJ.44. of 5 October 2023);
- Bałtyk II OWF and Bałtyk III OWF connection infrastructure (decision ref. RDOŚ-Gd-WOO.420.40.2022.AM.32. of 29 November 2023 and the resolution ref. RDOŚ-Gd-WOO.420.40.2022.AM.35. of 14 December 2023, supplementing the decision);
- Baltica B-2 and B-3 OWF connection infrastructure (decision ref. RDOŚ-Gd-WOO.420.47.2021.AJ.31. of 11 August 2022);
- Baltic Power Offshore Wind Farm connection infrastructure (decision ref. RDOŚ-Gd-WOO.420.16.2021.AJ.36. of 6 September 2022);
- BC-Wind connection infrastructure (decision ref. RDOŚ-Gd-WOO.420.43.2021.KSZ/AM.43. of 29 July 2024).

The construction of the first Polish nuclear power plant (NPP), for which the decision ref. DOOŚ-OA.4205.1.2015.125 of 19 September 2023 of the General Director of Environmental Protection on environmental conditions was issued, has begun in the Choczewo commune. In connection with the implementation of the NPP, the accompanying investment projects covered by separate environmental decisions will also be carried out. Among other things, tasks such as the Marine Off-Loading Facility (MOLF) and the cooling system for the NPP will be carried out in the PSA – of the two, only for the cooling system a decision on environmental conditions has been issued.

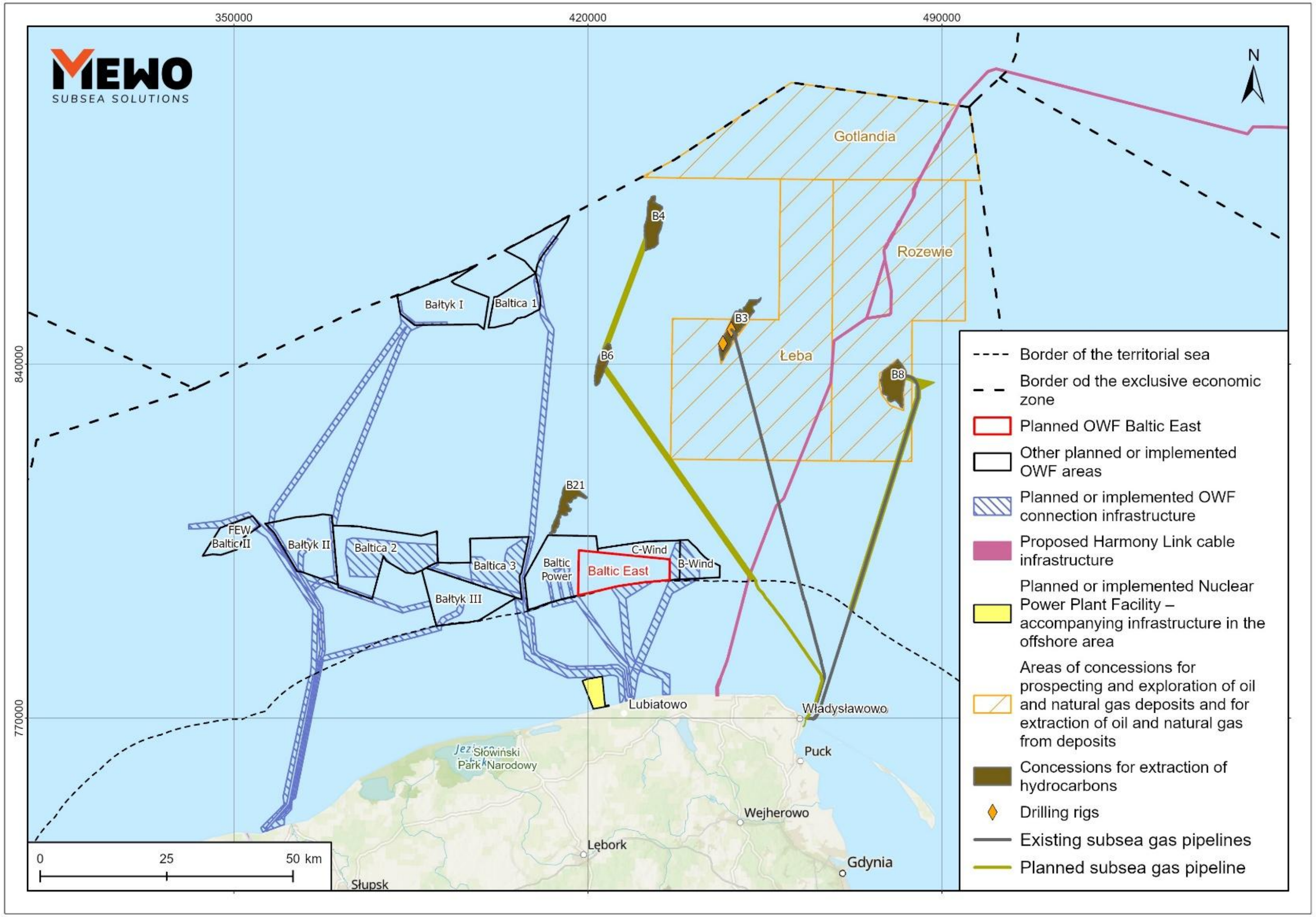

Figure 76 Location of the Baltic East OWF Area in relation to other existing, implemented and planned projects in the Polish Sea Areas [Source: internal materials]

The OWF preparation and construction works are currently underway or starting. They are at different stages of development with different project owners and their detailed schedules are not available. The possibility of the cumulative impact occurrence at the implementation stage, due to the time limitation of the impacts themselves, may take place only if works of the same nature are carried out simultaneously or in quick succession. With the general assumption of all project owners that the OWF implementation phase will last several years, it cannot be indicated clearly which activities will be performed simultaneously or within a short period of time. Nevertheless, taking into account that the OWF projects of various project owners will be implemented independently, it cannot be ruled out, guided by the precautionary principle, that accumulated impacts will not occur. The implementation of the Baltic East OWF is planned to commence in a few years, hence it is now likely that the start of its implementation will be parallel to the final stages of implementation of the neighbouring Baltic Power and BC-Wind OWFs, or will take place when both mentioned farms are already in operation. Once the construction phases have been completed, the operation phases of individual OWFs will commence, and here too, it is anticipated that this phase will begin later compared to the neighbouring farms, but due to the extensive length of the operation phases of these types of projects, there will be a considerable overlap. In the case of the decommissioning phases of the OWFs, both the timing and scale of the decommissioning are unknown at the moment, with the exception of the operation periods indicated in the decisions on environmental conditions. The environmental impacts associated with this phase will be of a different nature and will be no greater than in the case of the implementation and operation phases. As a result of the commencement of the removal of the above-water structures, the space will be gradually reclaimed until a state without offshore wind turbines is restored. Also, the removal of underwater structures will be a process of gradual restoration of the state of development from before the OWF implementation phase. Assuming that the OWF decommissioning process will be a long-term process, carried out in accordance with the applicable regulations and safety standards in terms of the vessels used, and that all structural elements dismantled will be transported to land and managed there, in accordance with the regulations in place at the time. Under the assumptions given, it can be indicated that even if decommissioning is carried out simultaneously in several locations within one or more OWFs, no cumulative impacts will occur.

6.3 Types of impacts that may cause cumulative impact

The assessment of the Baltic East OWF impact on particular components of the environment including the impact scale and significance is presented in Section 5. The cumulative impact of the Baltic East OWF with other projects implemented in the PSA may occur, if the activities generating similar impacts are carried out simultaneously. In the case of impacts that have been classified as temporary, the cases of simultaneous execution of the same activities by different project owners should be considered rare. Also impacts that have been identified as local will not cause cumulative impacts, since in most cases their range will not extend beyond the Baltic East OWF Area.

Therefore, the Baltic East OWF impacts, which may generate a cumulative impact with other projects, include impacts that are at least medium-term and their range extends beyond the Baltic East OWF Area, i.e.:

- spatial disturbances, including:
  - exclusion of foraging areas;
  - creation of a physical barrier;
  - landscape disturbances;
  - interference in the operation of systems using EMF;
- hindrances/restrictions to fishing;
- underwater noise;
- increase in the concentration of suspended solids and their sedimentation.

Two of the identified impacts (relating to underwater noise and the increase of suspended solids and their sedimentation) will occur during the construction phase, with the remainder occurring towards the end of the construction phase (with the construction of structures above the water surface, including substations) and during the operation phase. The identified potential cumulative impacts and their assessment are analogous in the APV and the RAV.

6.4 Identification of projects which may cause cumulative impacts

The projects indicated above, which have been granted a decision on environmental conditions, can be divided into the following groups:

- related to prospecting and exploration of hydrocarbon deposits;
- related to the extraction of hydrocarbons and their transportation by offshore gas pipelines or by vessels;
- related to the production of hydrogen;
- related to the offshore wind power generation and its transmission via offshore cable lines to the National Power System;
- nuclear power plant and the accompanying investments.

Each of these groups of projects has specific characteristics, with different environmental impacts including their type, scope, time range and scale.

Decisions on environmental conditions for the projects related to the extraction of hydrocarbon and gas, as well as to offshore gas pipelines, indicate the impacts and their significance. Some of these projects were completed in previous years, including two offshore gas pipelines. In the context of the impact that characterises the Baltic East OWF, and which may generate cumulative impacts, the impacts related to hydrocarbon and gas prospecting, exploration and extraction, as well as offshore gas pipelines, mainly relate to the generation of noise and the risk of emergency releases of hydrocarbons into the environment as well as the generation of suspended solids when gas pipelines are laid. In the decisions on environmental conditions for Deposit B8, it was indicated that the noise associated with the operation of the machines on the platform would not be emitted into the water, and thus, no negative impact on the surroundings or the marine environment is expected. In the case of Deposit B4 and B6, the gas pipeline construction will cause local and temporary water turbidity only in the immediate vicinity of the works. The impacts identified are insignificant enough that they will not cause significant cumulative impacts. Threats in the event of emergency situations and hydrocarbon release into the environment will be dealt with in accordance with company action plans.

Prospecting and exploration of hydrocarbon deposits are projects involving geochemical surveys, seismic profiling and drilling to confirm oil or gas saturation. Some of these projects have already been implemented. Carrying out seismic surveys involves noise generation, which requires soft-start procedures to be put in place due to impacts on porpoises, seals and fish, and work to be carried out outside fish protection periods. During seismic surveys, hazardous substances may be released, e.g. from weapons remaining on the seabed. During drilling, emergencies can occur causing the release of hydrocarbons into the environment and even eruptions. In the decision on environmental conditions, terms relating to the technical and organisational preparation for the works, monitoring of the environment during the works and combating threats were imposed.

The hydrogen production research and development project is to be carried out on the Lotos Petrobaltic platform on Deposit B8 for no longer than two years. The following conditions were imposed in the decision on environmental conditions regarding the scope which could potentially cause cumulative impacts: ‘During the construction phase, at night time, limit sources of strong light directed upwards to the level necessary under current regulations and occupational safety standards’ and ‘Comply with the requirements of marine traffic safety and undisturbed navigation to minimise the risk of collision with other vessels’.

In the case of the implementation of the following OWFs, i.e. the FEW Baltic II, Bałtyk II, Baltica 2, Bałtyk III, Baltica 3, Baltic Power, C-Wind and B-Wind, due to the analogous nature of the projects and the resulting practically identical impacts as well as their relatively close location, cumulative impact may occur. Each of these projects allows for a similar method of the laying of foundations for wind turbines and the development of the space above the water surface with large-size structures. Moreover, regardless of the date of the construction work commencement, the operation phase of each of the projects is planned for a period of several dozen years, which indicates that from a certain time the resulting environmental impacts may occur simultaneously.

A project with the potential to cause cumulative impacts is the nuclear power plant at the Lubiatowo-Kopalino Site, together with the accompanying investment projects planned to be carried out i.a. at sea. Potential cumulative impacts of the OWFs and NPP with the accompanying investment projects may include impacts such as piling and noise impacts primarily on mammals and fish, impacts of both projects on birds and bats, lighting impacts, suspended solids dispersal and vessel traffic.

6.5 Assessment of cumulative impacts

6.5.1 Space disturbances

6.5.1.1 Exclusion of foraging areas

The proposed Project implementation will result in a temporary loss of availability of feeding grounds for benthivorous and piscivorous birds. Spatial disturbance resulting from preparatory and construction works, such as noise emissions and reduced water transparency, will result in bird scaring and reduced food availability for diving birds.

The implementation of the OWF covers in its extent feeding grounds that will be difficult for birds to access after construction. The Baltic East OWF Area, as well as other areas in the central part of the Southern Baltic intended for offshore energy projects (sea areas POM 46.E, 45.E, 44.E and 43.E designated in the spatial development plan for internal sea waters, territorial sea and exclusive economic zone, at a scale of 1:200 000 (Journal of Laws of 2021, item 935, as amended)), cover areas with low seabird densities. This is due to a great depth (above 30 m) and thus the unavailability of food for diving benthivorous birds. The low densities are probably influenced by the availability of much more valuable and accessible feeding grounds nearby, such as the *Ławica Słupska* (PLB990001) and *Przybrzeżne wody Bałtyku* (PLB990002) Natura 2000 sites.

When assessing the OWF cumulative impact, in accordance with the worst-case scenario principle, the condition in which the operation phase of the last one of them shall begin was taken into consideration. This condition will cause the greatest impact on feeding grounds occupation. Assuming that the above-mentioned areas intended for offshore energy projects will be occupied by offshore wind farms, ultimately, an area of an estimated 970 km^2 will be built-up.

The cumulative loss of less important habitats will involve seabirds moving to more accessible, richer feeding grounds located in the nearby Natura 2000 sites. The significance of the aforementioned cumulative impact in the form of exclusion of foraging grounds was assessed to be low at most.

6.5.1.2 Physical barrier creation

The space disturbance generated as a result of the OWF construction stems from the presence of structures above the water surface, in the sea areas previously free from any physical barriers. The formal conditions indicated in the PSzW permit for the Baltic East OWF, as well as the other OWFs, introduce restrictions concerning the possibility of their development. They indicate that the distances between individual wind turbines cannot be smaller than four times the length of the diameter of the rotors. Therefore, the space disturbed is practically limited to the working height range of a rotor. Thus, within the Baltic East OWF Area, as well as in the remaining OWF areas, a partial, long-term (limited to the time of operation) restriction of the aerial space use shall take place. Within all of the OWF development areas (between individual wind turbines and the accompanying structures, including substations) as well as around the individual OWF areas, the space shall remain undisturbed. The discontinuous nature of the development, with significant distances between individual OWF structures (of at least approximately 1000 m), shall create a discontinuous and uneven spatial disturbance. This unevenness will also occur within the structures themselves. The greatest spatial disturbance will occur within the rotor swept area, i.e. more than 20 m or more above the water surface.

The aerial space above the sea areas is used regularly by birds, especially during migration periods. In the context of maintaining the continuity of bird migrations, first of all, it is important to maintain the possibility of bird movement without the risk of significant population depletion or significant energy expenditure, which could affect the population ecology and biology, including the survival of the individuals from those populations.

It has been noted that seabirds clearly avoid an area occupied by offshore wind turbines and their abundance decreases in the vicinity of turbines, e.g. for the long-tailed duck – within a radius of up to 2 and even up to 4 km [Christensen, 2003; Petersen, 2006; Leopold, 2011]. When assessing the cumulative impact of OWFs, in accordance with the worst-case scenario principle, the condition in which the operation phase of the last one of them shall begin was taken into consideration.

This will cause the barrier effect to be the greatest. Taking into account the investment plans related to wind energy in the central part of the Southern Baltic (sea areas POM 46.E, 45.E, 44.E and 43.E) and assuming that they will be implemented, it can be indicated that ultimately an area with a length of about 130 km will be built-up. For birds flying in accordance with the prevailing directions of migration in this region, the actual width of the barrier will be approximately 90 km. Disruption of space at such a long fragment of the sea area could lead to a significant disturbance in bird migration.

The development of this space shall not be uniform and shall depend on the location of the wind turbines in individual OWFs. The following space will remain free from development, in accordance with the DEC for the Baltica OWF, Baltic Power OWF and BC-Wind OWF:

- between the Baltica 2 OWF and the Baltica 3 OWF;
- between the Baltica 3 OWF and the Baltica Power OWF;
- between the Baltic Power OWF and the BC-Wind OWF.

These areas will enable migratory birds to fly to and from the Natura 2000 sites *Ławica Słupska* and *Przybrzeżne Wody Bałtyku*. They constitute an actual division of a sequence of the OWF development areas.

In order to effectively maintain the separation of the OWF development areas, it is important to plan free space in the area of the emerging Baltic East OWF that is consistent with the area left free from development between the Baltic Power OWF and the BC-Wind OWF.

The Baltic East OWF project takes into account the need to keep such an area free from wind turbine development. The area presented in Section 1 of this EIA Report, as 'development area B', is an approximately 4 km wide strip, oriented in a north-eastern and south-western direction, intended exclusively for linear infrastructure located in or on the seabed.

The creation of this corridor, in conjunction with the other above-mentioned development-free areas, will create a free space system in the area, allowing the movement of birds in a way that minimises the potential disruption of their migration [Figure 77- in the figure this area is marked with a number III].

The significance of the cumulative impact in the form of a physical barrier was assessed to be low at most [Baltic Power 2020b].

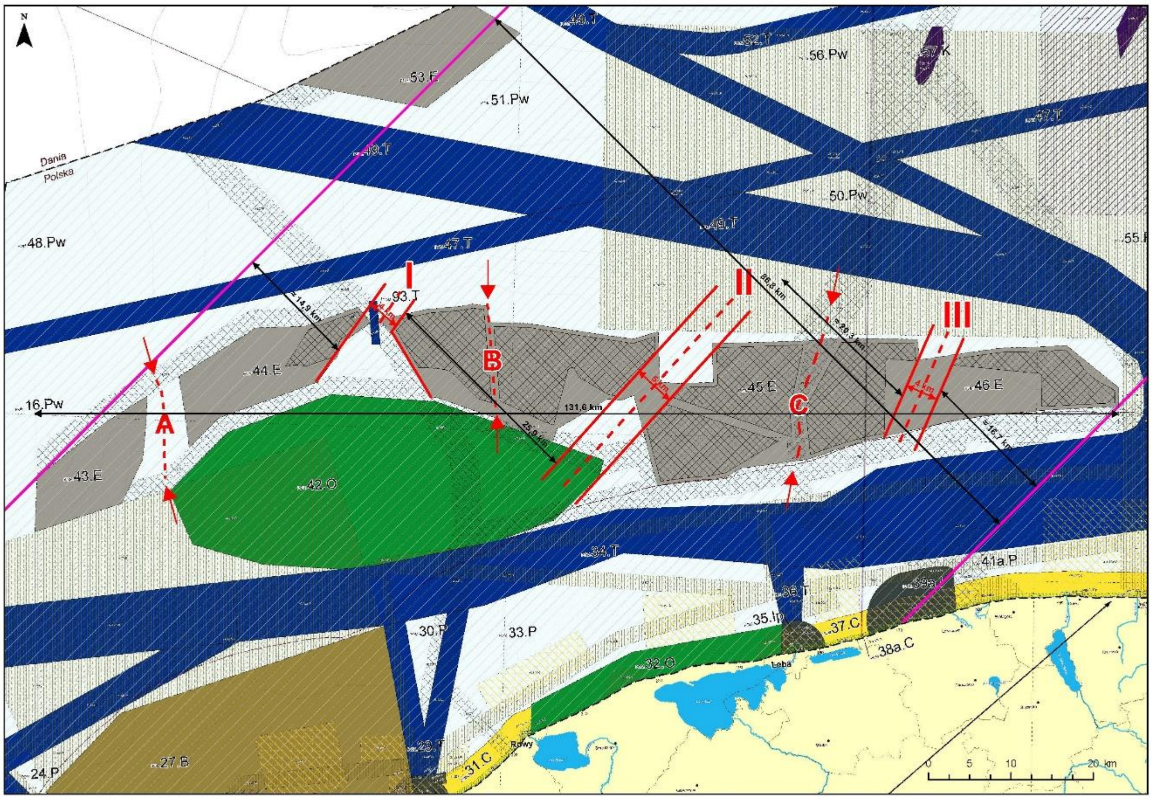

Figure 77 Location of the areas free from development between the OWFs planned in the PSA [internal materials based on Baltic Power 2020b]

6.5.1.3 Cumulative risk of bird collisions

Calculation of the cumulative collision risk for the Baltic East OWF was performed by extrapolating the values obtained in the collision risk modelling in relation to the power of individual projects expressed in the total value of the indicator or taking into account the values presented in the EIA Reports. For the OWF areas of Bałtyk I, Bałtyk II, Bałtyk III, Baltic Power, Baltica 2, Baltica 3, BC-Wind, 44.E.1, and FEW Baltic II, the anticipated mortality data (for individual species/group) included in environmental documentation were used. For the remaining OWFs, anticipated mortality levels of individual species and species groups were calculated on the basis of the results of collision modelling for the Baltic East OWF, taking into account the proportion of installed or planned capacity. The results of the calculations were presented in **Appendix 4** to the EIA Report as a cumulative collision risk with an avoidance rate of 95% for all species and groups except for the crane, for which an avoidance rate of 83% was applied. The maximum cumulative number of collisions during the migration period for all OWF projects in the Baltic Sea, calculated through modelling, is:

- 9 collisions for the long-tailed duck;
- 51 collisions for the common scoter;
- 142 collisions for the Eurasian wigeon;
- 23 collisions for the common guillemot;

- 204 collisions for the common crane;
- 265 collisions for the greater white-fronted goose;
- 32 collisions for the little gull;
- 104 collisions for the lesser black-backed gull.

It should be noted that the spatial extent of these projects is very large and it is unlikely that the same streams of birds migrating through the Baltic Sea will be a receptor of the impacts of all the OWFs. Rather, the most likely cumulative impacts relate to several OWFs in the immediate vicinity of the Baltic East OWF, such as the Baltic Power and BC-Wind OWFs. The estimated risk of cumulative collisions would then be several times lower. **Nevertheless, even in the worst-case scenario, the significance of the impact still remains irrelevant and low for most seabirds and moderate for the common crane.**

On the other hand, during adverse weather conditions with low visibility (migration at night, in foggy and/or cloudy conditions), birds may alter their flight trajectory by adjusting their flight direction to a source of artificial light, which they misinterpret as stars [Atchoi *et al*., 2020]. The cumulative effect of this impact can be minimised by limiting sources of strong light at night, particularly those directed upwards – this applies in particular to bird migration periods. In addition, illuminating OWFs at night with small, weak, pulsating light sources is recommended. It is also helpful to change the lighting during reduced visibility from continuous to pulsating with a long interval between the flashes. In order to increase the visibility of offshore wind turbines during daytime, it is recommended to paint the blade tips in bright colours to increase the visibility of operating offshore wind turbines. By ensuring increased visibility of offshore wind turbines during the day and reducing light pollution at night, the possible cumulative barrier effect for birds will be of low significance at most.

