ESPOO report
for Offshore Wind Farms
in the BALTIC WEST area
OWF 14.E.1, OWF 14.E.2, OWF 14.E.3, OWF 14.E.4



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ISO 9001:2015 (Quality Management Systems)

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ISO 45001:2018 (Occupational Health and Safety Management Systems)



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Abbreviations and definitions

Table 1 Abbreviations and definitions

ABBREVIATION	DEFINITION
a.s.l.	Above sea level
AdBm	Acoustic Dampening Bubble Mitigation system
AINJ	Auditory injury caused by noise
AIS	Automatic Identification System, with which all vessels of gross tonnage above 300 Mg are equipped. It provides for the automatic exchange of data useful in avoiding collisions between vessels and identifying vessels for shore-based vessel traffic monitoring systems.
APV	Applicant's proposed variant (APV)
Baltic West area	The complex of Offshore Wind Farms in the Baltic West area, comprising four Projects: OWF 14.E.1, OWF 14.E.2, OWF 14.E.3, OWF 14.E.4
BASS	A type of standardised spring survey cruise conducted by all Baltic Sea states, aimed at providing data for estimating pelagic species stocks (Baltic Acoustic Spring Survey)
BIAS	Baltic Sea Information on the Acoustic Soundscape
Birds directive	Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (OJ EU L 20/7 of 26.01.2010)
BZT_5	Five-day biochemical oxygen demand
CDU	Centrally dispatched generating unit
C-POD/F-POD	Continuous Porpoise Detector / Full waveform capture Porpoise Detector
CRS	Close-range system
DBBC	Double air bubble curtain – a technology intended to limit the propagation of sound underwater (Double Big Bubble Curtain)
EEZ	Exclusive economic zone
EIA	Environmental impact assessment – a procedure forming part of the procedure for the issuance of an environmental decision, carried out by the authority competent to issue the decision
EIA Directive	Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment (OJ EU L 26/1 of 28.01.2012)
Espoo report	This document containing environmental impact assessment documentation pursuant to Article 4 of the Convention on Environmental Impact Assessment in a Transboundary Context, containing the scope of information consistent with Appendix II to the aforementioned Convention
EU	European union
EUROBATS	The Agreement on the Conservation of Populations of European Bats
G+	Global Offshore Wind Health and Safety Organisation
GUS	Central statistical office
Habitats directive	Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (OJ EU L 206 of 22.07.1992)
HDPE	High density polyethylene;
HELCOM	The executive body of the Baltic Marine Environment Protection Commission (Helsinki Commission)
HSD	Hydro sound damper
HVAC	High Voltage Alternating Current transmission system
HVDC	High Voltage Direct Current transmission system
IMO	International marine organisation
MASIS	Maritime administration spatial information system
MSIOUG	Marine Station of the Institute of Oceanography, University of Gdańsk
MSPL	Mean sound pressure level
MW	Megawatt – an SI unit of power

ABBREVIATION	DEFINITION
nCDU	Generating unit that is not a centrally dispatched unit
NM	Nautical miles
NRS	Noise reduction system
OSS	Offshore substation
OWF	Offshore wind farm
PAH	Polycyclic aromatic hydrocarbons
PCAI	Permit for the construction and use of artificial islands, structures and installations in Polish maritime areas within the meaning of the Act of 21 March 1991 on Maritime Areas of the Republic of Poland and Maritime Administration (consolidated text: Journal of Laws 2024, item 1125)
PCB	Polychlorinated biphenyls
PDD	Positive-detection day
PDM	Positive-detection minute
PEP2040	Poland's Energy Policy until 2040
PMA	Polish Maritime Areas within the meaning of the Act of 21 March 1991 on Maritime Areas of the Republic of Poland and Maritime Administration (consolidated text: Journal of Laws 2024, item 1125)
PTS	Permanent threshold shift
RAV	Rational alternative variant
RES	Renewable energy sources
ROV	Remotely operated vehicle
SDF	Standard Data Form for Natura 2000 sites
SEL	Sound exposure level
TOC	Total organic carbon
TTS	Temporary threshold shift in hearing

1 NON-TECHNICAL SUMMARY

This report concerns the transboundary environmental impact assessment of projects involving the construction of wind-powered electricity generation facilities – Offshore Wind Farms in the Baltic West area, to be implemented by the following companies:

- Energa MWF 1 sp. z o.o. – for development area 14.E.1,
- Energa OWF 2 sp. z o.o. – for development area 14.E.2,
- Orlen Neptun III sp. z o.o. – for development area 14.E.3,
- Orlen Neptun IV sp. z o.o. – for development area 14.E.4.