6.5.1.4 Landscape disturbances

Initially, during the implementation phase, with the construction of structures above the water, cumulative impacts will occur in terms of landscape disturbance by the Baltic East OWF and other OWFs being implemented or completed. Next, during the operation phase, these impacts will be the greatest and will last the longest, for an assumed several decades. With the decommissioning of the Baltic East OWF, including the dismantling of the structures, the disturbance to the natural landscape will decrease until it completely ceases when the structures are dismantled to the seabed level.

In accordance with Subsection 5.1.2.7, the impact of the Baltic East OWF on the landscape during the operation phase depends on several factors such as:

- the size of structures, the diameter of the rotor and its position in relation to the viewer;

- number and location of wind turbines and facilities;
- the traffic of vessels related to the maintenance of the OWF;
- meteorological conditions and the state of the sea;
- the location of the landscape observer and their individual vision characteristics;
- the observer's perception of the landscape (aesthetic preferences).

Landscape disturbances in the case of the cumulative impacts related to the simultaneous operation of the Baltic East OWF and FEW Baltic II, Baltic II, Baltica 2 and Baltica 3, Baltic III, Baltic Power and BC-Wind OWFs, depend mostly on weather conditions i.e. visibility and the curvature of the Earth. Therefore, these elements became the determinant for the conducted analyses of cumulative impacts in terms of landscape disturbance.

The constraint associated with the visibility of wind turbines from land is the Earth's curvature and the associated height restriction of the objects that can be seen from a great distance. In practical terms, this limitation means that the further the OWFs are located from the observer, the fewer of them can be seen. At night, the OWFs will be visible due to the red warning lights necessary for air traffic safety. These lights are mounted on the wind turbine nacelle as well as on the power substation and operate in sync on a particular OWF. Within the range of the potential landscape impact zone of the Baltica East OWF, there is the land area from Ustka in the west to Hel in the east for the APV during the day and from Rowy to Jastarnia at night (for the RAV, these distances during the day and night will be about 10 km shorter, respectively), which affects the extent of the cumulative impact in terms of visibility from land. Visibility in the offshore area will be better than in the onshore area, where there are terrain obstacles such as topography, trees and buildings significantly reducing the visibility of the OWF.

Landscape disturbance, understood as the introduction of new landscape dominants, will be perceived subjectively, depending on the individual characteristics of a viewer and can be perceived negatively as well as positively and indifferently. Therefore, the sensitivity of receptors to impacts was defined as from irrelevant to very high.

Annex 5 of this EIA Report presents the visualisations of the views of the Baltic East OWF from the beach in the Słowiński National Park, located approximately 25 km from the Baltic East OWF and from the beach in Białogóra, located within the Polish Coastal Landscape Park at a distance of approximately 22.7 km from the Baltic East OWF. The second perspective presents a visualisation of the view of the Baltic East OWF together with the Baltic III, Baltica 3, Baltic Power and BC-Wind OWFs.

As a result of the analysis, the cumulative impact of the Project on the landscape during the construction, operation and decommissioning phases was determined to be of moderate significance. It depends on the sensitivity of a viewer (ranging from negative to positive, or indifferent perception) and varies according to the distance of the observer from the OWF – the further away, the less visible the OWF will be. In the open sea, the landscape is not disturbance-resistant, but very few people and over a short period will be exposed to the landscape change and some of them (e.g. tourists) may perceive it as advantageous or interesting. The scale of the impact will have a large spatial extent, which will decrease with the increasing distance from the OWF. This will be a long-term but a reversible change.

6.5.1.5 Interference in the operation of systems using EMF

Within the space above the PSA, there are systems using the electromagnetic field, such as: navigational radars of vessels, shore radar systems, radio communication devices and systems for transmitting radio and terrestrial television signals. The construction of a single wind farm as well as more farms may disrupt the proper functioning of these systems. The magnitude of the disruption will depend on the number of structures built in the sea areas and may cover a larger sea area. It might also be linked to the sequence of the projects' implementation.

The key activities during the implementation, operation and decommissioning phases of the Project that may impact the systems using EMF are identified in this EIA Report in Sections 5.1 and 5.2.

Impacts may include the creation of obstructions or barriers to the transmission of communication signals. These can be direct impacts and cumulative impacts with other structures as well as with wind turbines and substations located in the sea area. The extent of the EMF impact on the environment will be local, but it might be regional in terms of ensuring proper operation and safety, since the communication equipment is located outside the Baltic East OWF Area. These can be cumulative long-term impacts, both temporary and permanent. The nature of the impact will be negative.

The sensitivity of communication systems and connectivity to potential impacts during the implementation, operation and decommissioning phases of the Project can be assessed as very high.

Due to the need to ensure uninterrupted connectivity and communication of the functioning systems of various operators, the scale of the impact must be considered very high.

According to the methodology adopted for the preparation of the EIA Report, the impact will be significant unless appropriate mitigation or compensation measures are applied. It is assumed, however, that in accordance with the applicable legal requirements, possible impacts will be identified in relevant studies and, as part of the arrangements with the relevant authorities, including those related to security and defence, the actions necessary to be undertaken by the Applicant will be indicated. The Applicant will use the indicated measures and means to avoid, prevent, mitigate or compensate for the negative impacts on systems using EMF to ensure their continued proper functioning.

In view of the possible negative effects resulting from disturbances to systems using electromagnetic fields, in the PSzWs issued for all wind farms, the Minister for Maritime Economy obligated the project owners to carry out a number of specific actions to ensure the defence and safety of the state and the safety of navigation.

The necessity to perform these compensatory actions indicates that the impact of the Baltic East and other OWFs on the systems using electromagnetic field analysed both individually and in combination should be considered as unlikely and as those that may not actually occur.

As a result of the analysis carried out, the cumulative impact of the Project on the systems using EMF during the implementation, operation and decommissioning phases of the Project was determined to be of low significance, subject to mitigation or compensation measures if they result from expert reports or agreements with competent administrative bodies.

6.5.1.6 Impact on fishery

The Baltic East OWF is one of the planned offshore wind farms located in the Baltic statistical rectangles belt from K8 to P8 as well as M7, N7 and O7 in Figure 78. All OWFs will cover an area of approximately 1100 km^2 (including a 500 m buffer zone), consisting 20% of the total area of the nine Baltic statistical rectangles mentioned above.

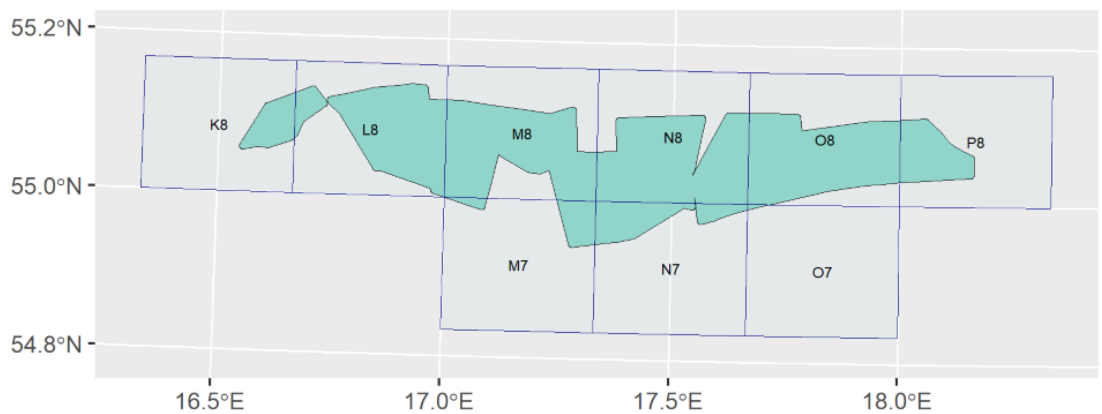

Figure 78 Location of offshore wind farms in the vicinity of the Baltic East OWF (500 m buffer zone included)

All of the projects identified above will have impact on marine fishing activities, with the presence of the above-water structures causing two possible types of impacts resulting from spatial restrictions, i.e. the lack of the possibility of conducting catches within the OWF Area and the necessity to by-pass the OWF on the way to and from the fishing grounds located north of the OWF. In the case of transmission infrastructure, in its immediate vicinity, fishing, in particular using bottom trawls, will not be possible either.

Limitation of the fishing area

In the years 2019 to 2023, in the area of the statistical rectangles analysed in which offshore wind farms are planned, between 21 and 68 fishing vessels were fishing, to a greater or lesser extent, representing 3–8% of the total number of registered Polish Baltic fishing vessels [Table 120].

A steady decrease in the number of fishing vessels conducting catches can be observed in the years analysed, both in the case of small fishing boats (<12) and larger vessels (>12 m), which is mainly linked to the cod fishing restrictions introduced in 2019.

Table 120 Number of vessels fishing in the OWF Area and the total number of registered fishing vessels between 2019 and 2023.

YEAR	NUMBER OF FISHING VESSELS OPERATING				PROPORTION OF THE NUMBER OF VESSELS IN THE STATISTICAL RECTANGLES IN RELATION TO THE TOTAL NUMBER OF VESSELS FISHING IN THE BALTIC SEA AND REGISTERED IN POLAND
	<12 m	>=12 m	TOTAL IN THE OWFS	BALTIC SEA	% OWF/BALTIC SEA
2019	28	40	68	825	8%
2020	18	35	53	821	6%
2021	19	31	50	821	6%
2022	12	21	33	822	4%
2023	6	15	21	822	3%

Estimated, on the basis of the VMS data and the proportion of the area that the offshore wind farms will occupy in relation to the area of the Baltic rectangles, the value of the completed fish catches restricted to the area of the OWF alone was significantly lower, averaging around PLN 250 thousand in 2019–2023, while in 2019 it was the highest at PLN 450 thousand total [Table 121].

Table 121 Value of catches conducted in the OWF areas in individual statistical rectangles (in PLN thousands)

RECTANGLE	2019	2020	2021	2022	2023	AVERAGE
K8	2	0	5	0	0	1
L8	77	2	30	5	4	24
M7	6	5	4	3	2	4
M8	56	34	14	52	8	33
N7	13	4	3	1	1	5
N8	31	35	62	19	1	30
O7	0	0	0	0	0	0
O8	39	47	27	10	22	29

RECTANGLE	2019	2020	2021	2022	2023	AVERAGE
P8	227	80	34	103	175	124
Total	**450**	**207**	**179**	**193**	**214**	**249**

Most of the fishing vessels conducting catches in the area of the 9 statistical rectangles to be partly occupied by OWFs conduct catches also in many other statistical rectangles, so the relocation of fishing activities should not involve significant costs due to the need to identify the fishing conditions in the new fishing grounds.

Throughout the period analysed, in the Baltic East OWF Area, pelagic trawls accounted for the dominant proportion of the catch, with approximately 90% of the total volume of fish reported, including mainly herring [Table 122].

Table 122 Species structure in the catches in the OWF Area in 2019–2023 (in tonnes)

SPECIES	2019	2020	2021	2022	2023
Herring	206	74	30	64	88
Sprat	60	7	29	37	12
Flounder	9	11	10	17	1
Cod	28	2	0	0	0
Other	1	3	5	0	0
Total	304	96	74	118	101

The necessity to relocate the fishing vessels conducting catches using set gear may cause conflicts with the existing users of the fishing grounds, where the number of gear deployed will increase. In view of the significant reduction in the fishing potential of the Polish fleet after accession to the EU and the deterioration of cod stocks resulting in the suspension of targeted fishing for this species in the Eastern Baltic in 2019 (EU 2019/1838) and also due to the fact that set gear fishing plays a marginal role in the planned location of the Baltic East OWF, the negative effect of the concentration of effort caused by the need to relocate the fleet should be considered **negligible**.

Increased distance to fishing grounds

The result of locating multiple wind farms in directly adjacent areas will be a barrier stretching for many kilometres, impeding the navigation of vessels. The location of other wind farms, adjacent to the Baltic East OWF to the east and west, without designating a navigation corridor for vessels, may significantly extend the route of fishing vessels to productive fishing grounds below the Middle Bank. This may result in additional losses, mainly for vessels registered in the ports of Ustka and Łeba, due to the increased fuel costs and travel time to the fishing grounds. Given the above, the significance of the cumulative negative impact related to the necessity to extend the routes of fishing vessels to fishing grounds should be regarded as **high**. In order to limit the cumulative negative impact on fishing in this area, a corridor or navigation corridors should be preserved between farms, with the necessary width ensuring the safety of navigation. In such a case, the significance of the cumulative impact of the Project on fishing may be considered moderate.

Several other wind farms are planned to be located in the immediate vicinity of the Baltic East OWF. Figure 79 presents the location of the OWFs, for which the DEC has been issued, and the shortest travel routes to the fishing grounds in the Słupsk Furrow, located above the locations of the offshore wind farms analysed.

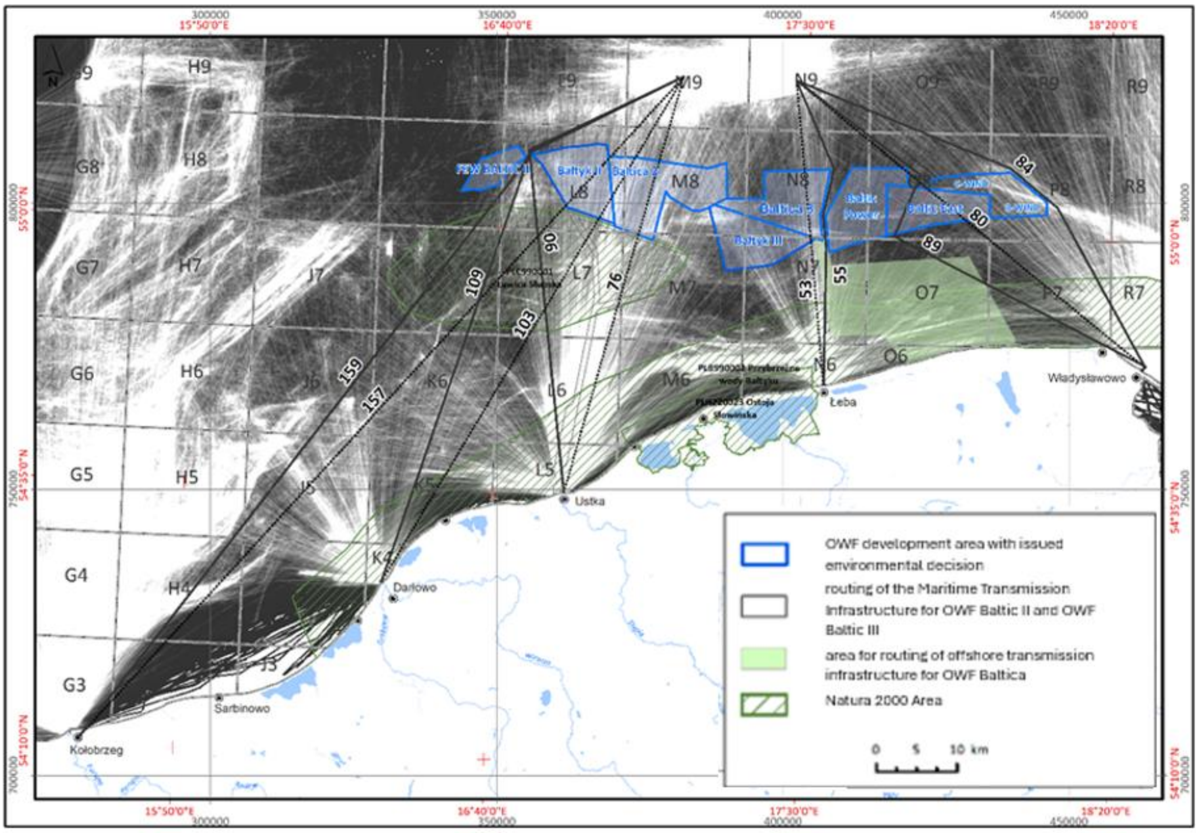

Figure 79 Increased distance from the ports of Kołobrzeg, Darłowo, Ustka, Łeba and Władysławowo to the fishing grounds located in the Słupsk Furrow – Baltic rectangles M9 and N9 (cumulative effect)

In order to calculate the estimated fishing losses resulting from the need to avoid the Baltic East OWF, the activity of fishing vessels departing from and returning to the ports of Kołobrzeg, Darłowo, Ustka, Łeba and Władysławowo was analysed. The number of cruises in each year targeting fishing grounds located above the Baltic East OWF Area was included in the calculations (centres of rectangles M9 and N9 were used for simplicity). On the basis of the data from the logbooks and the register of vessels, the number of fishing vessels carrying out catches from the analysed ports in one of the two rectangles was determined. All vessels that reported fishing in rectangles M9 or N9 and for which the port of departure and return were the listed ports were included. Only the cruises beginning and ending in the same port were considered. In view of the above, the analysis accounted for fishing activities of vessels that normally pass through the offshore wind farm areas in order to fish in the Słupsk Furrow. On the basis of the RRW-19 Questionnaire – 'Report on economic results of the fishing vessel' the average number of fishermen employed on board the vessels analysed was determined. The average diesel consumption of 0.185 kg/kWh was assumed [GMU]. The average marine fuel prices for the period 2019–2023 were assumed (PLN 2505 in 2019, PLN 1610 in 2020, PLN 2800 in 2021, PLN 5500 in 2022 and PLN 4710 in 2023 per tonne). The cost of additional work time of fishermen was calculated on the basis of average gross monthly salaries in the enterprise sector (PLN 5169 in 2019, PLN 5411 in 2020, PLN 5890 in 2021, PLN 6645 in 2022, PLN 7444 in 2023) [Statistics Poland data] and the time the crew will have to spend sailing around the group of OWFs. The additional time required by fishing vessels to sail around the OWFs was calculated assuming the average speed of a vessel travelling to and from the fishing grounds at an average speed of 6 knots (11.1 km/h). The following Table 123 provides data on the number of kilometres and hours by which the route of fishing vessels to and from the fishing grounds in the Słupsk Furrow will be extended.

Table 123 Additional time and distances required to bypass the Baltic East OWF and other offshore wind farms by vessels operating from the ports of Kołobrzeg, Darłowo, Ustka, Łeba and Władysławowo (in both directions)

PORT	TIME [H]	DISTANCE [KM]
Kołobrzeg	0.36	4
Darłowo	1.08	12
Ustka	2.52	28
Łeba	0.36	4
Władysławowo	0.72	8

The calculations carried out using the above methodology indicate that for fishing vessels operating from the ports of Kołobrzeg, Ustka and Władysławowo in the fishing grounds of the Słupsk Furrow the necessity to by-pass would result in an increase in fuel costs of approximately PLN 65 thousand in 2023. The increased time of arrival to and return from the fishing grounds would generate additional labour costs of approx. PLN 83 thousand. Due to the great importance of the Słupsk Furrow fishing grounds for vessels from Ustka, as well as the relatively greatest extension of the route (from 76 km to 90 km one way), vessels from this port will be affected the most by the necessity to avoid the area of the offshore wind farms analysed. The estimated total increase in fuel and labour costs for this port would amount to around PLN 144 thousand in the reality of 2023.

Table 124 Calculation of additional costs for fishing resulting from the extension of the route to the fishing grounds in the Słupsk Furrow

YEAR	PORT	NUMBER OF VESSELS	AVERAGE CREW	NUMBER OF CRUISES	KW CRUISE	ADDITIONAL CRUISE TIME [H]	ADDITIONAL LABOUR TIME [H]	COST OF 1 KWH [PLN]	LABOUR COST [PLN/H]	ADDITIONAL FUEL COST [PLN]	ADDITIONAL LABOUR COST [PLN]	TOTAL
2019	Darłowo	1	4.0	1	121	1	4	0.46	31	60	134	194
	Kołobrzeg	6	4.8	8	1993	3	13	0.46	31	330	411	741
	Łeba	11	3.8	99	10 730	36	139	0.46	31	1779	4306	6084
	Ustka	26	4.3	339	61 850	854	3736	0.46	31	71 772	115 821	187 592
	Władysławowo	7	5.0	33	9616	24	118	0.46	31	3188	3643	6831
2017 total		**51**	**4.4**	**480**	**84 310**	**918**	**4010**	**0.46**	**31**	**77 129**	**124 313**	**201 443**
2020	Darłowo	1	4.0	1	121	1	4	0.30	32	39	138	177
	Kołobrzeg	19	4.5	36	7670	13	58	0.30	32	818	1852	2670
	Łeba	5	3.9	10	1213	4	14	0.30	32	129	454	583
	Ustka	18	4.4	123	20 965	310	1379	0.30	32	15 646	44 126	59 772
	Władysławowo	6	4.8	19	4789	14	67	0.30	32	1021	2138	3159
2018 total		**49**	**4.4**	**189**	**34 758**	**341**	**1522**	**0.30**	**32**	**17 653**	**48 709**	**66 361**
2021	Darłowo	1	4.0	3	363	3	13	0.52	35	202	454	656
	Kołobrzeg	7	5.0	13	2777	5	21	0.52	35	515	746	1261
	Łeba	2	4.0	6	811	2	9	0.52	35	150	302	453
	Ustka	16	4.6	117	28 462	295	1464	0.52	35	36 970	51 227	88 196
	Władysławowo	6	5.2	16	4136	12	62	0.52	35	1535	2157	3692
2019 total		**32**	**4.8**	**155**	**36 549**	**316**	**1568**	**0.52**	**35**	**39 372**	**54 886**	**94 258**
2022	Kołobrzeg	12	4.4	33	6212	12	50	1.04	40	2315	2004	4320
	Ustka	17	4.4	126	21 760	318	1361	1.04	40	56 774	54 432	111 206
	Władysławowo	6	5.6	21	5868	15	93	1.04	40	4374	3732	8107
2019 total		**35**	**4.6**	**180**	**33 840**	**345**	**1504**	**1.04**	**40**	**63 464**	**60 169**	**123 633**
2023	Kołobrzeg	8	5.5	8	2584	3	16	0.87	45	810	713	1523
	Ustka	17	4.6	164	28 660	413	1798	0.87	45	62 916	80 922	143 838
	Władysławowo	3	6.4	7	2475	5	32	0.87	45	1552	1452	3004
2019 total		**28**	**5.0**	**179**	**33 719**	**421**	**1846**	**0.87**	**45**	**65 279**	**83 087**	**148 365**
Average		**39**		**237**	**44 635**	**468**	**2090**			**52 579**	**74 233**	**126 812**

The significance of the cumulative negative impact related to the necessity to extend the routes of fishing vessels to fishing grounds should be considered moderate. In order to limit the negative impact on fishing in this regard, an area should be preserved between the OWFs, with the necessary width ensuring the safety of navigation. In this case, the significance of the cumulative impact of the Project together with the OWFs for which the DEC has been issued on fishing will be considered low. It is possible to allow the transit of fishing vessels through the Baltic East OWF Area, which is facilitated by the planned OWF development area including a separate 'bird corridor' (Section 1). The establishment of navigation corridors or the approval of navigation through the Baltic East OWF Area is the sole responsibility of the relevant director of the maritime office.

6.5.2 Underwater noise and its impact on marine mammals

The sound emitted during the piling of the wind turbine support structures during the implementation phase may propagate in the water column over considerable distances and may adversely affect marine organisms. The planned Baltic East OWF is located in close proximity to other planned offshore wind farms, therefore a cumulative assessment of the impact of underwater noise from piling on marine mammals was carried out.

Numerical modelling was carried out as part of the cumulative impact analysis. The calculations were made assuming the use of mitigation measures in the form of BBC and HSD+DBBC, for piling at two and three locations simultaneously. The modelled piling locations took into account the Baltic East OWF Area and the adjacent waters within a radius of up to 20 km. The calculations were made for the summer and winter seasons, assuming two scenarios for the location of turbines within the OWF – east and west. The values obtained through modelling were analysed in terms of predicted maximum impact areas for three types of effects: cumulative TTS and PTS as well as behavioural changes. On the basis of the results obtained, it was verified whether the predicted impact ranges may overlap with the area of other planned OWFs for which the DEC has been issued.

The analysis focused primarily on the harbour porpoise as the species most sensitive to noise impacts and critically endangered in the Baltic Sea. Since the harbour porpoise is subject to protection in the two Natura 2000 sites that are located at a distance indicating the possibility of potential noise impacts from piling, the analysis of cumulative impacts also took into account the possible noise exceedances in the Natura 2000 sites *Ostoja Słowińska* and *Hoburgs Bank och Midsjöbankarna*.

In addition, modelling results obtained for seals were included in the study to verify whether or not cumulative noise effects from piling works may also affect other marine mammals present in the Baltic Sea.

The calculations carried out showed that the pile driving process in the Baltic East OWF Area should not be taking place in several locations simultaneously if a single mitigation in the form of a BBC is to be used. This applies particularly for the winter season, for which wide ranges of the effect of hearing damage in the form of TTS in seals were calculated. The areas of impact were up to 375 km^2 for two simultaneous pilings and 623 km^2 for three sound sources (eastern location) [Table 125]. The results presented account for simultaneous piling works in two and three locations, with mitigation measures in the form of BBC and HSD+DBBC. During the summer season, the TTS ranges were much smaller, up to 23 km^2 and 35 km^2, respectively, which still indicates the potential for negative impacts on seals. However, given the low occurrence frequency of seals in the survey area, the significance of the impact predicted will be limited in the summer period. The use of dual mitigation in the form of HSD+DBBC reduces the impact area of hearing damage to marine mammals to a minimum, whether piling at two or three sites simultaneously.

Given the behavioural response of harbour porpoises and seals, the impact ranges predicted with the use of BBC during simultaneous piling at several locations are very large. The largest impact areas were identified for harbour porpoises, primarily during the winter period – up to 1198 km^2 for two sound sources and 1711 km^2 for three sources (eastern location). This means that the area where animal behaviour could be altered extends for a long distance from the Baltic East OWF. During the summer season, the estimated impact ranges are much smaller, but still have high values of up to 536 km^2 for two sound sources and 791 km^2 for three sources. The use of dual mitigation in the form of HSD+DBBC does not effectively reduce those ranges. As with the BBC, the areas where porpoise behaviour may be altered extend far beyond the boundaries of the Baltic East OWF [Table 125, Figure 80 – Figure 82].

Table 125 Anticipated maximum ranges of the noise impact from simultaneous piling in the Baltic East OWF Area and in adjacent areas, obtained for marine mammals on the basis of numerical modelling [Source: internal materials]

Location	Species/group of animals	Sound source	Season	Effect	Maximum impact area [km^2]	
					BBC	HSD + DBBC
Western	Harbour porpoise	2 sources	Summer	PTS_{cum}	0.06	0.06
				TTS_{cum}	0.1	0.06
				Behavioural change	478	306
			Winter	PTS_{cum}	0.06	0.06
				TTS_{cum}	0.06	0.06
				Behavioural change	1116	670
		3 sources	Summer	PTS_{cum}	0.1	0.09

Location	Species/group of animals	Sound source	Season	Effect	Maximum impact area [km²]	
					BBC	HSD + DBBC
				TTS cum	0.1	0.09
				Behavioural change	656	429
			Winter	PTS cum	0.09	0.09
				TTS cum	0.09	0.09
				Behavioural change	1610	996
	Seals	2 sources	Summer	PTS cum	0.06	0.06
				TTS cum	11	0.06
				Behavioural change	109	22.4
			Winter	PTS cum	0.06	0.06
				TTS cum	183	0.06
				Behavioural change	197	30.3
		3 sources	Summer	PTS cum	0.11	0.09
				TTS cum	15	0.09
				Behavioural change	163	31.7
			Winter	PTS cum	0.09	0.09
				TTS cum	270	0.09
				Behavioural change	293	42.8
Eastern	Harbour porpoise	2 sources	Summer	PTS cum	0.06	0.06
				TTS cum	0.1	0.06
				Behavioural change	536	297
			Winter	PTS cum	0.06	0.06
				TTS cum	0.1	0.06
				Behavioural change	1198	684
		3 sources	Summer	PTS cum	0.09	0.09
				TTS cum	0.1	0.09
				Behavioural change	791	461
			Winter	PTS cum	0.09	0.09
				TTS cum	0.1	0.09
				Behavioural change	1711	1023
	Seals	2 sources	Summer	PTS cum	0.06	0.06
				TTS cum	22.9	0.06
				Behavioural change	231	32.4
			Winter	PTS cum	0.06	0.06
				TTS cum	375	0.06
				Behavioural change	481	41.7
		3 sources	Summer	PTS cum	0.09	0.09
				TTS cum	35.1	0.09
				Behavioural change	345	44.5

Location	Species/group of animals	Sound source	Season	Effect	Maximum impact area [km²]	
					BBC	HSD + DBBC
			Winter	PTS_{cum}	0.09	0.06
				TTS_{cum}	623	0.1
				Behavioural change	688	58.6

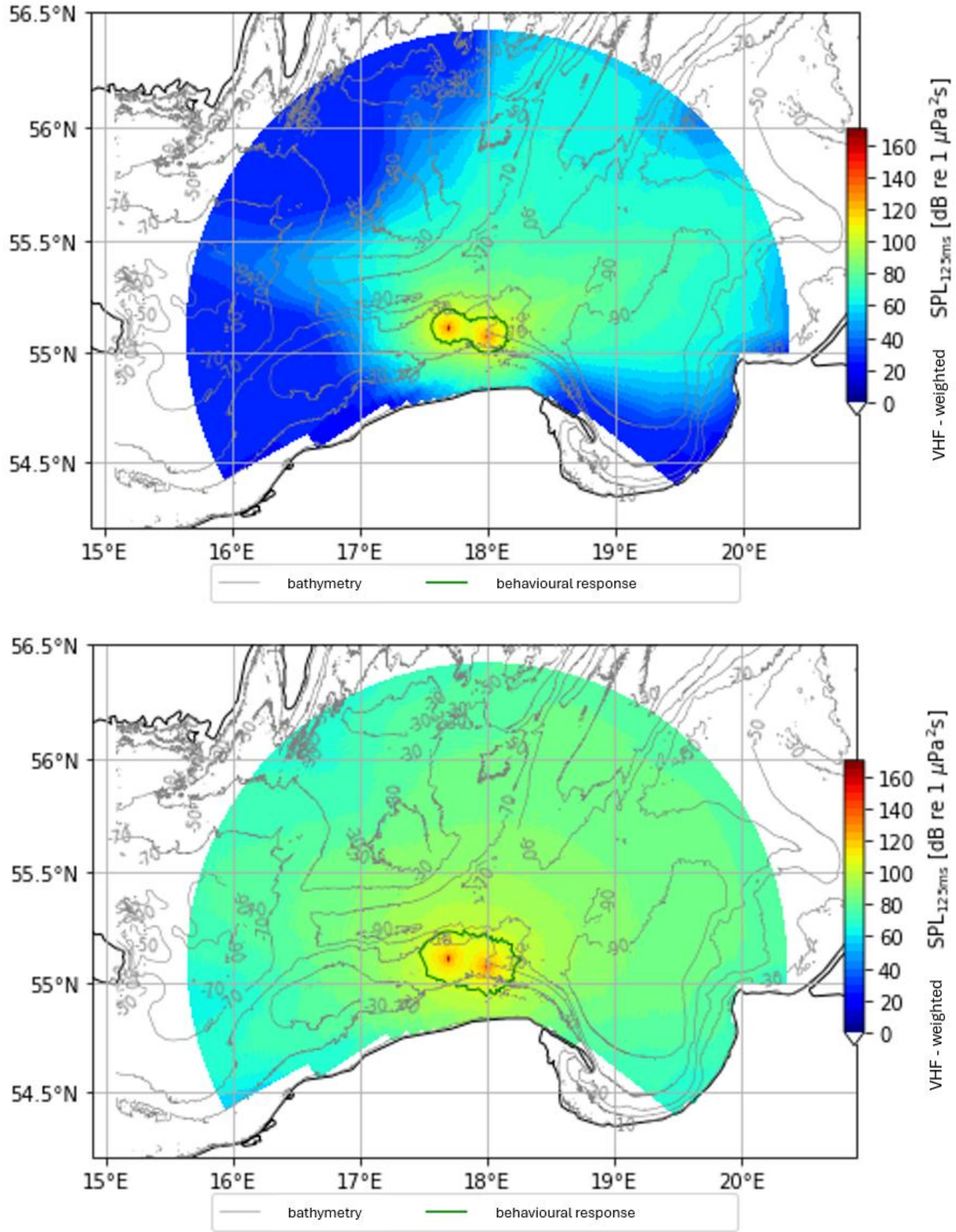

*Figure 80 Map of VHF-weighted SPL_{125ms} from two piling sources, one of which is located in the Baltic East OWF Area and the second one is located within 20 km and **the impact range for the harbour porpoise** using the BBC during the summer (top map) and winter (bottom map) seasons*

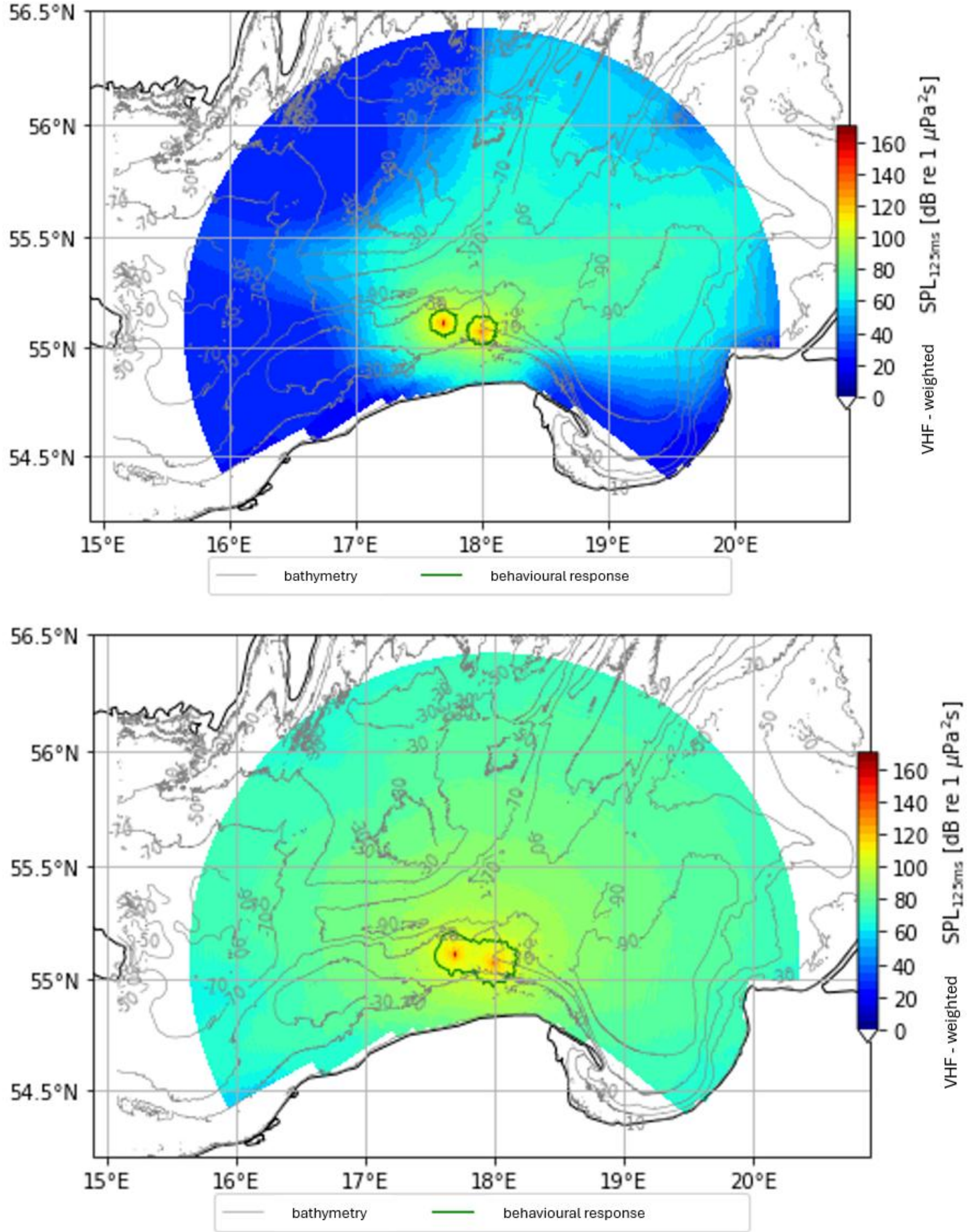

*Figure 81 Map of VHF-weighted SPL_{125ms} from two piling sources, one of which is located in the Baltic East OWF Area and the second one is located within 20 km and **the impact ranges for the harbour porpoise** using the HSD + DBBC during the summer (top map) and winter (bottom map) seasons*

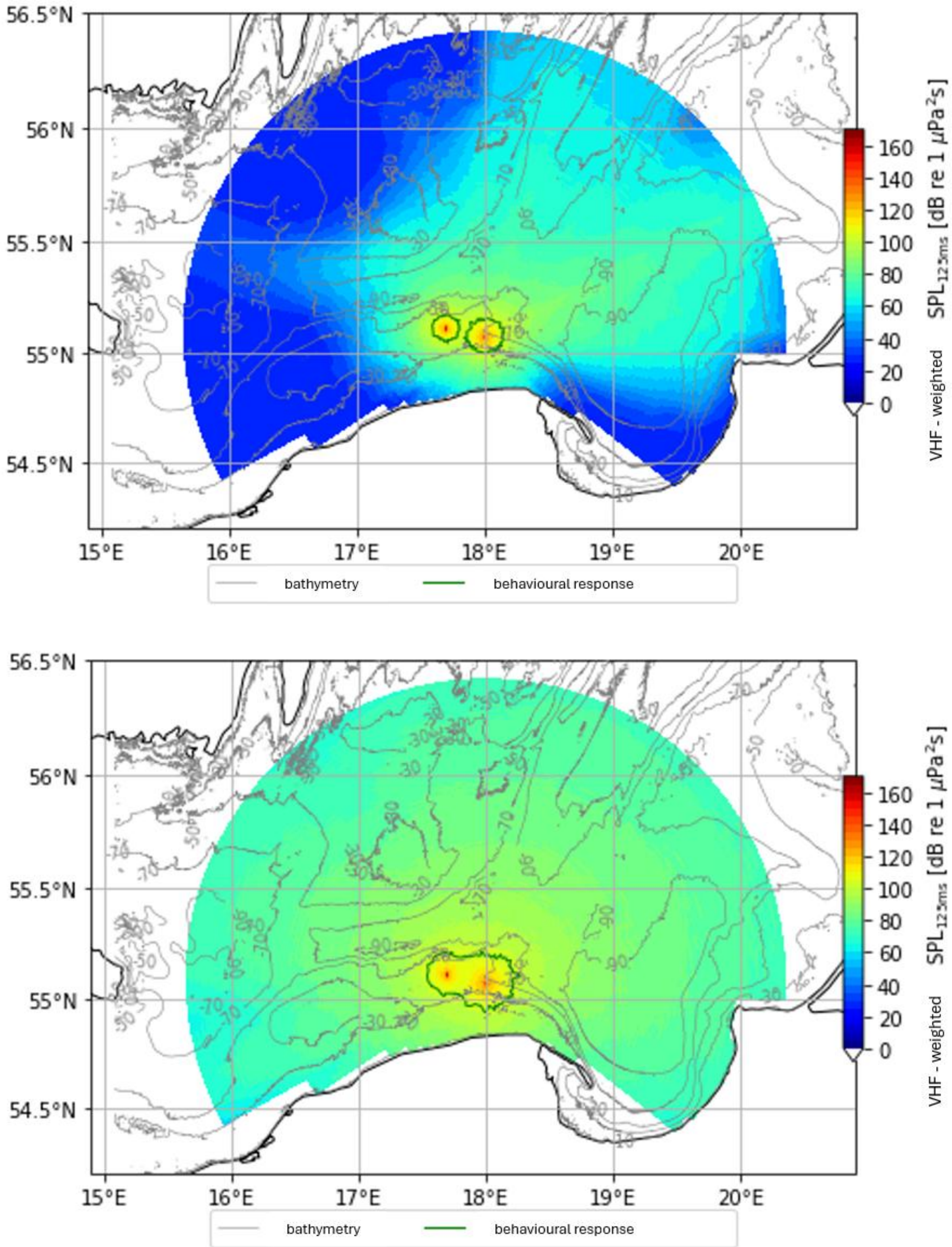

*Figure 82 Map of VHF-weighted SPL_{125ms} from three piling sources, two of which are located close to each other in the Baltic East OWF Area and the third one is located within 20 km and **the impact ranges for the harbour porpoise** using the HSD + DBBC during the summer (top map) and winter (bottom map) seasons*

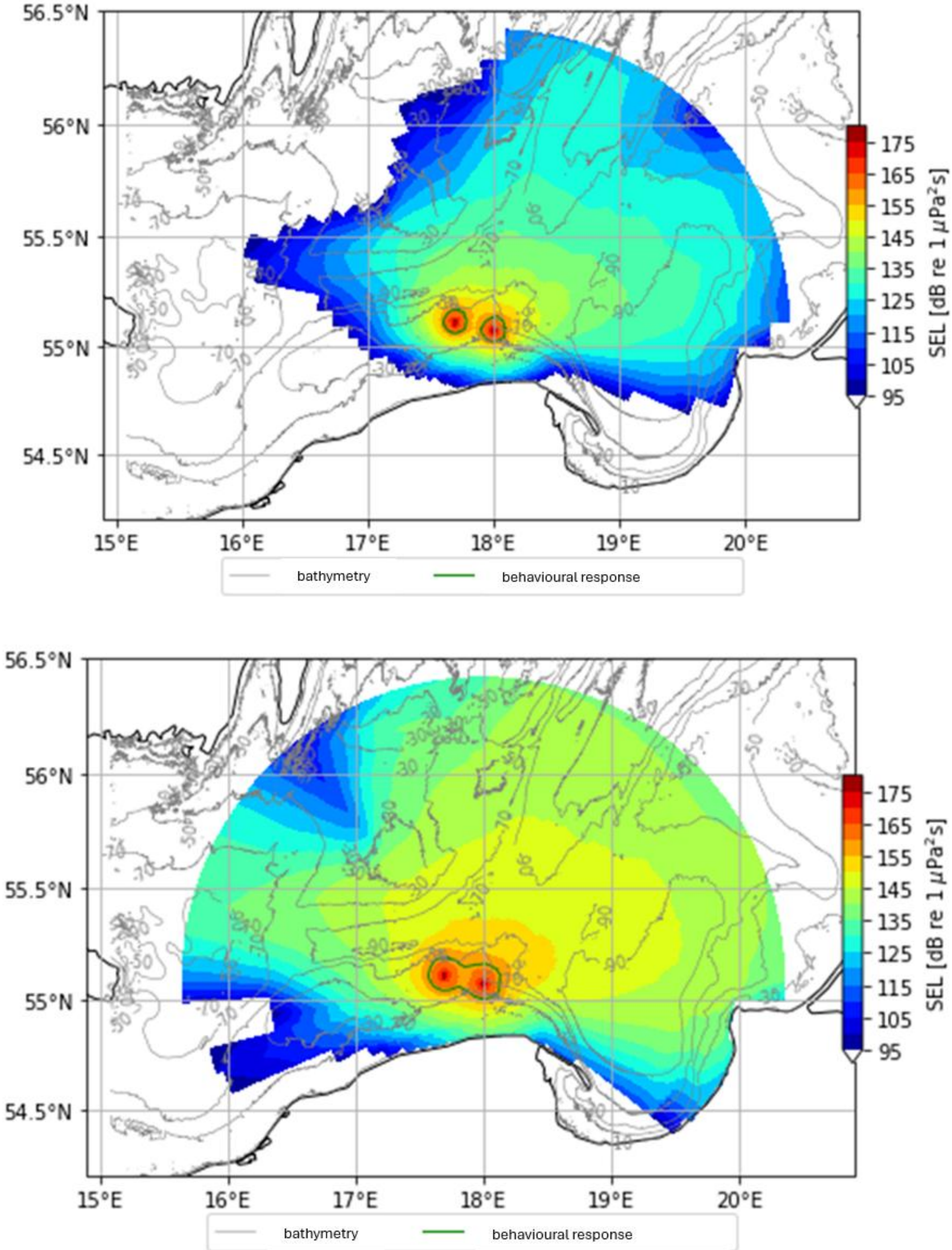

*Figure 83 Map of unweighted SEL above ambient noise from two piling sources, one of which is located in the Baltic East OWF Area and the second one is located within 20 km and **the impact range for the grey seal and the harbour seal** using the BBC during the summer (top map) and winter (bottom map) seasons*

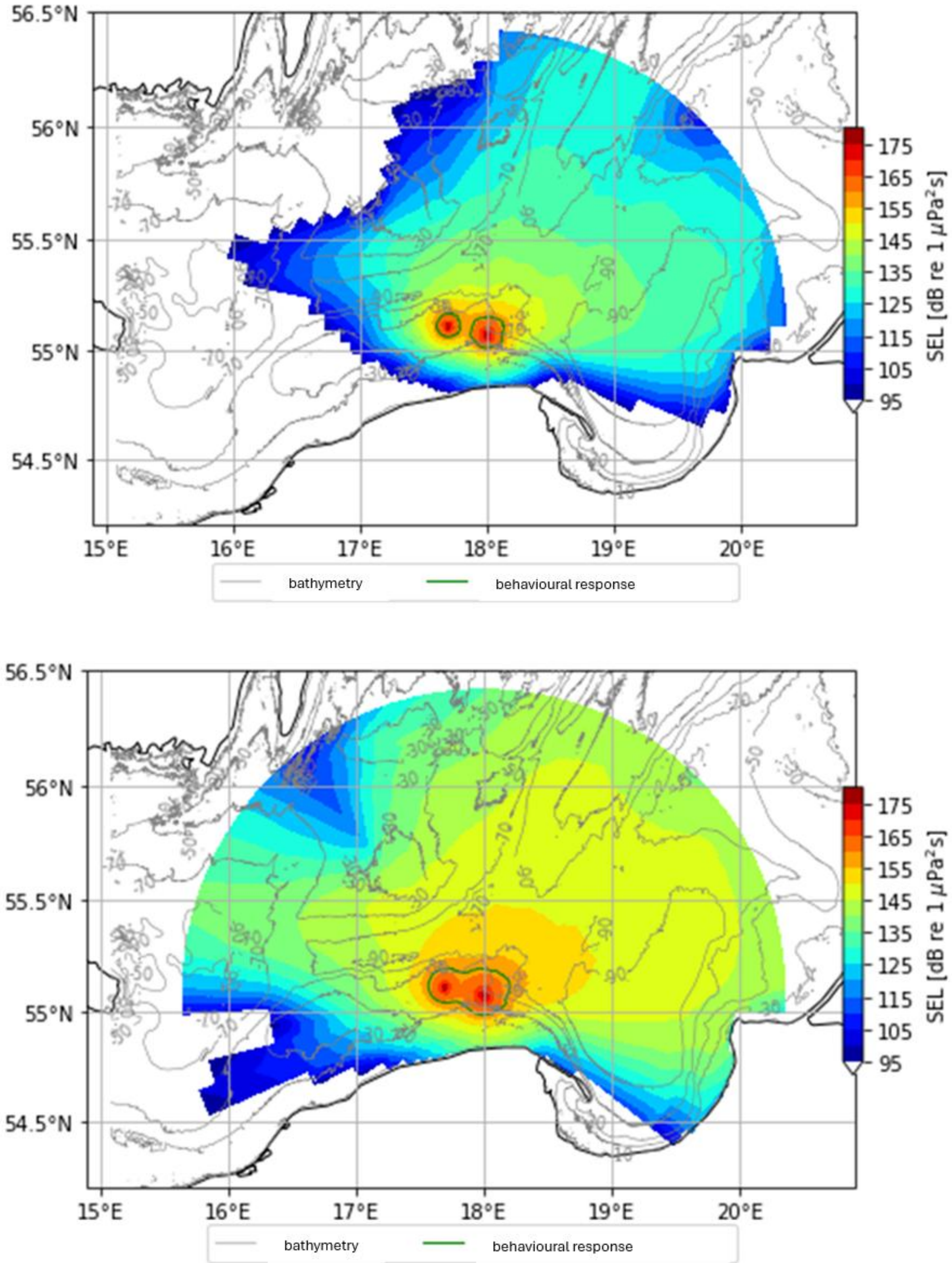

Figure 84 Map of unweighted SEL above ambient noise from three piling sources, two of which are located close to each other in the Baltic East OWF Area and the third one is located within 20 km and ***the impact ranges for the grey seal and the harbour seal*** *using the BBC during the summer (top map) and winter (bottom map) seasons*

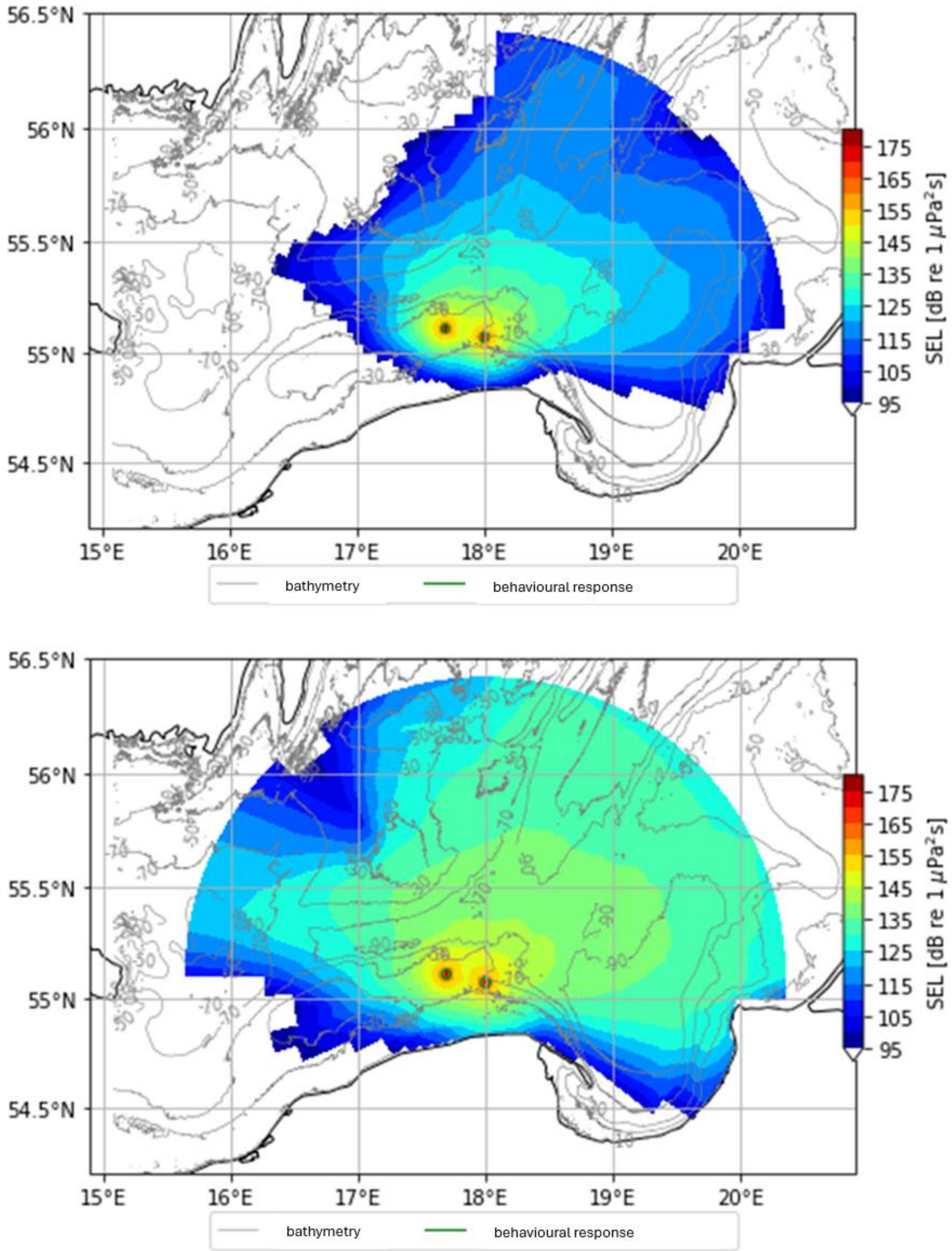

Figure 85 Map of unweighted SEL above ambient noise from two piling sources, one of which are located in the Baltic East OWF Area and the second one is located within 20 km and ***the impact ranges for the grey seal and the harbour seal*** *using the HSD + DBBC during the summer (top map) and winter (bottom map) seasons*

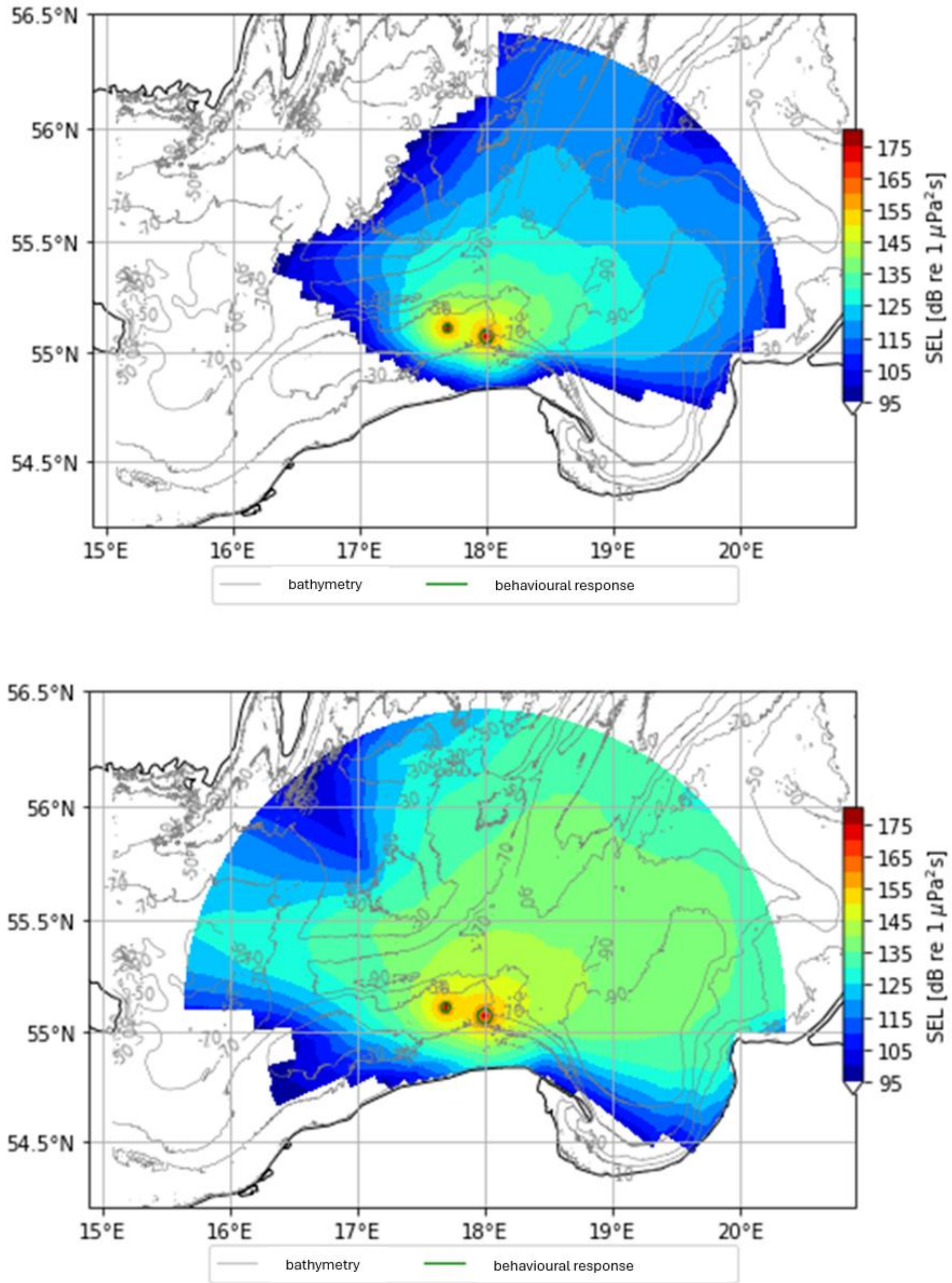

Figure 86 Map of unweighted SEL above ambient noise from three piling sources, two of which are located close to each other in the Baltic East OWF Area and the third one is located within 20 km and ***the impact ranges for the grey seal and the harbour seal*** *using the HSD + DBBC during the summer (top map) and winter (bottom map) seasons*

The Baltic East OWF Area is located in an area in which the construction of several neighbouring offshore wind farms is planned or underway, most of which already have approved investment plans. Since piling has not yet started in any of these OWFs, the cumulative impact analysis takes into account simultaneous construction works in the neighbouring areas. In the immediate vicinity of the Baltic East OWF there are the locations of the Baltic Power OWF and the BC Wind OWF. The numerical modelling results obtained for several simultaneous pilings showed that, when the BBC is used, the predicted impact ranges for seal hearing damage overlap with the areas of these nearby farms. This means that cumulative impacts may occur if piling is carried out simultaneously. This is also indicated by the acoustic modelling results presented in the EIA Reports for the Baltic Power OWF and the BC Wind OWF. From the data obtained for those projects, it appears that in the case of piling at a single location, the impact ranges in the form of TTS in seals may cover the area of the Baltic East OWF [Table 126]. Moreover, the same situation applies to the TTS effect in the case of the harbour porpoise. In the case of HSD+DBBC application during piling in the Baltic East OWF Area, cumulative impacts in the form of hearing damage are not expected. In addition, for the TTS and PTS, no cumulative impacts are predicted with other OWFs planned in the central part of the PSA in any of the mitigation scenarios analysed. However, given the behavioural response effect, none of the mitigation methods analysed are sufficient to reduce the large extent of impact from piling noise. In the case of the harbour porpoise, even with HSD+DBBC application, the projected impact areas have values indicating the coverage of other locations of the planned OWFs, particularly during the winter season.

Table 126 Maximum ranges and areas of the impact of underwater noise resulting in behavioural response, TTS and PTS in the harbour porpoise and seals, obtained on the basis of numerical modelling for the Baltic Power OWF and the BC Wind OWF [Source: internal materials based on environmental impact reports for the projects listed]

SPECIES/GROUP OF ANIMALS	OWF	MITIGATION TYPE	SEASON	EFFECT	MAXIMUM RANGE [km]	IMPACT AREA [km^2]
Harbour porpoise	Baltic Power	BBC	Spring	PTS_{cum}	9.1	203
				TTS_{cum}	20.0	1020
				Behavioural change	15.6	552
	BC-Wind	BBC	Spring	PTS_{cum}	12.0	250
				TTS_{cum}	36.0	1500
				Behavioural change	28.0	870
Seals	Baltic Power	BBC	Spring	PTS_{cum}	0.8	1.7
				TTS_{cum}	6.1	90
				Behavioural change	2.9	21.8
	BC-Wind	BBC	Spring	PTS_{cum}	1	2.3
				TTS_{cum}	7.8	120
				Behavioural change	3.5	32

Considering the results of the analysis of exceedances of permissible noise levels in the Polish and Swedish Natura 2000 sites in relation to the occurrence of TTS and PTS in the harbour porpoise, it was concluded that with mitigation in the form of BBC or HSD+DBBC, the cumulative noise impact from simultaneous piling would not extend to the protected areas analysed [Section 5.3].

In conclusion, the assessment carried out of the cumulative impact of underwater noise on marine mammals indicates that during piling at two or three locations simultaneously, a single mitigation with BBC will be insufficient. The possibility of hearing damage in seals in the form of TTS and behavioural changes in harbour porpoises is predicted at a large area extending beyond the Baltic East OWF. In the scenario of applying dual mitigation in the form of HSD+DBBC, the effect of damage to marine mammal hearing is not expected, but behavioural changes may occur over a very large area, particularly in the case of porpoises. In addition, due to the likelihood of cumulative impacts, pile driving construction works should not take place at the same time as at the planned Baltic Power OWF and BC Wind OWF. According to public information on the work schedule for the Baltic Power OWF and the BC Wind OWF, it can be confirmed that there will be no simultaneous piling in these projects and the Baltic East OWF.

During the operation and decommissioning phases of the Baltic East OWF, underwater noise levels related to wind turbines operation, ship traffic, cutting and drilling of large-diameter piles will be significantly lower than during the implementation phase, and their cumulative impact can be assessed as negligible.

6.5.3 Increase in the content of suspended solids and their sedimentation

The issue of the increase in the concentration of suspended solids and their sedimentation in terms of the cumulative impact of the Baltic East OWF with the Baltic Power, Baltic II, Baltic III, Baltica 2, Baltica 3, FEW Baltic II, and BC-Wind OWFs were characterised on the basis of the results of suspended solids dispersal modelling presented in Appendix 2 to the EIA Report.

The modelling covered six scenarios for the three leading activities predicted within the OWF boundaries. These activities consist of:

- clearing the seabed of boulders around the two WTG/OSS stations; scenario 1 and scenario 2;
- burying the cable to a maximum depth of 3 m, as part of the construction of internal transmission infrastructure; scenario 3 and scenario 4;
- underwater works carried out at the same time and in close proximity to each other involving the extraction of soil from the seabed – dredging works associated with the

replacement of low bearing capacity soil for six vessel support legs and the discharge of slurry at a distance of not less than 350 m from the edge of the trench being excavated; including mitigation measures in the form of the so-called silt curtains spread around the suction nozzle and assuming a suspended solids discharge at 5 m above the seabed; scenario 5 and scenario 6.

The scenarios address these three activities divided by the two leading seabed-forming sediment types, within which they can be carried out: cohesive soils (scenarios 1, 3, 5) and non-cohesive soils (scenarios 2, 4, 6). The results indicate that all the works analysed in cohesive soils will generate more suspended solids than the corresponding works in non-cohesive soils.

The maximum concentration range for instantaneous events in a situation for which the values obtained during modelling were the highest relates to soil replacement (scenarios 5 and 6). The range is a maximum of 9.7 km for the lowest concentrations assumed in the modelling (5 mg/l) to 1.7 km for the highest concentrations (100 mg/l) of suspended solids mobilised from cohesive sediments. For non-cohesive sediments, the maximum range for the lowest concentrations is 8.4 km to 0.7 km for the highest concentrations. For the remaining activities, the maximum range values of the lowest concentrations do not exceed 4.7 km [Figure 87].

For the low concentrations adopted in the modelling (5 mg/l and 10 mg/l), there was little difference in coverage, regardless of the type of sediment forming the seabed. In both cohesive and non-cohesive soils, the range of concentrations is similar. Only at higher concentrations is the range for non-cohesive sediments significantly smaller (two to three times) than for cohesive sediments.

The maximum modelled thickness of newly formed sediments, at a distance of 500 m from the worksite, is 5.5 mm (scenario 5; soil extraction and replacement, cohesive sediments). The maximum distance from the worksite, for this scenario, for the formation of a 1 mm thick layer is 4.3 km. For the remaining scenarios, the maximum distance, for the formation of a layer with a thickness of 1 mm, does not exceed 0.5 km (only in scenario no. 6 (soil extraction and soil replacement, non-cohesive sediments) it is 2.83 km), and the maximum value of the sediment thickness, at a distance of 500 m from the worksite, does not exceed 1.0 mm (for scenario no. 6, it does not exceed 2.2 mm).

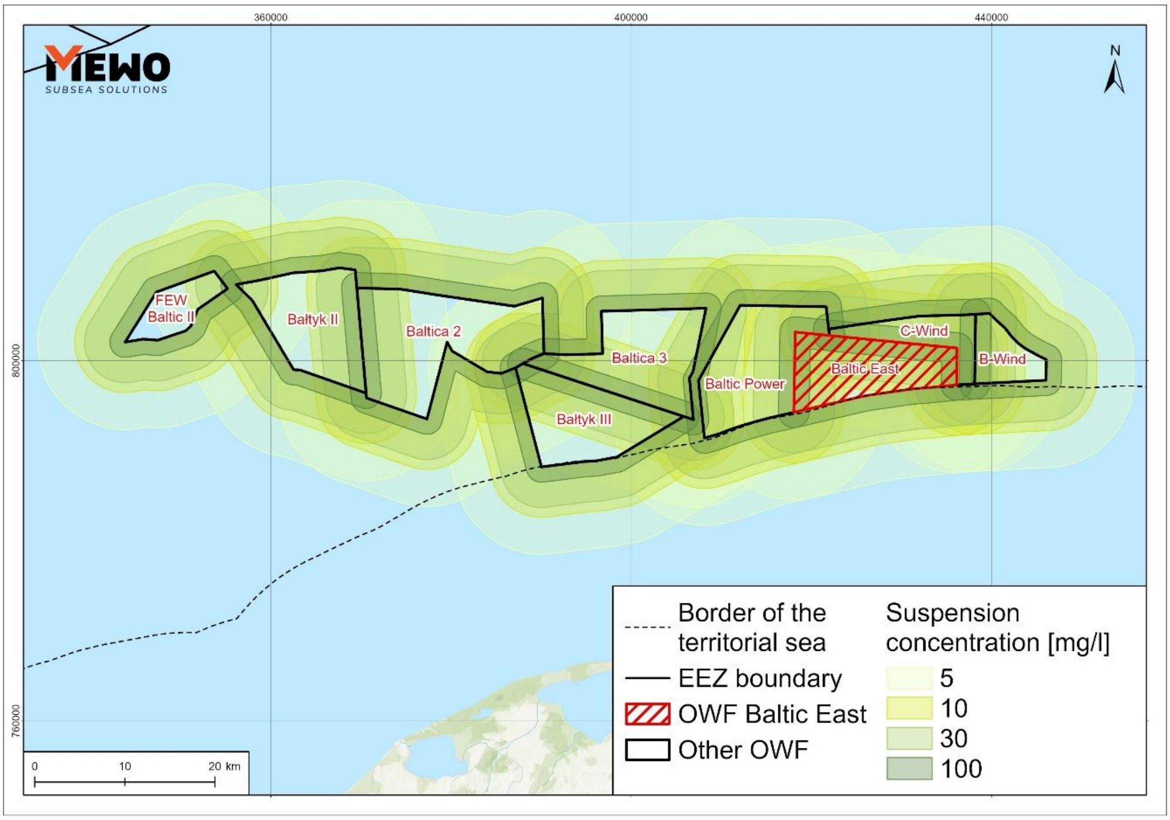

Figure 87 Maximum rages of suspended solids propagation for individual OWFs [Source: internal materials]

The maximum duration of 5 mg/l suspended solids from the moment of the completion of works in five of the six scenarios presented, does not exceed 8 hours. Only in the case of cohesive soil replacement (soil collecting and depositing; scenario no. 5) can the suspended solids at a concentration of 5 mg/l remain for up to 25 hours. It should be noted that the scenario analysed assumes carrying out works in a single turbine location. This means that the calculated time may be necessary to introduce a break between the works carried out for individual turbines in order to avoid the cumulative impact of suspended solids as the construction of the entire OWF proceeds.

The calculations conducted indicate that in terms of suspended solids concentration in the water, the furthest impacts (for a concentration of 5 mg/l) have a range of approximately 9700 m and last approximately 24 hours, while in terms of sedimentation, already at a distance of 500 m from the worksite, sediment layers deposited on the seabed will be of 5.5 mm at most. This means that there may be cumulative impacts associated with the content of suspended solids, provided that opposing sea currents are present. Such a case does not occur in practice. In addition, it should be noted that there would still have to be a case of simultaneous works being carried out at different OWFs in close proximity. In the context of cumulative impacts, it can be assumed that potential cumulative impacts related to suspended solids would apply to the BC-Wind OWF, and Baltic Power OWF projects. All of these so-called Phase I projects should be completed before the implementation of the Baltic East OWF. Therefore, it can be concluded that there will be no cumulative impacts in this area.

Based on the model calculations carried out, the cumulative effect of an increase in suspended solids content was found to be possible as a result of various anthropogenic activities during the implementation phase, but unlikely due to the need for simultaneous works in close proximity. The increase in the content of suspended solids and their sedimentation will be local and the increase in suspended solids concentration will be short-term.

Due to the temporal and spatial gap between the activities carried out within the OWF and in the area of the external connection infrastructure, there will be no cumulative impact resulting from the increase in the content of suspended solids and their sedimentation.

7 DETERMINATION OF THE ENVIRONMENTAL IMPACTS PREDICTED IN THE EVENT OF A MAJOR ACCIDENT, NATURAL DISASTER AND STRUCTURAL COLLAPSE

The environmental impacts predicted in the event of a major accident, natural disaster and structural collapse are described in Section 2.7 of this EIA Report. Below, in accordance with the methodology of the EIA Report, there is a summary of the significance of the environmental impact of the above-mentioned impacts during the implementation, operation and decommissioning phases of the Baltic East OWF. The impact significance for the APV and RAV will be similar and therefore the information presented applies to both Baltic East OWF options.

7.1 Implementation phase

A table with a summary of the environmental impacts in the event of a major accident, natural disaster and structural collapse during the Baltic East OWF implementation phase is presented below [Table 127].

Table 127 Analysis of the significance of environmental impacts in the event of a major accident, natural disaster and construction disaster during the Baltic East OWF implementation phase with the application of mitigation or compensatory measures [Source: internal materials]

IMPACT	IMPACT SCALE	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
Emissions to the environment, potential emergencies, related to the production of the OWF components in ports	Irrelevant	Low	Negligible (N)
Spills of petroleum products at the time of transport of the Baltic East OWF components during normal ship operation (small spills)	Low	High	Low (N)
Spills during the OWF servicing in emergency situations or as a result of collisions between vessels or with the OWF components (spill of medium size or catastrophic spill)	Moderate	High	Moderate (N)
Emissions to the environment, e.g. accidental release of sewage or waste in the Baltic East OWF Area	Irrelevant	High	Low (N)
Emissions to the environment of hazardous substances, e.g. incidental entering of materials, equipment, OWF components, chemical agents, into the Baltic East OWF Area	Irrelevant	High	Low (N)
Technical problems, damage or destruction of the OWF components as a result of a natural disaster and/or structural collapse in the Baltic East OWF Area	Moderate	High	Moderate (N)
Contamination of water and seabed sediments with antifouling agents	Irrelevant	High	Low (N)
Release of contaminants from anthropogenic objects on the seabed	Low	High	Low (N)
Noise reduction system failure with regard to security processes (possibilities to operationally influence the piling parameters on the basis of measured	Moderate	Very high	Important (N)

IMPACT	IMPACT SCALE	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
underwater noise values, e.g.: reduction of hammer energy, hammer frequency, increase of the bubble curtain output)			
Indirect threats resulting from accidental events to living organisms inhabiting or otherwise using the seabed, water column and the surface of the sea	High	High	Important (N)

Based on the analysis carried out, it was concluded that the significance of the impact of the Project in question in the event of a serious accident, natural disaster or structural collapse during the implementation phase of the Baltic East OWF with the application of mitigation or compensatory measures could range from negligible to significant. These will be negative, direct or indirect, local, short-term, and temporary impacts. The impact of emergency events during the implementation of the Baltic East OWF on living organisms inhabiting or otherwise utilising the seabed, the water column and the sea surface should be considered important.

7.2 Operation phase

A table with a summary of the environmental impacts in the event of a major accident, natural disaster and structural collapse during the Baltic East OWF operation phase is presented below, along with their assessment [Table 128].

Table 128 Analysis of the significance of environmental impacts in the event of a major accident, natural disaster and structural collapse during the Baltic East OWF implementation phase with the application of mitigation or compensatory measures [Source: internal materials]

IMPACT	IMPACT SCALE	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
Emissions to the environment, possible emergencies in service ports	Irrelevant	Low	Negligible (N)
Spills of petroleum products at the time of the servicing during normal ship operation (small spills)	Low	High	Low (N)
Spills during the OWF servicing in emergency situations or as a result of collisions between vessels or with OWF components (spill of medium size or catastrophic spill)	Moderate	High	Moderate (N)
Emissions to the environment, e.g. accidental release of sewage or waste in the Baltic East OWF Area	Irrelevant	High	Low (N)
Emissions to the environment of hazardous substances, e.g. incidental entering of materials, equipment, OWF components, chemical agents, into the Baltic East OWF Area	Irrelevant	High	Low (N)
Technical problems, damage or destruction of the OWF components as a result of a natural disaster and/or structural collapse in the Baltic East OWF Area	Moderate	High	Moderate (N)
Contamination of water and seabed sediments with antifouling agents	Irrelevant	High	Low (N)
Indirect threats resulting from accidental events to living organisms inhabiting or otherwise using the seabed, water column and the surface of the sea	High	High	Important (N)

Based on the analysis carried out, it was concluded that the significance of the impact of the Project in question in the event of a serious accident, natural or construction disaster during the operation phase of the Baltic East OWF with the application of mitigation or compensatory measures could range from negligible to important. These will be negative, direct or indirect, local, short-term, and temporary impacts. The impact of emergency events during the operation of the Baltic East OWF on living organisms inhabiting or otherwise utilising the seabed, the water column and the sea surface should be considered important.

7.3 Decommissioning phase

A table with a summary of the environmental impacts in the event of a major accident, natural disaster and structural collapse during the Baltic East OWF decommissioning phase is presented below, along with their assessment [Table 129].

Table 129 Analysis of the significance of environmental impacts in the event of a major accident, natural disaster and structural collapse during the Baltic East OWF decommissioning phase with the application of mitigation or compensatory measures [Source: internal materials]

IMPACT	IMPACT SCALE	RECEPTOR SENSITIVITY	IMPACT SIGNIFICANCE
Emissions to the environment, potential emergencies, related to the decommissioning of the OWF components in ports	irrelevant	Low	Negligible (N)
Spills of petroleum products at the time of transport of the Baltic East OWF components during normal ship operation (small spills)	Low	High	Low (N)
Spills during transport of the OWF components in emergency situations or as a result of collisions between vessels or with the OWF components (spill of medium size or catastrophic spill)	Moderate	High	Moderate (N)
Emissions to the environment, e.g. accidental release of sewage or waste in the Baltic East OWF Area	Irrelevant	High	Low (N)
Emissions to the environment of hazardous substances, e.g. incidental entering of materials, equipment, OWF components, chemical agents, into the Baltic East OWF Area	Irrelevant	High	Low (N)
Technical problems, damage or destruction of the OWF components as a result of a natural disaster and/or structural collapse in the Baltic East OWF Area	Moderate	High	Moderate (N)
Contamination of water and seabed sediments with antifouling agents	Irrelevant	High	Low (N)
Indirect threats resulting from accidental events to living organisms inhabiting or otherwise using the seabed, water column and the surface of the sea	High	High	Important (N)

Based on the analysis carried out, it was concluded that the significance of the impact of the Project in question in the event of a serious accident, natural disaster or structural collapse during the implementation phase of the Baltic East OWF with the application of mitigation or compensatory measures could range from negligible to important. These will be negative, direct or indirect, local, short-term, and temporary impacts. The impact of emergency events during the implementation of the Baltic East OWF on living organisms inhabiting or otherwise utilising the seabed, the water column and the sea surface should be considered important.

8 DETERMINATION OF A POSSIBLE TRANSBOUNDARY ENVIRONMENTAL IMPACT

Pursuant to Article 104(1) of the EIA Act, if the possibility of a significant transboundary environmental impact originating from the territory of the Republic of Poland as a result of the implementation of a planned project is identified, a transboundary environmental impact assessment procedure shall be carried out. In view of the above, the aim of the following analyses is to establish or exclude the possibility of a significant transboundary environmental impact as a result of the implementation of the Baltic East OWF.

In the case of the Project under consideration, due to its location (approximately 60 kilometres in a straight line from the nearest boundary) and the specifics of the proposed Project, no transboundary environmental impact is expected.

The Baltic East OWF Area is located in the Polish exclusive economic zone (EEZ). The distances of this area from the boundaries of the EEZs of other countries are as follows [Figure 88]:

- over 59 km from the Swedish Exclusive Economic Zone (EEZ);
- over 82 km from the Danish EEZ;
- over 73 km from the Russian EEZ;
- over 199 km from the German EEZ.

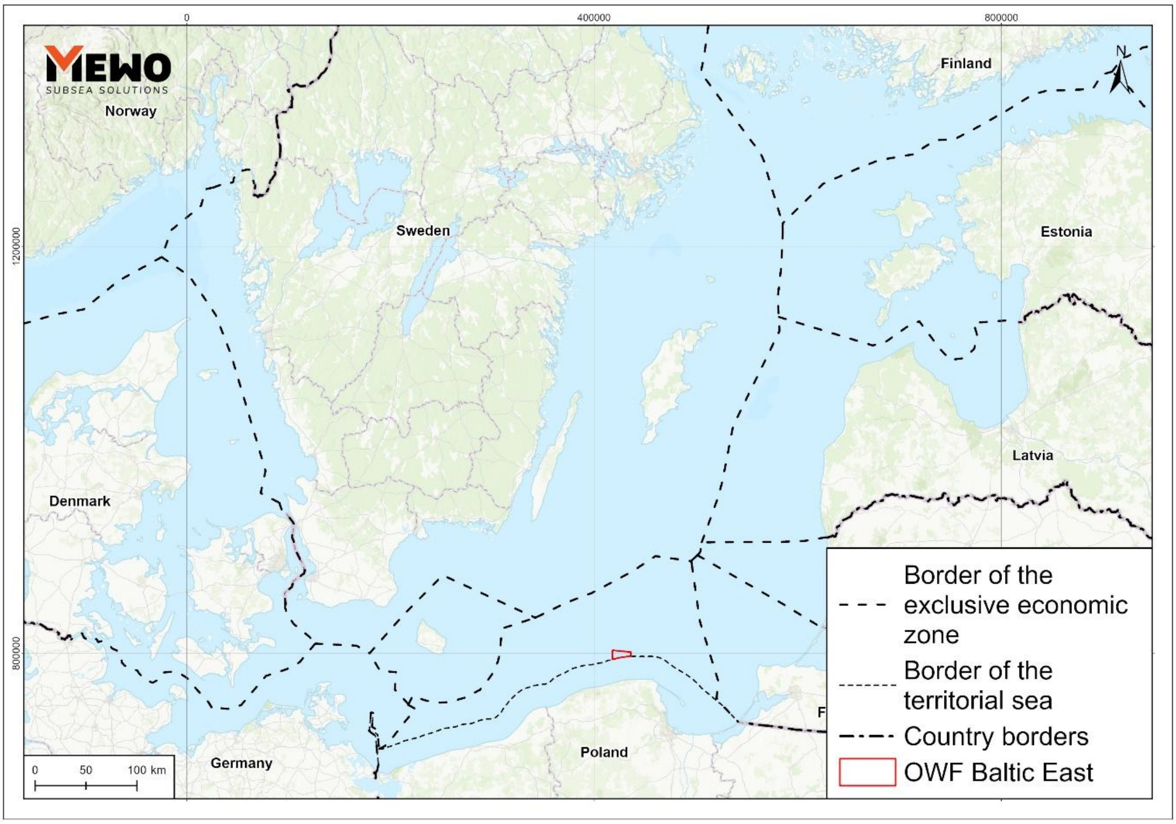

Figure 88 Location of the Baltic East OWF in relation to the boundaries of the exclusive economic zones of the Baltic States [Source: internal materials]

In order to assess the potential for transboundary impacts, the results of a detailed assessment of each significant potential impact on marine receptors were analysed, which is discussed in Section 5 of this report. The table below presents a synthetic assessment of the potential for transboundary impacts. In many cases, due to the local range of most impacts related to the Project, significant transboundary impacts can be confidently ruled out. For those environmental components for which the initial assessment indicated the possibility of regional impacts, a more detailed analysis is carried out in the following Section and the resulting conclusions are presented.

According to the adopted definition of impacts from Section 1.7.3, the regional extent is the range of the impact, the effects of which extend beyond the immediate vicinity of the activity associated with the proposed Project, but not beyond the Polish sea areas.

Table 130 Initial assessment of transboundary impacts

ENVIRONMENTAL COMPONENT (RECEPTOR)	ASSESSMENT IN TERMS OF TRANSBOUNDARY IMPACT
Geological structure, seabed relief and availability of raw materials and deposits	Impacts discussed in Sections 5.1.1.1. and 5.1.2.1 The impacts are assessed to **only occur locally**, in the wind farm development area. Therefore, transboundary impacts can be excluded.
Sea waters dynamics	Impacts discussed in Section 5.1.2.2 The impacts are assessed to **only occur locally**, in the wind farm development area. Therefore, transboundary impacts can be excluded.
Seawater quality and seabed sediments	Impacts discussed in Sections 5.1.1.2. and 5.1.2.2 Impacts with **possible regional range** are: Release of pollutants and nutrients from sediment into water during the implementation phase; Contamination of water and seabed sediments with petroleum products (emergency situations and collisions) during all phases. The remaining impacts will only occur **locally,** therefore a transboundary impact for them can be excluded.
Atmospheric air quality, including climate and greenhouse gas emissions	Impacts discussed in Sections 5.1.1.3. and 5.1.2.3 The negative impacts are assessed to **only occur locally**, in the wind farm development area. Therefore, transboundary impacts can be excluded.
Systems using EMF	Impacts discussed in Sections 5.1.1.4. and 5.1.2.4 Impacts with **possible regional range** are: Obstructions or barriers to the transmission of communication signals.
Cultural values, monuments and archaeological sites and objects	Impacts discussed in Sections 5.1.1.5. and 5.1.2.5 Impacts are assessed to occur **only locally**. Therefore, transboundary impacts can be excluded due to the distance from the nearest objects of cultural heritage located outside Poland.
Use and management of the water area and tangible property	Impacts discussed in Sections 5.1.1.6. and 5.1.2.7 The impacts are assessed to **only occur locally** during the implementation phase. Therefore, transboundary impacts can be excluded. Impacts during the operation phase with **possible regional range** are: exclusion or restriction of vessel traffic in the sea area except for the OWF service vessels, exclusion of the sea area from transport and navigation, fishing, survey, tourist and other cruises.
Landscape, including cultural landscape	Impacts discussed in Sections 5.1.1.7. and 5.1.2.8 Impacts with **possible regional range** are: landscape change as seen from land and sea, landscape dominance, vessel traffic. The remaining impacts will only occur locally, therefore a transboundary impact for them can be excluded.
Population, health and living conditions	Impacts discussed in Sections 5.1.1.8. and 5.1.2.9 The negative impacts are assessed to **only occur locally**. Therefore, transboundary impacts can be excluded.
Phytobenthos	Phytobenthos does not occur in the Project area. Therefore, there will be no impact on this marine environmental component during the implementation phase. Impacts during the operation phase are discussed in Section 5.1.2.10.1.

ENVIRONMENTAL COMPONENT (RECEPTOR)	ASSESSMENT IN TERMS OF TRANSBOUNDARY IMPACT
	The impacts are assessed to **only occur locally** during the operation phase. Therefore, transboundary impacts can be excluded.
Macrozoobenthos	Impacts are discussed in Sections 5.1.1.9.2 and 5.1.2.10.2 The negative impacts are assessed to **only occur locally**. Therefore, transboundary impacts can be excluded
Ichthyofauna	Impacts are discussed in Sections 5.1.1.9.3 and 5.1.2.10.3 Impacts of **possible regional range** are noise and vibration emissions during the implementation phase. The remaining impacts will **only occur locally**, therefore a transboundary impact for them can be excluded.
Marine mammals	Impacts are discussed in Sections 5.1.1.9.4 and 5.1.2.10.4 Impacts of **possible regional range** are noise and vibration emissions during the implementation phase. The remaining impacts will **only occur locally**, therefore a transboundary impact for them can be excluded.
Seabirds	Impacts are discussed in Sections 5.1.1.9.5 and 5.1.2.10.5 Impacts of **possible regional range** are vessel traffic, noise and vibration emissions during the construction phase, lighting of the Project site, barrier effect and risk of collision, destruction of benthic habitats, bird disturbance and habitat displacement.
Migratory birds	Impacts are discussed in Sections 5.1.1.9.6 and 5.1.2.10.5.2 Negative impacts are assessed to be negligible or insignificant. Therefore, significant transboundary impacts can be excluded.
Bats	Impacts are discussed in Sections 5.1.1.9.7 and 5.1.2.10.6 The impacts are assessed to **only occur locally**, in the wind farm development area. Therefore, transboundary impacts can be excluded.
Protected areas and the subjects of protection in these areas	Transboundary impacts can be excluded due to the significant distance from protected areas located outside Poland and the demonstrated lack of impact on relations between these areas and the areas within the range of the potential OWF impact.
Wildlife corridors	Underwater structures will not restrict the movement of marine organisms in the water column and on the seabed. The possibility of transboundary impacts was excluded.

The analysis of the impacts of the construction, operation and decommissioning of the Baltic East OWF, summarised in the table above, has shown that most of the impacts will be local – limited to the OWF area or its immediate vicinity.

The only impacts likely to be regional in range will concern:

- Seawater and seabed sediment quality;
- Systems utilising EMF;
- Land use and development;
- Landscape;
- Ichthyofauna;
- Marine mammals;
- Seabirds.

The vast majority of these impacts will be of negligible, low or moderate range.

8.1 Seawater and seabed sediment quality

Pollutants and nutrients can be released from sediments and pass into sea waters during any works resulting in seabed disturbance. This impact is influenced in particular by the dimensions and number of foundations and/or support structures, the length of cable sections and the width and depth of the cable trench, the types and amount of pollutants accumulated in seabed sediments and the type of rock material forming the seabed.

This report estimates the predicted amounts of pollution that may be released during the construction of the Baltic East OWF. The results show that these quantities are so negligible (in the order of thousandths of a per mille) compared to the quantities entering the Baltic Sea from the rivers flowing into it and from precipitation, that they can be considered negligible. At the same time, taking into account the distances to the EEZ boundaries of other countries (the nearest boundary is at a distance of more than 59 km), the possibility of transboundary impacts related to pollution of sea waters as a result of sediment disturbance can be excluded.

The vessels, which will be used during both the construction and operation of the OWF, may only cause minor spills of petroleum products during normal operation, resulting in water and sediment pollution of local range. In the event of a breakdown or collision, the volume of petroleum products spillage will be greater – estimated to be up to 200 m^3 maximum. However, the likelihood of such an event occurring is low, and due to the significant distance of over 59 km from the nearest boundary, the possibility of a significant transboundary impact can be excluded.

8.2 Systems using EMF

The potential impact of the OWF on systems using EMF can result in obstructing or impeding the transmission of communication signals. In practice, however, due to the importance of the functioning of these systems, the Project Owner will be obligated to apply minimising or compensatory measures in the event that the expert reports and agreements with the administrative bodies, carried out prior to obtaining the building permit, demonstrate such necessity.

Thus, given the need to implement measures to ensure that there is no significant negative impact on systems using EMF within the Polish EEZ, the possibility of significant transboundary impacts can be all the more excluded.

8.3 Land use and development

The impacts of the OWF in the operation phase on land use and development will result from the fact that the farm area will be excluded from use, or its use for purposes other than those associated with its operation will be limited. This will mean that in many cases the vessel shipping routes will need to be altered, sometimes even lengthened.

However, the size of the Baltic East OWF Area is relatively small in the scale of the entire Baltic Sea. Thus, for vessels on international routes, the lengthening of the shipping routes necessitated by the need to bypass the OWF in relation to the entire length of the route will be virtually imperceptible. Therefore, the possibility of a significant transboundary impact can be excluded.

8.4 Landscape

The impact of the Baltic East OWF on the landscape will result from the introduction of a new component into the landscape that is visible from a distance. Visibility of the power plant will depend, among other things, on weather conditions – with high air clarity it will be visible even from land.

Disturbance of the landscape due to the operation of wind farms depends mostly on atmospheric conditions – visibility and the curvature of the Earth. For the tallest wind turbines considered (heights up to 347.5 m), the visibility range can reach 71 km, provided there is very good horizontal visibility, while the height of the object seen from this height above the horizon will be 100 m. The impact was assessed to be negligible, although it varies depending on the distance of the observer from the OWF. In the open sea, the landscape is not disturbance-resistant, but its value is not high, as very few people and over a short period will be exposed to the landscape change and some of them (e.g. tourists) may perceive it as advantageous or interesting. The scale of the impact will have a large spatial range, which will decrease with the increasing distance from the OWF. Therefore, due to the distance from the EEZ boundaries of other countries (the closest boundary at a distance of nearly 60 km), as well as the many times greater distance from the shoreline of other countries, there is no possibility for the wind turbine towers to be visible from outside Poland's boundaries. Therefore, the possibility of a significant transboundary impact can be excluded.

8.5 Ichthyofauna

The impact of the Project on ichthyofauna will only occur during the construction phase and will result from noise emissions generated during the installation of the foundations using the piling method. The nature of the impact can vary – depending on the noise intensity and the distance from its source, the impact can have various effects, ranging from behavioural changes to the death of fish. If pile driving of foundations is carried out without measures to reduce noise propagation, the extent of the impact on fish could be very high. However, the Project Owner has already anticipated the use of such measures at the planning stage of the Project, which will reduce the extent of underwater noise impacts many times over. Noise mitigation measures will be tailored individually to the situation, as described in Section 2.4.2.2.2.

An assessment of the impact of noise emissions on ichthyofauna, taking into account the results of noise propagation modelling, has shown that the area where increased fish mortality is likely to occur will extend to a maximum of a few tens of metres from the worksite. The extent of the impact involving reversible hearing damage will cover up to 4.4 km^2, while the extent of the TTS effect will cover up to 575 km^2.

Noise modelling results for the furthest-reaching scenario in summer, when cod spawning takes place, indicate that with the maximum mitigation measures in place, the nearest major cod spawning ground (the Bornholm Deep) is too far away from the Baltic East OWF for the piling conducted in the Project area to cause lethal impacts or reversible tissue damage in the spawning areas, or even a behavioural response.

In the case of herring, the nearest spawning grounds are outside the range of noise levels causing reversible damage, TTS and behavioural changes. The situation is similar in the case of straightnose pipefish, common seasnail and sand goby.

The range of significant impact on sprat will also be small – the area of increased larval mortality will be up to a few tens of metres from the noise source. At the same time, due to the pelagic lifestyle of sprats and the wide availability of areas with similar conditions in the water depths, periodically leaving the affected area will not have a significant impact on sprat population.

In the case of fish species without swim bladders, including but not limited to flounder, it is their low sensitivity to noise impacts that will limit the extent of the impact to the immediate vicinity of the noise-generating works.

Given the conditions described above, the possibility of a significant transboundary impact can certainly be excluded.

8.6 Marine mammals

The impact of the Project on marine mammals will only occur during the construction phase and will result from noise emissions during the installation of the foundations using the piling method. Noise can significantly affect the behaviour and physiological condition of harbour porpoises and seals.

Numerical modelling of underwater noise propagation was carried out to estimate the potential impact of piling sounds during the construction of the Baltic East OWF on marine mammals to determine the extents to and areas in which noise impacts on animals may occur. Based on the results of the modelling, the Project Owner defined a NRS (Noise Reduction System) limiting the propagation of underwater noise so as to minimise the impact on marine mammals – harbour porpoises and seals. Thus, thanks to NRS, the maximum extent of the impact on the harbour porpoise causing behavioural change is predicted to be less than 17 km, and less than 10 km for the seal. Impacts in the form of hearing damage will occur over an even smaller area − only in the immediate vicinity of the worksite.

With such a small extent of potential impacts, significantly smaller than the distance to the nearest EEZ boundary, the possibility of significant transboundary impacts on marine mammals can certainly be excluded.

8.7 Seabirds

Negative impacts on seabirds associated with the implementation and operation of the Baltic East OWF of regional scope will only affect benthivorous and piscivorous birds. In the case of gulls, all impacts will have a local range only, limited to the Project area.

Impacts on benthivorous and piscivorous birds, due to the characteristics of these species groups, will have a slightly greater extent. At the OWF implementation stage, when the significance of many of the impacts identified, particularly those associated with the construction process itself, was assessed to be important, the impacts will be of a short-term nature, limited only to the construction duration. After its completion, there will be impacts associated with the operation of the OWF, including vessel traffic, the disturbance and displacement of birds from habitats or the barrier effect created by the construction of the farm elements.

However, the scale factor must be taken into account here. Whilst vessel traffic will increase due to servicing of the Project, it will be concentrated in the immediate vicinity of the Project, therefore the impact will be concentrated there, decreasing with increasing distance. A similar situation will occur with regard to noise and vibration emissions during construction works and lighting of the Project area.

Impacts related to habitat conditions, such as destruction of benthic habitats or bird disturbance and displacement from habitats, will have the effect of changing habitat and feeding ground locations, but due to the small size of the Project surface in relation to the entire sea area, as well as the considerable distance from the boundaries, it can be assured that the impact will not extend beyond the boundaries of the Polish EEZ. Closely related to this is the barrier effect, which will have an impact on bird avoidance of the Project area, but due to the flight corridors between the offshore wind farms, this will not impede the movement of avifauna on a larger scale.

Therefore, despite the fact that the impact of the Baltic East OWF on benthivorous and piscivorous birds may occur at the population level, it will not be significant outside the areas in the immediate vicinity of the Project. Therefore, given the conditions described above, the possibility of a significant transboundary impact on seabirds can certainly be excluded.

8.8 Cumulative impacts

Cumulative impacts are environmental impacts resulting from the combined effects of the activities of the project under assessment with other ongoing or planned projects.

Section 6 of this report identifies the projects the impacts of which could potentially cumulate with those of the Baltica-1 OWF, in order to assess them regarding the possibility of occurrence of cumulative impacts.

The analysis carried out demonstrated that such projects are located within the Polish EEZ. These are other offshore wind farms planned for implementation: FEW Baltic II, Bałtyk II, Baltica 2, Bałtyk III, Baltica 3, Baltic Power, C-Wind and B-Wind. The potential for cumulative impacts results from the relatively close location and the analogous nature of these projects, which entails analogous impacts. A potential cumulation of impacts with the nuclear power plant at the Lubiatowo-Kopalino site and the associated investments may also take place.

As shown by the analyses carried out, the potential cumulation may be related to the following impacts:

- Spatial disturbances (impact on avifauna, landscape, systems using EMF, fishing);
- Underwater noise;
- Increase in the concentration of suspended solids and their sedimentation.

8.8.1 Spatial disturbances

Impacts associated with spatial disturbance will be connected to the appearance of new emissions and facilities in the maritime space, firstly related to the implementation process of the individual projects, and then with the creation of new permanent structures. These impacts are mainly likely to affect avifauna. In the case of the implementation phase, the cumulation of impacts may only occur when simultaneous or closely timed successive works generating similar impacts are carried out. Assuming that the construction phases of the nearby OWFs will last several years in each case, it is impossible to clearly indicate which activities will be carried out at similar or at the same time. Cumulative impacts may occur for the nearest OWFs due to the analogous nature of the projects and their impacts on birds. However, due to the large areas of open, undeveloped Baltic waters between individual wind farms, as well as due to the planned corridors between the closest wind farms, the consequences of cumulative spatial disturbance by individual wind farms will be relatively small. There could be potential transboundary impacts on migratory birds, including the lengthening of migratory routes caused by the need to avoid wind farms or the risk of collisions with the elements of the farms. However, the modelling of the cumulative barrier effect carried out showed that, on average, the migration distance would extend by 12.3%, which would increase the energy expenditure by an average of 10.47%. The calculated risk of collision is also low. Notwithstanding the above, in order to minimise the cumulative impacts, the Baltic East OWF Project has taken into account the need to leave the area free of wind turbine development as an optimal corridor width for the passages of migratory birds. By creating such a corridor, as well as by ensuring adequate lighting and marking of the blade tips, potential cumulative impacts are minimised, which will also exclude the possibility of significant transboundary impacts associated with the cumulative disturbance of space as a result of offshore developments.

Landscape disturbances in the case of the cumulative impacts related to the simultaneous exploitation of the MFW Baltic Power, Baltica, Bałtyk II, Bałtyk III, FEW Baltic II and BC-Wind, as described in subsection 6.5.1.4, depend mostly on weather conditions i.e. visibility and the curvature of the Earth, similarly to the impact on the landscape of a single OWF. As with the impact of a single wind farm, there will be no transboundary impact, which is primarily due to the distance from the shorelines of other countries, significantly exceeding the maximum visibility range.

Potential cumulative impacts associated with spatial disturbance may also apply to fishing. However, due to the relatively low importance of the area occupied by the Baltic East OWF for fishing and, above all, its lack of use by foreign fishing vessels, the possibility of transboundary cumulative impacts can be excluded.

8.8.2 Underwater noise

The cumulative impacts of underwater noise during pile driving of the wind turbine foundations were assessed on the basis of the numerical modelling of noise propagation.

Organisms that are particularly sensitive to the effects of underwater noise are marine mammals – harbour porpoises. Both the noise propagation modelling carried out for this report and the modelling results presented in the EIA reports for other neighbouring offshore wind farms (Baltic Power OWF and BC Wind OWF) have shown that even with the application of noise propagation mitigation measures in the form of HSD+DBBC, cumulative impacts can occur when piling is carried out simultaneously, particularly during the winter season. However, due to the considerable distance from the EEZ boundary, including from the protected areas outside Poland, calculations showed that the cumulative impact of noise from simultaneous piling would not cover these areas. Therefore, on the basis of the conducted analyses, it can be concluded with certainty that despite the occurrence of cumulative impacts related to the propagation of underwater noise in the case of simultaneous implementation of the Baltic East OWF and the Baltic Power OWF or the BC Wind OWF, the impact will not have a transboundary range.

8.8.3 Increase in the concentration of suspended solids and their sedimentation

The impact of cumulative increase in suspended solids concentration and sedimentation due to the interaction of the Baltic East OWF with the nearby offshore wind farms Baltic Power, Baltic II, Baltic III, Baltica 2, Baltica 3, FEW Baltic II, and BC-Wind was assessed on the basis of numerical modelling results of the propagation of suspended solids.

The modelling of suspended solids propagation, carried out for the purposes of this EIA Report, has shown that the impact ranges associated with an increase in suspended solids concentration in water, in the worst possible scenario, will extend to less than 10 km, while those associated with sedimentation will extend to less than 1 km from the worksite [Figure 89]. This means that any cumulative impact can only occur in the immediate vicinity of the Baltic East OWF. These distances are small enough for the potential cumulative impacts with suspended solids impacts during construction works on other offshore wind farms located in the immediate vicinity is minimal. Therefore, there is no risk of cumulative impacts exceeding the boundaries of the Polish EEZ and the occurrence of transboundary impacts can be excluded.

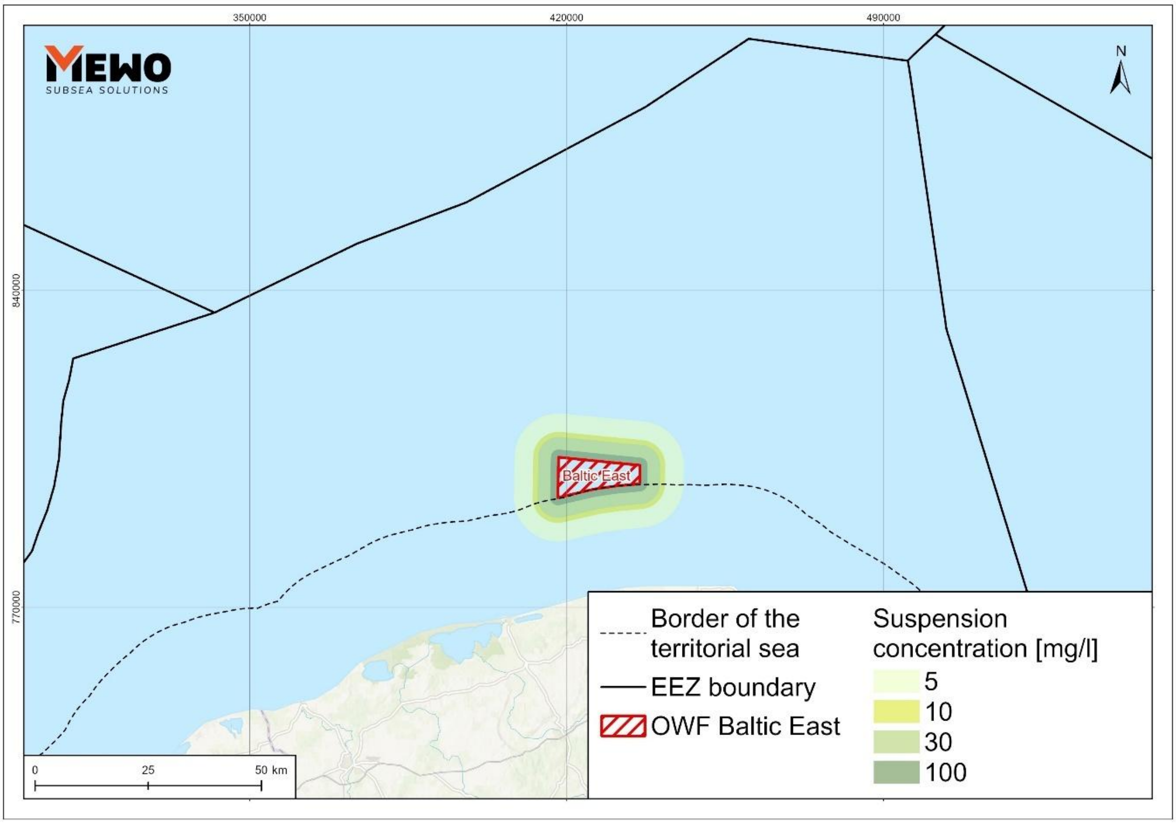

Figure 89 Maximum rages of suspended solids propagation for the Baltic East OWF [Source: internal materials]

8.8.4 Collisions of migratory birds

As indicated in the section on cumulative impacts, collisions of birds migrating over the Baltic Sea (including seabirds) will accumulate across all offshore wind farms. Therefore, all known OWF projects (including the planned ones) were considered in the assessment of the cumulative impacts regarding collisions of birds flying through OWF areas across the Baltic Sea. It should be emphasised that such an approach is an upfront impact estimation approach, as the methodology adopted does not allow determining which part of the migrating birds will avoid the OWF (and thus will be impacted by the barrier effect) and which part will fly through the OWF and in what spatial range. However, since the impact of the collision on migratory birds was also assessed in this extended case to be negligible and low, and only in the case of the common crane to be moderate, it must be concluded that there will be no significant transboundary impacts in this respect.

8.9 Summary

The environmental impact assessment of the Baltic East OWF Project has excluded the possibility of significant transboundary impacts.

Due to the nature and design of the Project, the impacts that will occur will be predominantly local in extent, as is comprehensively justified in Section 5 of this report. For impacts assessed to be of regional extent, additional analyses were carried out to assess whether there is a risk that these impacts will extend beyond the boundary of the Polish EEZ. The possibility of cumulative impacts of the Baltic East OWF with other planned offshore wind farms was also taken into account during the analysis.

The main factor influencing the lack of risk of transboundary impacts is the significant distance of the Project area from the EEZ boundaries – nearly 60 km. In addition, the potential impacts will be reduced through appropriate measures designed by the Project Owner, such as noise propagation reduction measures.

9 ANALYSIS AND IDENTIFICATION OF THE MOST ENVIRONMENTALLY BENEFICIAL OPTION

Issues related to the proposed Project variants, including descriptions and comparison of technical parameters of the two options analysed, i.e. the Applicant Proposed Variant (APV) and the Reasonable Alternative Variant (RAV), are included in the subsection 2.2 of this EIA Report. Taking into account the specificity of the proposed Project, including, in particular, the location decision issued (PSzW no. DGM-3.530.20.2022), it would be unjustified to include another location of the Baltic East OWF implementation in the RAV. Therefore, both the APV and the RAV were considered for the same area.

9.1 Methodology of the identification of the most environmentally beneficial option

The methodology applied to select variant most beneficial for the environment is based on the results obtained as part of the impact assessment conducted for both variants analysed in Section 5. Due to the fact that the assessed significance of the impact on individual components does not differ between individual variants – which results from small differences between technical parameters, as well as the location of both variants in the same area, the expert assessments carried out as part of the assessment of the impact on individual environmental components based on the assumptions indicated below were taken into account.

Construction and operation of a smaller number of wind turbines as part of the APV in relation to the RAV, means, consequently, less interference in the environment as a result of:

- shorter duration of the construction and decommissioning phases;
- lower number of hazardous lifting and offshore operations;
- lower consumption of construction materials and consumables;
- smaller rotor swept area, as well as
- smaller seabed surface occupied or covered by underwater works;
- smaller number of service or operational activities.

9.2 Selection of the most beneficial variant

The RAV assumes 14 MW turbines for the purposes of the analyses. Taking into account the maximum installed capacity of the Baltic East OWF, in this variant, it would be necessary to construct 69 wind turbines. With the turbine power output of 15–25 MW assumed in the APV, the comparable installed capacity will be achieved already after the construction of 38 wind turbines (for 25 MW) or

64 turbines (for 15 MW). By increasing the power of a single turbine in the same area in the APV, it is possible to erect fewer wind turbines. A smaller number of wind turbines in the APV means a shorter construction time and a shorter time for the Project decommissioning – the impacts identified for the implementation and decommissioning phases will therefore have a smaller impact on the environment in the APV than in the RAV. In addition, in the RAV, a greater part of the seabed will be occupied by foundations, while marine mammals and fish will be exposed to noise for a longer period than in the APV.

To sum up the above considerations, it should be stated that the main parameters differentiating the two variants analysed are the number of wind turbines and the rotor diameter. In consequence, they determine the size of the impact on individual components of the environment.

9.3 Justification for the proposed variant

Taking into account economic, technical and social factors, the most beneficial variant for the environment is the Applicant Proposed Variant (APV). This is mainly due to the implementation and decommissioning phases, in which due to the smaller number of wind turbines, the construction and decommissioning costs will be reduced and there will be a smaller impact on all environmental components analysed in this EIA Report. The operation phase will also be more beneficial in the APV, which is mainly due to the smaller swept area.

Summarising, the most environmentally beneficial variant for the implementation of this Project is the APV.

10 DESCRIPTION OF THE PROSPECTIVE ACTIONS TO AVOID, PREVENT AND REDUCE NEGATIVE IMPACTS ON THE ENVIRONMENT

The environmental impact assessment carried out for the Baltic East OWF indicates that there will be no significant negative impacts as a result of this Project implementation. Nevertheless, impacts of lesser significance are unavoidable. Hence, the rational measures to avoid, prevent and limit the negative environmental impacts resulting from the implementation of the Baltic East OWF Project, are presented below broken down into individual phases.

10.1 Solutions to avoid, prevent and limit the impacts included in the Project

The Project will include solutions to avoid, prevent and limit negative impacts on the environment.

An integral part of the Baltic East OWF will be:

the systems described in Section 2:

1 Noise Reduction System (NRS);

2 systems monitoring and securing the operation of wind turbines, primarily – the overspeed protection system and the lightning protection system (LPS);

3 system of temporary shutdowns during bird migration.

Procedures – standards:

- construction and transport works will be carried out in compliance with the provisions of the labour law and OHS standards;
- transport and logistics shall be planned to minimise impacts on and disruptions to maritime traffic;
- within the Baltic East OWF, a 4 km wide corridor without above-water constructions has been designated, in which only power cables will be laid on the seabed;
- offshore structures will be painted and marked, and illuminated at night in accordance with the requirements and standards in force in this respect in order to ensure maritime and aviation safety, as well as the safety of contractors performing implementation, service and decommissioning works;
- before obtaining a building permit, an archaeological inventory will be carried out and submitted to the relevant administration bodies, works in the vicinity of identified cultural heritage objects will be carried out in accordance with the requirements and agreements

with the Pomorskie Voivodeship Heritage Conservation Officer, including during the implementation of the Project under archaeological supervision;

- prior to obtaining a building permit, expert reports required by law regarding the impact of the Baltic East OWF on systems using EMF, defence, aviation, maritime safety and combating threats will be prepared and agreed with the relevant administration bodies (see Section 2.7.6); on this basis, the needs and scope of application of measures to avoid, prevent, mitigate or compensate possible negative impacts on systems using EMF, defence, aviation (in the implementation, operation and decommissioning phases) will be determined and implemented.

The above systems, procedures and standards are therefore part of the Project (description in Section 2). The Environmental Impact Assessment Report was developed taking into account the implementation of the above systems, obligations and procedures.

The Project will be implemented, operated and decommissioned in accordance with the applicable regulations and requirements. The Project includes operating standards – a system of shutdowns for the duration of bird migration.

The occurrence of negative impacts of lesser significance (e.g. important, moderate) is inevitable, their occurrence usually resulting from the impact scale and the sensitivity of a given receptor. It is impossible to predict whether a given impact will definitely occur or not or whether its significance cannot be avoided, limited or prevented by the Applicant's actions but requires, for example, administrative decisions (archaeology – monuments, restrictions on fishing). Hence, the reasonable measures to avoid, prevent and limit the negative environmental impacts of the Baltic East OWF are indicated below by individual phases.

10.1.1 Mitigating the impact on marine mammals

In the case of marine mammals, the negative impacts from the Baltic East OWF implementation phase are mainly related to the generation of underwater noise during the piling of foundations for the wind turbines and substations. In order to reduce the impact of noise on the harbour porpoise and seals during the OWF implementation phase, the Project will implement noise reduction systems (NRS, see Section 2).

In the case of piling at one, two and three locations, NRS will be applied to ensure sufficient noise reduction to minimise the effect of hearing damage (TTS) to the harbour porpoise and seals, i.e. not exceeding levels of 140 dB re 1 µPa2s SEL_{cum} VHF-weighted according to Southall *et al*. (2019), and 170 dB re 1 µPa2s SEL_{cum} PW-weighted according to NMFS (2018), at 11 km from the sound source.

It is necessary to:

- implement a marine mammal observer (MMO) programme to verify that no animal is present in the immediate area of the works; a marine mammal-free zone should be clearly delineated before the commencement of construction works;
- implement the piling process in accordance with the adopted Noise Reduction Scheme (Section 2), considering potential cumulative impacts on marine mammals.

10.1.2 Mitigating the impact on migratory birds

The environmental impact assessment carried out for the Baltic East OWF concludes that no significant negative impacts will result from the Project discussed. However, minor impacts are unavoidable, particularly with regard to possible fatal collisions of cranes.

The mitigation measures proposed for the operation phase include fitting the Baltic East OWF with a detection and response system allowing to slow down selected wind turbines (the so-called temporary shutdown system described in Section 2) during periods of crane migration, if the results of the operational monitoring, according to the methodology adopted, indicate that an intensive migration of cranes takes place over the Baltic East OWF Area at collision heights.

10.1.3 Mitigating the impact on seabirds

The mitigation measures proposed for the implementation phase include:

- beginning of piling using the so-called soft-start procedure to allow seabirds to leave and move away from the work site area;
- carrying out ornithological supervision during piling operations; if the ornithological supervisors do not observe the presence of the common guillemot, the razorbill, the long-tailed duck and the velvet scoter in the area with a radius of 1.5 km from the piling site, the work may begin, each time preceded by the soft-start procedure;
- limiting sources of strong light at night, directed upwards and, where possible, also to the sides. This applies in particular to bird migration periods. Light emission should be limited to the necessary level, in compliance with the applicable regulations and work safety standards;

The mitigation measures proposed for the operation phase include:

- limiting sources of strong light at night, directed upwards and, where possible, also to the sides. This applies in particular to bird migration periods. Light emission should be limited to the necessary level, in compliance with the applicable regulations and work safety standards;
- if jacket (lattice structure) foundations are used, their above-water elements should be painted in a bright colour to minimise the risk of bird collisions.

The mitigation measures proposed for the decommissioning phase include:

- the removal of any possible debris and contaminants from the seabed after the completion of wind turbine and OSS dismantling, unless otherwise agreed with the relevant authorities; the removal of subsequent wind turbines beginning from one location, so that the sea basin occupied by the OWF is cleared from the structures gradually.

10.1.4 Mitigating the impact on cultural heritage, historical monuments, as well as archaeological sites and objects

In accordance with the provisions of the PSzW, the Applicant is required to provide *in situ* protection for historical monuments together with their surroundings (understood as the seabed within a distance of at least 25 m from the outer boundary of the monument), to carry out an archaeological inventory survey, and to report to the relevant administrative authorities all identified objects of cultural value, as well as to protect them until the relevant permits for further proceedings are obtained. In particular, there is a prohibition on development and commercial works related to the disturbance of the seabed structure, such as seabed dredging, sand extraction, foundation of structures, anchoring, or fishing with towed gear, which might lead to the destruction or damage of the historical monument.

11 PROPOSAL FOR THE MONITORING OF THE PROPOSED PROJECT IMPACT AND INFORMATION ON THE AVAILABLE RESULTS OF OTHER MONITORING, WHICH MAY BE IMPORTANT FOR ESTABLISHING RESPONSIBILITIES IN THIS AREA

The temporal and spatial scope of the proposed monitoring has been developed in such a way that its implementation will enable detecting the Project impact on the environmental components monitored and obtaining measurable data to assess how the environment of the affected area will respond to that impact. The scope of the proposed environmental monitoring takes into account the differences in the range of impacts generated by the Project in its individual phases, in relation to the duration of specific activities.

The monitoring survey methodologies will be presented to the territorially competent Regional Director for Environmental Protection to be agreed before the beginning of the surveys.

11.1 Underwater noise monitoring

Underwater noise monitoring is recommended during the implementation phase of the Baltic East OWF, **during the piling of support structures.** The measurements are to be conducted taking into account the following guidelines:

- collecting acoustic recordings in the frequency range from 10 Hz to 20kHz;
- considering the recommendations of Skiellerup *et al*. (2015);
  - using calibrated omni-directional hydrophones with a sensitivity deviation of less than ±2 dB up to 40 kHz in the horizontal plane and less than ±3 dB up to 40 kHz in the vertical plane and recording the calibration signal;
  - recording in the .wav format with the sampling frequency of 44.1 Hz and a 16-bit resolution;
  - determining SEL for each pile driver strike;
  - selecting survey stations at two different depths, at 66 and 33% of the water depth, and more than 2 m below the sea surface;
- using survey stations at which monitoring will be carried out each time when piling takes place;

- one station at a distance of 11 km from the piling location, in the direction with the best underwater noise propagation;
- one station on the boundary of the Natura 2000 site *Ostoja Słowińska*.

At the stations mentioned above, underwater noise generated during piling should not exceed the following levels: 140 dB re 1 µPa2s SEL_{cum} VHF-weighted according to Southall *et al*. (2019), and 170 dB re 1 µPa2s SEL_{cum} PW-weighted according to NMFS (2018). Any exceedances of the defined sound emission thresholds due to NRS failures should be immediately communicated to the territorially competent Regional Director for Environmental Protection, and the results should be reported to the aforementioned authority after the monitoring is completed.

11.2 Monitoring of benthic organisms

Due to the occurrence of negative impacts on benthic communities, monitoring of these organisms is proposed, since the Baltic East OWF construction will influence the local changes in the seabed biocenosis structure. During the implementation phase, the primary impact will be the disturbance of the seabed sediment structure and physical destruction of invertebrates, while during the operation phase, it will be the loss of a fragment of benthic fauna habitat and the artificial reef effect, the significance of which in the PSA is unclear at present.

Therefore, the purpose of the proposed monitoring is to determine the scale, as well as spatial and temporal extent of the surveys of the aforementioned factors, all the more because no OWF is yet in operation within the PSA and the actual intensity of the impacts caused by such a project in this part of the Baltic Sea is not supported by the knowledge gained during the monitoring of the Project. An important aspect of the monitoring of benthic organisms is also to organise the hitherto random knowledge on the colonisation of artificial hard bottom substrates by animal and plant periphyton complexes in the PSA. An important strategy of monitoring surveys is the possibility of comparing them with the data obtained during the inventory surveys carried out as part of this EIA Report.

For this reason, the proposed monitoring should cover the seasons similar to the inventory surveys. Due to the lack of standard, commonly used guidelines for the implementation of this type of surveys in the PSA, an original monitoring methodology was proposed, based primarily on the life cycle of benthic organisms in the Southern Baltic. The benthic monitoring proposal developed herein was also based on the literature of the subject [Coates *et al.* 2011; Degraer *et al.* 2012; Standard 2013].

Surveys of soft-bottom macrozoobenthos communities should be carried out in the area of 5 wind turbine support structures. In addition to a scour protection zone, 6 stations should be designated in the vicinity of a wind turbine foundation, including 3 stations along the main profile transect (along the near-seabed current axis) at a distance of 20, 50 and 100 m from the foundation and its scour protection, and 3 stations along a transect perpendicular to the main profile (reference profile) at the same distances. Quantitative macrozoobenthos sampling should be carried out using a standard Van Veen grab sampler. Macrozoobenthos surveys should be conducted in accordance with standard methodologies [HELCOM 2021, Osowiecki and Błeńska, 2020], with regard to taxonomic composition, abundance (except for individuals representing Gymnolaemata and Hydrozoa) as well as biomass of organisms.

The first macrozoobenthos surveys should be carried out in April–June, provided that 3 months have passed since the completion of construction works involving seabed interventions within the wind turbine location selected for the survey. Subsequent surveys should be carried out in June, 2 and 4 years after the first surveys.

Surveys of the periphytic flora and fauna should be conducted at 5 subsea structural elements of the wind turbines (the same ones around which soft-bottom macrozoobenthos monitoring surveys will be performed). At each site surveyed, video (and/or photographic) documentation should be recorded with the use of an ROV, on the submerged part of a wind turbine in a vertical profile from the surface to the seabed (the depth of periphytic flora occurrence may differ from the range of periphytic fauna occurrence). Additionally, the video recording should cover the scour protection layer around the 5 selected wind turbines as well as 5 hard-bottom sites at a distance of approximately 100 m from the edge of the scour protection (if the turbines selected for monitoring are installed on mixed-type or rocky seabeds, or within boulder areas).

The first surveys of periphytic organisms should be carried out in June, provided that 3 months have passed since the completion of construction works involving seabed interventions within the wind turbine location selected for the survey. Subsequent surveys should be carried out in June, 2 and 4 years after the first survey year.

11.3 Monitoring of ichthyofauna

The proposed monitoring of ichthyofauna for the Baltic East OWF aims to assess the impact of the Project implementation and operation. The surveys should be conducted in the spring and summer, one year and five years after the completion of construction, and one year after the completion of decommissioning. The monitoring will include both ichthyoplankton (early life stages of fish) and adult fish living near the seabed (demersal fish). The surveys will help determine the species structure, abundance, and the condition of local fish populations.

The ichthyoplankton surveys are to be conducted using a Bongo net with a mouth of 60 cm in diameter and a 300 µm mesh size. The hauls will be conducted from a depth of 5 metres above the seabed to the surface level, at a vessel speed of approximately 3 knots. The volume of filtered water will be measured with a flow meter. Ichthyoplankton samples will be preserved in a 4% formaldehyde solution and analysed under a stereoscopic microscope. A quantitative and qualitative analysis of the ichthyoplankton will be carried out in a laboratory to determine the taxonomic composition and abundance of individual taxa. In case of high larval abundance, a subsampling method will be used. Taxonomic determination will be carried out to the lowest possible species level (in most cases, to the species level). The standard length (SL) of larvae will be measured using a computer image analysis system.

Demersal fish monitoring will be carried out with the use of custom-designed bottom-set nets enabling an analysis of the full range of fish species present in the Baltic East OWF Area. Each set is to consist of Nordic coastal multi-mesh gillnets targeting cod as well as nets targeting flatfish (such as flounder and turbot). The total length of one set will be 605 m, with the nets deployed at 12 survey stations within the Baltic East OWF Area and at 4 stations within 1000 m of its boundary. Each set of nets will be deployed for a minimum of 12 hours, covering important periods of daily fish migration, such as dawn and dusk. The results of the catches will be converted to 24-hour data to enable comparison with the data obtained during previous surveys.

During the catches, key data will be recorded, such as the date and time of the net set deployment and recovery, the geographical position of the set (recorded using GPS), the depth of the catch, as well as the temperature and salinity profile of the water. The catches will be analysed quantitatively and qualitatively, and the fish caught will be sorted into species. Each species will be accurately measured in terms of weight and length and, in the case of large numbers of fish, a representative subsample will be analysed. Commercially exploited species such as cod and flounder are to be analysed in detail, including the measurement of length, weight, sex, stage of gonad maturity, and assessment of stomach filling. The age of fish will be determined by the otolith analysis: in the case of cod – on a sectioned otolith, and for flatfish – on stained thin sections.

An assessment of the impact of the artificial reef created by the Baltic East OWF on local fish populations is also planned. As part of the artificial reef monitoring, potential colonisation by invasive species will be analysed, which is crucial for the protection of local marine ecosystems.

The proposed monitoring covers a wide range of surveys that will enable a comprehensive assessment of the impact of the Baltic East OWF on ichthyofauna and the marine environment, while the results will enable a comparison with observations from other offshore wind farms. The surveys will be conducted in accordance with scientific methodologies and ICES guidelines to ensure their high scientific value.

11.4 Monitoring of seawater and seabed sediment quality

Monitoring during the implementation phase

Monitoring during the implementation phase may be required following random events such as accidents and ship collisions, in order to assess potential changes in water quality in the environment within the construction area.

The scope and method of monitoring in the event of random incidents will be decided in the plan for combating risk and pollution for the offshore wind farm and the complex of facilities, agreed in accordance with the Maritime Safety Act by the director of the maritime office.

Monitoring during the operation phase

During the Baltic East OWF operation, the monitoring of seawater and seabed sediments should be carried out in parallel with the monitoring planned for macrozoobenthos surveys. This monitoring will provide data which will be compared with the data from pre-investment surveys to confirm the conclusions of the EIA Report, which stated that the implementation of the Baltic East OWF will not change the basic conditions of the seawater and seabed sediments. Therefore, water and sediment samples should be collected at the same time and in the same places as under the macrozoobenthos monitoring plan, and then sent for analysis. The analysis of water and sediment samples will mostly cover the same parameters as the pre-investment surveys and should include:

- sampling and analysis of physico-chemical parameters in the water column: conductivity, temperature, depth and turbidity; oxygen conditions (dissolved oxygen), total organic carbon (TOC), acidification (pH), DIN, total nitrogen, DIP, and total phosphorus;
- sampling and physico-chemical analyses of seabed sediments:
    - tests of nutrients: loss on ignition, total nitrogen, and total phosphorus;
    - tests of metals and non-metals: mercury (Hg), nickel (Ni), lead (Pb), cadmium (Cd), arsenic (As), total chromium ($Cr_{tot.}$), chromium (VI) (Cr IV);
- tests of hydrocarbons: mineral oils (TPH – total petroleum hydrocarbons), polycyclic aromatic hydrocarbons (16 PAHs).

Data collected and analysed for the Baltic East OWF Area in the above-mentioned scope and using the above-mentioned reference methods will enable their comparison with other data collected in the Southern Baltic region, including data for other OWF projects. The reference methods are the survey methods presented in the marine water monitoring program compliant with HELCOM guidelines (e.g. in the Marine Water Monitoring Update – M.P. of 2021, item 414, Annex 1) and the Regulation of the Minister of Infrastructure of 25 February 2021 on the adoption of an update of a set of properties typical of the good environmental status of marine waters (Journal of Laws of 2021, item 568).

In the Baltic East OWF operation phase, monitoring should be conducted 3 times after the completion of works involving seabed interventions during the construction phase, in parallel with the monitoring of benthic organisms (Section 11.2).

Monitoring during decommissioning phase

No monitoring of water nor seabed sediments is planned to be conducted during the decommissioning phase.

11.5 Monitoring of migratory birds

Monitoring during the operation phase

The purpose of the monitoring of migratory birds during the Baltic East OWF operation phase after the completion of all construction works is to analyse the number of bird collisions and the barrier effect. Data necessary to assess the extent of the impacts include flight trajectories (radar), flight height (radar), species identification (visual observations, acoustic recordings, automated radar and camera system), flight behaviour aimed at assessing micro-, meso- and macro-avoidance rates (radar). The latest guidelines related to monitoring during the OWF operation phase recommend an automated radar-camera system as the most effective and cost-efficient method for continuous observation of OWFs. Such a system, installed on an OWF to capture seasonal migrations to and from breeding sites, has a much broader coverage than visual observations from a vessel, and provides high data quality and resolution. Once installed, the system operates continuously or at fixed times and does not require ongoing maintenance. In order to evaluate the data acquired by the system, it would be advisable to carry out 24-hour observations from a vessel, twice in autumn and twice in spring, at both locations (a total of eight 24-hour observations per year). The installation of such a system will also allow for individual slowing down (shutting down) of wind turbines when cranes approaching an OWF at collision height are detected, thus further reducing the risk of collisions.

Given the experience from similar projects in the Baltic Sea and North Sea (e.g. EIA Report for Bałtyk II, 2015; Bednarska *et al*., 2017; DOF 2024), the authors of the Report propose that the monitoring of migratory birds is conducted in two cycles per year, resulting from the two bird migration periods, i.e. from March to May (spring migration) and from July to November (autumn migration), in four monitoring blocks:

- two cycles of surveys in the first year **after the completion of all works of the implementation phase**, i.e. one during the spring migration period and the other during the autumn migration period;
- two survey cycles in the fourth year **after the completion of all works of the implementation phase**, i.e. one during the spring migration period and the other during the autumn migration period.

Monitoring during the implementation and decommissioning phases

No monitoring is planned to be conducted during the implementation and decommissioning phases.

11.6 Monitoring of seabirds

Pre-investment monitoring (before the commencement of the implementation phase)

The proposed pre-investment monitoring of the Baltic East OWF, involving seabird surveys, should include daytime counts of birds present in the area. The surveys should be conducted in a monthly cycle for one year **before the commencement of any work** belonging to the OWF implementation phase. The route of a survey cruise should be planned in such a manner so that the count covers the 5-kilometre zone around the Baltic East OWF boundaries, and to enable the assessment of changes in the density of birds present at different distances from the future wind turbines.

The detailed methodology of the pre-investment monitoring will be possible to be determined after the final design of the Project has been approved and the schedule of the implementation works has been presented by the Project Owner. On the basis of the building permit design, it will be possible to designate the routes of seabird survey transects in the Baltic East OWF Area, in such a manner so as to meet the condition of conducting the surveys at different distances from the wind turbines.

Monitoring during the operation phase

Monitoring **after the completion of all construction works (launching the last of the wind turbines)**, involving seabird surveys, should include counts of birds present in the OWF area.

The survey cruise route should be the same or very similar to that in the pre-investment monitoring (before the commencement of the implementation phase). These surveys should first and foremost cover the period of the greatest abundance of birds in the Southern Baltic, i.e. they should last from October to May with a frequency of not less than 1 cruise per month (optimally 2 cruises per month). In the remaining months, the abundance of birds in the Baltic East OWF Area is low, and therefore in the summer period, it is enough to carry out 2 survey cruises – one in mid-August and one in mid-September.

The surveys should be conducted for 2 consecutive years (the first 2 years of the OWF operation phase) if the implementation is not planned in stages. If the implementation is staged, these surveys should be performed after the first construction phase is completed and after the entire OWF construction is completed. During the first season, birds will gradually become accustomed to the situation in which the sea basin designated for the Baltic East OWF becomes inaccessible to them (the so-called habituation), which will result in changes in their distribution. Therefore, this period can be treated as a transitional one, and only in the second year the OWF impacts on the seabirds present in this area will stabilise.

A detailed methodology of the operation phase monitoring will be possible to be developed on the basis of a building permit design, and when the schedule of the implementation works has been presented by the Project Owner.

Monitoring during the implementation and decommissioning phases

No monitoring of seabirds is planned during the implementation and decommissioning phases.

11.7 Monitoring of marine mammals

As the presence of the harbour porpoise was recorded within the Baltic East OWF Area, further monitoring of the animals is recommended, using passive acoustic monitoring with C-POD/F-POD equipment. The monitoring is recommended both in the implementation phase and during the operation of the OWF. In addition, it is suggested to carry out surveys immediately before the commencement of construction works. Monitoring of the harbour porpoise is aimed at verifying whether or not the works related to the Project implementation will have an impact on the occurrence of the species in the Baltic East OWF Area and adjacent waters, within the predicted range of behavioural response.

Pre-investment monitoring

Due to the temporal variability of the harbour porpoise occurrence in the Baltic East OWF Area, as recorded over two consecutive years of monitoring, it is recommended to carry out additional monitoring immediately before the commencement of the construction works. It is suggested to conduct acoustic surveys with CPODs/FPODs **over the period of at least half a year**, taking into account the summer and autumn season **preceding the first piling**. The monitoring should take place at at least five survey stations, in the same or similar locations as during the surveys conducted before the EIA Report preparation. It is suggested to collect data at at least four stations located outside the Baltic East OWF Area, at a distance up to 20 km from the OWF boundary. The recommended size of the additional zone results from the predicted behavioural response ranges of the harbour porpoise, obtained on the basis of numerical modelling. The information collected during the pre-investment monitoring will be used as reference data for the surveys conducted during the OWF implementation and operation.

Implementation phase

During the entire construction period of the Baltic East OWF, conducting passive acoustic monitoring is recommended, using a methodology similar to the pre-investment surveys described above.

Operation phase

After the launch of the last wind turbine, during the Baltic East OWF operation phase, conducting passive acoustic monitoring is suggested until the animals return, in a manner similar to the surveys conducted during the pre-investment phase and during construction.

Decommissioning phase

No monitoring of the harbour porpoise is anticipated during the Baltic East OWF decommissioning phase.

11.8 Monitoring of chiropterofauna

During the operation phase, after the completion of the implementation phase, three-year monitoring of chiropterofauna is proposed in accordance with the applicable guidelines. The monitoring should be based on automated broadband recording of the activity of these mammals at the wind turbines, using recording devices with parameters compliant with the guidelines. The number of recording devices should not be fewer than 1 recorder per 5 turbines (rounded down to the nearest integer). Conducting mortality monitoring, as for onshore turbines, is impossible. Notably, bat mortality should be accounted for when automated systems for recording bird collisions/mortality are used at wind turbines.

If new guidelines for post-implementation monitoring at offshore wind farms have been developed by the time the Baltic East OWF becomes operational, monitoring should be carried out in line with such guidelines.

11.9 Summary of the monitoring programme proposed

Table 131 Proposed programme of monitoring surveys in the Baltic East OWF Area [Source: internal materials]

PARAMETER	TIMING	METHODOLOGY
Underwater noise	**During the piling** of support structures	The measurements are to be conducted taking into account the following guidelines: • collecting acoustic recordings in the frequency range from 10 Hz to 20kHz; • considering the recommendations of Skiellerup *et al*. (2015); • using calibrated omni-directional hydrophones with a sensitivity deviation of less than ±2 dB up to 40 kHz in the horizontal plane and less than ±3 dB up to 40 kHz in the vertical plane and recording the calibration signal; • recording in the .wav format with the sampling frequency of 44.1 Hz and a 16-bit resolution; • determining SEL for each pile driver strike; • selecting survey stations at two different depths, at 66 and 33% of the water depth, and more than 2 m below the sea surface; • using survey stations at which monitoring will be carried out each time when piling takes place; • using two survey stations at which continuous recording of the ambient noise will be carried out in the period starting at least two weeks before the commencement of piling and ending at least two weeks after the completion of piling operations: ▪ one station at a distance of 11 km from the piling location, in the direction with the best underwater noise propagation; ▪ one station on the boundary of the Natura 2000 site *Ostoja Słowińska*.
Macrozoobenthos	The first macrozoobenthos surveys should be carried out in April–June, provided that **3 months have passed since the completion of installation works** at the wind turbines selected for the survey. Subsequent surveys should be carried out in June, 2 and 4 years after the first surveys.	Surveys of soft-bottom macrozoobenthos communities in the vicinity of 5 wind turbine foundations / support structures. In the vicinity of a wind turbine foundation, outside the scour protection zone, 6 stations will be designated, including 3 stations on the main profile transect (along the near-seabed current axis) at a distance of 20, 50 and 100 m from the foundation and its scour protection, as well as 3 stations on the transect perpendicular to the main profile (reference profile) at the same distances. Quantitative macrozoobenthos sampling will be carried out using a standard Van Veen grab sampler. Macrozoobenthos surveys should be conducted in accordance with standard methodologies [HELCOM 2021, Osowiecki and Błeńska, 2020], with regard to taxonomic composition, abundance (except for individuals representing Gymnolaemata and Hydrozoa) as well as biomass of organisms.
Periphytic fauna and flora	The first surveys of periphytic organisms should be carried out in	The surveys of periphytic fauna and flora will be carried out at 5 underwater structural components of wind turbines. At each site surveyed, video (and/or photographic) documentation will be recorded with the use of an ROV, on the

PARAMETER	TIMING	METHODOLOGY
	June, provided that **3 months have passed since the completion of installation works** at the wind turbine selected for the survey. Subsequent surveys should be carried out in June, **2 and 4 years after the first survey year**.	submerged part of a wind turbine in a vertical profile from the surface to the seabed (note: the depth of periphytic flora occurrence may differ from the range of periphytic fauna occurrence). Additionally, the video recording should cover the scour protection layer around the 5 selected wind turbines as well as 5 hard-bottom sites at a distance of approx. 100 m from the edge of the scour protection (if the turbines selected for monitoring are installed on mixed-type or rocky seabeds, or within boulder areas).
Seawater and seabed sediment quality	**After an accident or spill**	In accordance with the scope established in the threats and pollution control plan for the offshore wind farm and complex of facilities
	surveys conducted 3 times, **in parallel with the surveys of benthic organisms**	• sampling and analysis of physico-chemical parameters in the water column: conductivity, temperature, depth and turbidity; oxygen conditions (dissolved oxygen), total organic carbon (TOC), acidification (pH), DIN, total nitrogen, DIP, and total phosphorus; • sampling and physico-chemical analyses of seabed sediments; • tests of nutrients: loss on ignition, total nitrogen, and total phosphorus; • tests of metals and non-metals: mercury (Hg), nickel (Ni), lead (Pb), cadmium (Cd), arsenic (As), total chromium ($Cr_{tot.}$), chromium (VI) (Cr IV); • tests of hydrocarbons: mineral oils (TPH), polycyclic aromatic hydrocarbons (16 PAHs).
Bird migrations	two cycles of surveys in the first and fourth year **after the completion of all works of the implementation phase**, i.e. one during the spring migration period and the other during the autumn migration period	An automated radar-camera system installed at an OWF to capture seasonal migrations to and from breeding sites, not requiring ongoing maintenance. In order to evaluate the data acquired by the system, it would be advisable to carry out 24-hour observations from a vessel, twice in autumn and twice in spring, at both locations (a total of eight 24-hour observations). The installation of such a system will also allow for individual slowing down (temporary shutting down) of wind turbines when cranes approaching an OWF at collision height are detected, thus further reducing the risk of collisions.

PARAMETER	TIMING	METHODOLOGY
Seabirds	The surveys should be conducted for one year **before the commencement of any work** belonging to the OWF implementation phase.	The route of a survey cruise should be planned in such a manner so that the count covers the 5-kilometre zone around the OWF boundaries, and to enable the assessment of changes in the density of birds present at different distances from the future wind turbines.
Marine mammals	6 months **before the commencement of the first** piling; continued during the **implementation phase and for 1 year of the OWF operation**.	Animal monitoring using passive acoustic monitoring with porpoise click detectors.
Chiropterofauna	Continuous 3-year monitoring **from the completion of the installation of the last wind turbine** during the first 5 years of operation	In line with current guidelines. The monitoring should be based on automated broadband recording of the activity of these mammals at the wind turbine towers, using recording devices with parameters compliant with the guidelines. The number of recording devices should not be fewer than 1 recorder per 5 turbines (rounded down to the nearest integer). Notably, bat mortality should be accounted for when automated systems for recording bird collisions/mortality are used at wind turbines.

11.10 Information on the results available for other monitoring surveys, which may be important for establishing responsibilities in this area

The environmental monitoring of the Polish part of the Baltic Sea is carried out as part of the 2020–2025 State Environmental Monitoring (SEM). It aims to provide knowledge on the water status for the purpose of taking measures to improve the environment and protect the Baltic Sea waters against pollution [SEM Strategic Programme, 2020]. Measurement results are made available by the CIEP on the CIEP INSPIRE – node of Infrastructure for CIEP Spatial Information.

Moreover, since 2015, the Monitoring of Marine Habitats and Species has been carried out, covering 8 species of fish and lampreys (sea lamprey, river lamprey, twaite shad, asp, weatherfish, spined loach, sabrefish and European bitterling), 4 species of marine mammals (harbour porpoise, grey seal, harbour seal and ringed seal) and 5 natural habitats connected to marine areas (Sublittoral sandbanks (1110); Estuaries (1130), Coastal lagoons (1150); Large shallow inlets and bays (1160) and Reefs (1170)). The results of the Monitoring of Marine Habitats and Species are collected and made available by the Chief Inspectorate for Environmental Protection in Warsaw.

Within the framework of SEM, as part of the task entitled 'Bird monitoring including Natura 2000 Special Protection Areas', a number of bird monitoring surveys is carried out, which may be important for establishing the obligations of monitoring the impact of the proposed Project, including [SEM, 2015]:

- the Flagship Bird Species Survey, covering the monitoring of twelve bird species with the characteristics of the so-called flagship species such as, the mute swan, the red-necked grebe, the black-necked grebe, the Eurasian bittern, the grey heron, the white stork, the western marsh harrier, the common crane, the black-headed gull, the common tern, the black tern and the rook;
- the Monitoring of Wintering Seabirds (MWS), covering the monitoring of species of average abundance and the abundant species of Anseriformes wintering in the Polish zone of the Baltic Sea, including primary species (the red-throated diver, the black-throated diver, the horned grebe, the red-necked grebe, the long-tailed duck, the velvet scoter, the common scoter, the black guillemot, the razorbill, and the common guillemot) as well as additional species (the great crested grebe, the European herring gull, the great black-backed gull, the common gull, and the black-headed gull).

The results of these monitoring surveys are also collected and made available by the Chief Inspectorate for Environmental Protection in Warsaw.

The ministry in charge of maritime economy collects data on the volume of fish catches carried out in PSA. The analysis of these data will enable the future assessment of the proposed Project impact on fishery.

The results of the monitoring surveys of Polish sea areas, based on the offshore survey stations situated near the Baltic East OWF Area, can be used for the determination of the status of environmental conditions of the sea basins related to the wind farm as reference data, at the same time offering a valuable complement to the survey data obtained from the direct monitoring surveys conducted in the Baltic East OWF Area in the pre-investment, implementation, operation and decommissioning phases.

In the perspective of several decades, for which the Baltic East OWF is planned, the survey results obtained as part of the monitoring conducted and the information on other activities carried out in the sea areas can be used to monitor the environmental impact of the Project. This is due to the fact that the scope of these monitoring surveys and information covers those components of the marine environment which the Project may affect directly and indirectly. In addition, the long-term series of data, will allow eliminating from the assessment the short-term changes in the environment resulting from the complex marine ecosystem characteristics, and not being a consequence of the proposed Project impact.

12 INDICATION IF THE PROPOSED PROJECT REQUIRES ESTABLISHING A LIMITED USE AREA

The issue of establishing limited use area (LUA) is regulated by the provisions of Article 135(1) of the Act of 27 April 2001 – Environmental Protection Law: "*If the environmental review or the environmental impact assessment required pursuant to the Act of 3 October 2008 on the provision of information on the environment and environmental protection, public participation in environmental protection and on environmental impact assessments or the post-implementation analysis show that, despite the application of technical, technological and organisational solutions available, the environmental quality standards outside the premises of the plant or other facility cannot be met, then a limited use area is established for a wastewater treatment plant, municipal waste landfill, composting plant, communication route, airport, overhead power line and substation, gas network facilities as well as a radio communication, radio navigation and radiolocation system*".

Among the above-mentioned elements, two planned for implementation within the framework of the Project, i.e. substations and radio communication, radio navigation and radiolocation installations, fall within the provisions of the aforementioned Article 135. Referring to the presented grounds for establishing a limited use area, based on the analyses conducted and their results, it should be stated that emissions from the above-mentioned facilities, such as noise or EMF emissions, will not cause environmental quality standards to be exceeded outside the Baltic East OWF Area (outside the area to which the Applicant has legal title). Furthermore, environmental quality standards for noise and EMF refer to the permanent presence of people in the vicinity of the emission source – in the case of the Project and its location in maritime areas, permanent presence of people is excluded.

13 COMPARISON OF THE TECHNOLOGICAL SOLUTIONS PROPOSED WITH THE TECHNOLOGICAL SOLUTIONS MEETING THE REQUIREMENTS REFERRED TO IN ARTICLE 143 OF THE ENVIRONMENTAL PROTECTION LAW

Pursuant to Article 143 of the Act of 27 April 2001 – *Environmental Protection Law* (consolidated text: Journal of Laws of 2024, item 54, as amended), technologies used in newly launched installations that are a source of environmental hazards should meet the following requirements:

- use of substances with a low hazard potential;
- efficient generation and use of energy;
- ensuring rational consumption of water and other raw materials as well as consumables and fuels;
- use of waste-free and low-waste technologies and possibility of waste recovery;
- indication of the type, range and volume of emissions;
- use of comparable processes and methods that have been successfully applied on an industrial scale;
- scientific and technical progress.

Due to the technological specificity of the implementation, operation and decommissioning phases as well as the conditions of operation in the marine environment, offshore wind farms require verification of these requirements at the project planning stage.

The structural elements of the Baltic East OWF will be made of materials neutral to sea water and the seabed. The basic condition for failure-free operation of the Baltic East OWF is the resistance to erosion, corrosion and chemical compounds activity which may occur in the water.

The efficiency of energy generation is one of the basic criteria for OWFs distribution, as well as the method of generated energy transmission to the National Power System limiting transmission losses. The overriding criterion of energy efficiency for offshore wind farms is to generate energy in a fully renewable way, without consuming energy resources, with obvious limitations related to environmental conditions – the windiness of a sea area.

In the case of this type of renewable energy sector, the actual efficiency of energy use involves non-returnable energy consumption for the production of OWF components (wind turbines and other facilities) and their installation at sea.

The consumption of water, materials, raw materials and fuels will take place during the implementation process (installation of successive wind turbines and laying of subsea cables) and during the decommissioning of the Baltic East OWF elements after they are technically worn. For a few dozen years of operation, wind turbines will require the use of consumable resources and fuels during servicing.

The emissions and their range will primarily concern the acoustic impact associated with the operation of wind turbines. They will not affect marine organisms significantly nor cause noticeable electromagnetic interactions.

Experiences related to the operation of wind turbines in the Baltic Sea allow the installation of the most efficient and proven solutions that meet the requirements of the most advanced technologies, resistant to the operating conditions of the marine environment at highly variable winds.

14 ANALYSIS OF POSSIBLE SOCIAL CONFLICTS RELATED TO THE PROPOSED PROJECT, INCLUDING THE ANALYSIS OF IMPACTS ON THE LOCAL COMMUNITY

When considering the likelihood of social conflicts related to the implementation of the Baltic East OWF, it was taken into account that the process of informing society about its implementation began many years ago during the development and consultation of strategic documents related directly or indirectly to the development of wind energy in the Baltic Sea. Below, there are several main strategic and planning documents that take into account the implementation of offshore wind farms in the Baltic Sea:

- Energy Policy of Poland until 2040 – Notice of the Minister of Climate and the Environment of 2 March 2021 on the energy policy of Poland until 2040 [Monitor Polski 2021, item 264];
- Maritime Policy of the Republic of Poland until 2020 (with perspective up to 2030) [Ministry of Infrastructure, Warsaw 2015] prepared by the Interministerial Group on Maritime Policy of the Republic of Poland, on the basis of the document 'Assumptions for the Maritime Policy of the Republic of Poland until 2020' of 14 September 2009;
- Spatial development plan for internal sea waters, territorial sea and exclusive economic zone, adopted by the Regulation of the Council of Ministers of 14 April 2021 (Journal of Laws of 2021, item 935, as amended);
- 2030 Pomorskie Voivodeship Development Strategy adopted by the Resolution no. 376/XXXI/21 of the Regional Council of the Pomeranian Voivodeship of 12 April 2021 on the adoption of the 2030 Pomorskie Voivodeship Development Strategy;
- 2030 Pomorskie Voivodeship Spatial Development Plan adopted by the Resolution of the Pomorskie Regional Assembly no. 318/XXX/16 of 29 December 2016 on the adoption of the new Pomorskie Voivodship Spatial Development Plan along with a Spatial Development Plan for the Tri-City Metropolitan Area constituting a part of the former.

For each of the above-mentioned strategic and planning documents, a strategic environmental impact assessment was carried out before the document was adopted, during which the draft documents together with environmental impact forecasts were subject to public consultation.

Another document that introduces the dialogue process – which should limit the occurrence of conflicts – and which addresses the issues of cooperation and sharing of the maritime area by groups of stakeholders, i.e. fisheries and offshore wind energy, is the Sectoral Agreement of 15 September

2021 for the development of offshore wind energy in Poland. The agreement aims to support the development of the offshore sector and ensure cooperation as well as the greatest possible participation of Polish entrepreneurs in the process of supplying resources and materials during the construction and operation of offshore wind farms.

The location of the Baltic East OWF Area results from the decision no. MFW/46.E.1 of the Minister of Infrastructure dated 29 September 2023, ref. DGM-3.530.20.2022, on the permit for the construction and use of artificial islands, structures and devices in the Polish Sea Areas. At the stage of the proceedings on issuing this decision, the governing body requested an opinion from the ministers responsible for economy, culture and national heritage, fisheries, environment, internal affairs and agriculture. Therefore, already at this stage, the needs of key stakeholders were taken into account and sources of possible conflicts related to the tasks carried out by these bodies or issues that these bodies were aware of and considered justified when taking a position were eliminated to a certain extent.

Press releases, social media posts and local media posts that appeared in connection with the process of preparation for the implementation of offshore wind farms were analysed. No signals prompting negative public feelings regarding this type of project were identified.

The proposed Project will also be subject to public consultations as part of environmental impact assessment procedure, both within the national procedure and, if necessary, also in the transboundary context. Pursuant to Article 30 of the EIA Act, the governing body will ensure, as part of the environmental impact assessment of the Project, the possibility of public participation in the procedure. Pursuant to Article 33(1) of the aforementioned EIA Act, the governing body conducting the proceedings will publicly announce information on the commencement of the environmental impact assessment of the Project, initiation of the proceedings, the subject of the decision to be issued in the case, the body competent to issue the decision and the body competent to issue opinions or agreements, the possibility of familiarising oneself with the necessary case documentation and the place where the documentation is made available for inspection, the possibility, method and place of submitting comments and motions, at the same time indicating the 30-day deadline for their submission and the body competent to consider the comments and motions.

Pursuant to Article 29 of the EIA Act, everyone has the right to submit comments and motions in proceedings requiring public participation. During the EIA procedure, information about the proposed Project is made available in order for the public to become familiar with the proposed Project.

Sources of possible social conflicts

Social conflict is a process of mutual influence of entities, in which there is an actual or imagined incompatibility of goals and interests. The aim of the influence is to force a change in the undertaken or planned actions of the other party [Słaboń 2008].

Social perception of the implementation and subsequent functioning of the Baltic East OWF may result from both objective factors (e.g. introduction of restrictions in the current use of the sea area, real negative impact on the state of the environment, possible future financial losses of specific groups using the sea area) and subjective factors (e.g. fear of reduced tourist potential). Thus, the reception by the local community may be negative and result in protests.

The causes of potential conflicts may include:

- fear of introducing restrictions on the sea area usage, such as: reduction of the fishing grounds, change in commercial fish stocks, decrease in catch volume, change of shipping routes that run through and fishing grounds within the area;
- fear of negative impact of the farm on landscape values;
- fear of diminished tourist potential;
- fear of decrease in the natural value of areas in the vicinity of the Project.

The above concerns of the local community, if not properly addressed, may in the future constitute a significant reason for social conflicts between local stakeholders and the Project Owner. However, in order to indicate a conflict, at least one of the parties mentioned must be in opposition to the Project Owner. The nature and scale of the conflict usually depend on the type, size and level of advancement of the project itself, and thus on the introduction of a change in the current use of the sea area as a result of the planned project.

A significant part of potential social conflicts in all types of projects is caused by the lack of sufficient knowledge about the project and its possible impacts, the lack of access to information about the project, as well as the presentation of unreliable information by the media or disinformation spread by the opponents of the project implementation. Therefore, it is extremely important to conduct activities at an early stage aimed at presenting reliable, complete and unambiguous information on the process of implementation and operation of the infrastructure, including on the possible impacts on the environment, society and economy, as well as the planned mitigation and, if necessary, compensatory measures.

The real factors that will occur and may give rise to conflicts are:

- the occurrence of nuisances related to the process of preparing and building the farm – the work of machines and devices, the erection of marine structures and increased ship traffic as well as the transport of large-size marine structures,
- impact on the natural environment of the Baltic Sea, the broadly defined environmental protection including the protection of birds;
- limitation of fishing grounds;
- impact on landscape and the Baltic East OWF visibility;
- impact on tourism in coastal municipalities;
- impact on the economy in coastal communes.

There is also a possibility of conflict with environmental organisations raising the issue of the Project impact on protected areas and valuable animal species (primarily birds and marine mammals).

The potential conflict concerning the planned Baltic East OWF may be underpinned by the following issues:

- possible hindrances to fishing in the sea area occupied by the farm, resulting from limited access to it and thus obstructions to free catches and transit through the farm area;
- incompatibility of the goals and interests of the parties – the goal indicated by the fishermen community is fishing and transit through the OWF area to further fishing grounds, as well as ensuring the presence of fish in the Baltic Sea;
- disruption in the environment that the OWF may cause.

The potential stakeholders (target groups) are:

- public administration and state institutions;
- local government units and institutions;
- trade organisations, including fishing organisations;
- national, regional and local public associations and organisations;
- potential suppliers, partners, and other offshore investors;
- scientific and research as well as design units;
- inhabitants of the area.

Social conflict is inextricably linked to the process of planning and implementing large-scale projects, including infrastructure projects; the emergence of conflicts is therefore a completely natural phenomenon that demonstrates public awareness and involvement in decision-making processes. Nevertheless, it is extremely important to avoid conflicts through appropriate pre-emptive actions, to minimise the number of conflict situations, in particular those resulting from the lack of knowledge about the proposed project and its effects, as well as to limit the escalation of conflicts that have arisen.

To this end, the Project Owner, already at the stage of preparatory work for submitting an application for a decision on environmental conditions, has undertaken parallel preparations for conducting a dialogue with the stakeholders and ensuring both reliable information and an appropriately fast and substantive response in the event of situations that may lead to the emergence of a conflict.

A very important action leading to increased acceptance for the implemented Project was conducting surveys aimed at comprehensive determination of the state of the environment in the area of the Project and in its potential impact area. This resulted in a reliable identification of the potential impacts of the Project, as well as planning adequate actions to eliminate, minimise or compensate for these impacts. The reliability of the data on the expected project impacts is a factor which significantly reduces the uncertainty of the local community and allows for building trust based on solid foundations.

When discussing the sources of potential conflicts related to the construction and operation of the farm, it is necessary to emphasise at the same time the positive aspects of this type of project for the local community:

- workplaces for the residents of coastal communes at the stages of implementation and the long-term operation of the OWF;
- impulse for the development of business activities related to the OWF maintenance;
- impact on tourism and perception of the OWF as a tourist attraction.

Properly used potential benefits will allow for partial elimination of potential nuisances.

15 INDICATION OF DIFFICULTIES RESULTING FROM TECHNICAL SHORTCOMINGS OR GAPS IN THE STATE OF THE ART ENCOUNTERED DURING THE PREPARATION OF THE REPORT

The identification of the environmental components, which may be affected by a wind farm in the Polish Sea Areas, is inconsistent. Some aspects, especially the biotic ones, are better identified, e.g. the occurrence of zoobenthos, and for some the information is scarce, e.g. the presence of bats over the sea areas. The surveys conducted for the EIA Report allowed detailing the information on the environment within the proposed Project area (**Appendix 1** to the EIA Report). This allowed developing a comprehensive environmental inventory, both in terms of abiotic and biotic components.

There is no information on the potential impacts of OWFs in the PSA, especially during the operation phase, e.g. regarding the phenomenon of underwater structure overgrowth, environmental effects of an artificial reef or behaviour of birds encountering above-water structures during flights. Thus far, no wind power stations have been erected in the Polish Sea Areas. Therefore, there is no experience nor detailed knowledge based on the results of surveys on the impact of this types of projects in the Polish Sea Areas.

16 SOURCES OF INFORMATION AND MATERIALS USED

16.1 Legislative acts

Agreement on the Conservation of Populations of European Bats (EUROBATS) (1991), London, 4th December 1991.

COUNCIL REGULATION (EU) 2019/1838 of 30 October 2019 fixing for 2020 the fishing opportunities for certain fish stocks and groups of fish stocks applicable in the Baltic Sea and amending Regulation (EU) 2019/124 as regards certain fishing opportunities in other waters

Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (OJ EU. L. 2018 No. 328, p. 82 as amended).

Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (codified version) (OJ EU. L. 2010 No. 20, p. 7 as amended). Regulation of the Council of Ministers of 14 April 2021 on the adoption of the spatial development plan of internal sea waters, territorial sea and the exclusive economic zone at a scale of 1:200 000 (Journal of Laws, item 935, as amended).

Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 establishing a framework for maritime spatial planning (OJ EU. L. 257, 2014, p. 135)- 'Directive 2014/89/EU'.

Directive (EU) 2023/1791 of the European Parliament and of the Council of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955 (OJ L 231, 20.09.2023)

Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (OJ EU. L. 1992, No. 206, p. 7 as amended).

Convention on the Conservation of Species of European Wild Flora and Fauna and their Habitats, Bern, 19 September 1979 (Journal of Laws 1996, No. 58, item 263, as amended).

Convention on the Protection of the Marine Environment of the Baltic Sea Area, done at Helsinki on 9 April 1992.- 'Helsinki Convention'.

Convention on the Conservation of Migratory Species of Wild Animals, Bonn, 23 June 1979 (Journal of Laws 2003, No. 2, item 17).

National Programme for the Protection of Marine Waters (NPOWM) adopted by the Regulation of the Council of Ministers of 11 December 2017 on the adoption of the National Programme for the Protection of Marine Waters OJ. 2017 item 2469

International Convention on the control of harmful anti-fouling systems on ships (OJ 2008 No. 134, item 851)

Spatial Development Plan for Polish Maritime Areas (SPPOM) established by the Ordinance of the Council of Ministers of 14 April 2021 on the adoption of the Spatial Development Plan for Internal Seas, Territorial Sea and the Exclusive Economic Zone at a scale of 1:200 000.

Pomeranian Voivodeship Spatial Management Plan 2030 (PZPWP) adopted by Resolution No. 318/XXX/16 of the Pomeranian Voivodeship Assembly of 29 December 2016.

Agreement on the Conservation of European Bat Populations, signed in London on 4 December 1991 (Journal of Laws 1999, No. 96, item 1112, as amended).

United Nations Framework Convention on Climate Change (UNFCCC), drawn up in New York on 9 May 1992, (Official Journal 1996 No. 53, item 238)

Regulation of the Minister of Infrastructure of 25 June 2021 on the classification of ecological status, ecological potential and chemical status and the method of classifying the status of surface water bodies, as well as environmental quality standards for priority substances (Journal of Laws 2021, item 1475).

Regulation of the Minister of Infrastructure of 25 November 2008 on the structure of Polish airspace and detailed conditions and use of that space (Journal of Laws 2019, item 619).

Regulation of the Minister of Infrastructure of 25 February 2021 on the adoption of an update of the set of environmental objectives for marine waters (Journal of Laws 2021, item 569)

Ordinance of the Minister of the Environment of 11 March 2005 on establishing the list of wild game species (Journal of Laws of 2023, item 2454). Regulation of the Minister of the Environment of 11 March 2005 on establishing the list of game animal species (i.e. Journal of Laws of 2023, item 2454). Regulation of the Minister of the Environment of 16 December 2016 on the protection of animal species (i.e. Journal of Laws of 2022, item 2380).

Regulation of the Minister of the Environment of 16 December 2016 on the protection of animal species (i.e. Journal of Laws 2022, item 2380).

Ordinance of the Minister of the Environment of 30 December 2002 on major accidents subject to reporting to the Chief Inspector of Environmental Protection (i.e. Journal of Laws of 2021, item 1555).

Regulation (EU) No 508/2014 of the European Parliament and of the Council of 15 May 2014 on the European Maritime and Fisheries Fund and repealing Council Regulations (EC) No 2328/2003, (EC) No 861/2006, (EC) No 1198/2006 and (EC) No 791/2007 and Regulation (EU) No 1255/2011 of the European Parliament and of the Council (OJ EU. L. 2014 No 149, p. 1 as amended).

COUNCIL REGULATION (EU) 2019/1838 of 30 October 2019 fixing for 2020 the fishing opportunities for certain fish stocks and groups of fish stocks in the Baltic Sea and amending Regulation (EU) 2019/124 as regards fishing opportunities in other waters.

COUNCIL REGULATION (EU) 2020/1579 of 29 October 2020 fixing for 2021 the fishing opportunities for certain fish stocks and groups of fish stocks in the Baltic Sea and amending Regulation (EU) 2020/123 as regards fishing opportunities in other waters (and subsequent TAC Regulations for 2022 and 2023).

Regulation of the Council of Ministers by the Regulation of 11 December 2017 on the adoption of the National Programme for the Protection of Marine Waters (Journal of Laws 2017, item 2469).

Strategic programme of state environmental monitoring for 2020-2025, Główny Inspektorat Ochrony Środowiska, Warsaw 2020

Resolution No. 783/LXIII/24 of the Sejmik of Pomorskie Voivodeship of 25 March 2024 on accession to the preparation of amendments to the spatial development plan of Pomorskie Voivodeship: https://pbpr.pomorskie.pl/plan-zagospodarowania-wojewodztwa/zmiana-planu-zagospodarowania-przestrzennego-wojewodztwa-pomorskiego/

Resolution No. XLVII/359/2022 of the Choczewo Commune Council of 29 March 2022 on adopting a change to the Choczewo Commune Spatial Development Conditions and Directions Study in part 2.

Resolution No.: 318/XXX/16 of the Sejmik of Pomorskie Voivodeship of: 2016-12-29 on the adoption of the new spatial development plan of Pomorskie Voivodeship and the spatial development plan of the Tri-City metropolitan area constituting its part.

UNFCCC (2015) Paris Agreement: https://www.consilium.europa.eu/media/21659/201512-euco-conclusions_pl.pdf

Act of 21 March 1991 on maritime areas of the Republic of Poland and maritime administration (consolidated text Dz. U. of 2023, item 60).

Act of 3 October 2008 on the provision of information on the environment and its protection, public participation in environmental protection and environmental impact assessments (Journal of Laws 2024, item 1112).

16.2 Databases

AIS-PL- vessel traffic data obtained from the Maritime Office in Gdynia for 2019,2023, broken down into six-month periods;

Baltic Sea IMGW PIB- Monitoring of Polish marine areas of the Baltic Sea https://baltyk.imgw.pl/?page=23&subpage=101

CSO, Local Data Bank 2022 https://bdl.stat.gov.pl/bdl/start

CSO, Environmental Protection 2023 www.stat.gow.pl

HELCOM WEB – A web portal providing a source of Helsinki Convention legislation, reports on maritime incidents, illegal emissions of oil and other hazardous substances, UXO location and transport data, CWA storage and shipping traffic data in the Baltic Sea- HELCOM AIS for the period 2021- 2022;

Data obtained from spatial information systems, e.g. CBDG, CRFOP, SIPAM, MIDAS

https://www.cmr.gov.pl/

https://rdsm.gios.gov.pl/pl/monitoring

https://www.emodnet-seabedhabitats.eu/

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