The report fulfils the requirements of the Espoo Convention, which regulates transboundary environmental impact assessment at the international level, and also takes into account the practice and experience associated with such assessments.

The group of projects entitled 'Offshore Wind Farms in the Baltic West area' comprises four adjacent offshore wind farms (OWF 14.E.1, OWF 14.E.2, OWF 14.E.3, OWF 14.E.4), for which separate national proceedings will be conducted to issue environmental decisions, including separate environmental impact assessment procedures within them. For the purposes of the transboundary impact assessment, however, a joint approach has been adopted. This approach is dictated by the assumption that the four farms form a single area of environmental pressure and that their impacts may accumulate and mutually reinforce one another. In addition to this, the proceedings for issuing the environmental decision for each project are being conducted at the same time and subjecting them to a joint transboundary assessment will ensure transparency and a clear understanding of the conditions and principles governing the implementation of the projects. This approach enables a reliable assessment of the full scope of impacts and increases the transparency of the transboundary consultations, in line with the objectives of the Espoo Convention.

In August 2025, the Polish side sent written notifications to potentially affected countries (Sweden, Denmark, Finland, Lithuania, Latvia, Estonia, Germany), in accordance with Article 3(1) of the Espoo Convention, providing information on the proposed implementation of the aforementioned group of projects under the name: Offshore Wind Farms in the Baltic West area, and on the initiation of the proceedings for the issuance of environmental decisions in this regard. In response to the notification, the interested States (Denmark, Sweden and Germany) officially expressed their wish to participate in the transboundary procedure and submitted their comments and requests regarding the scope of the planned environmental analyses. The ESPOO Report fully addresses all issues and

requests raised by the above-mentioned States in the course of the consultations held to date, as discussed in detail in Chapter 12.

The construction of the Offshore Wind Farms in the Baltic West area concerns a group of projects that are strategic from the point of view of Poland's energy security and forms part of the policy of increasing the share of electricity generated from renewable energy sources. The country's energy policy assumes the construction of offshore wind farms with a total capacity of up to 5.9 GW within the Polish Exclusive Economic Zone (EEZ) by 2030, with potential for approximately 11 GW by 2040.

It should also be noted that these projects are in line with the direction of measures being undertaken by the Baltic Sea countries, which confirms their activity in the field of offshore wind energy.

The projects are located within the Exclusive Economic Zone (EEZ) of the Republic of Poland, off the localities of Niechorze, Mrzeżyno and Dźwirzyno, at a distance of approximately 26 km to approximately 37 km from the coastline, depending on the location of each of the offshore wind farms within the entire Baltic West complex.

The scope covers the construction, operation and decommissioning of each of the four offshore wind farms, together with the associated technical, measurement and service infrastructure. The proposed Projects will consist of the following main components:

- wind turbines consisting of a nacelle with a rotor and a tower, together with single-support foundations (monopile) or multi-support foundations (tripod, quadropod, jacket) or gravity-based structures (GBS), together with a transition piece (where this is not an integral part of the foundation);
- offshore substations (OSS);
- internal power and ICT cables, together with accessories.

The proposed Baltic West area will consist of a maximum of 273 offshore wind turbines, a maximum of 8 offshore substations, and internal offshore power cables with a total length of up to 1100 km.

In order to gain a detailed understanding of the baseline environmental conditions, enabling the proper identification of potential impacts, analyses of available data and extensive, multi-seasonal environmental surveys were carried out in the years 2022–2026 within the area of the proposed farms and the area covered by the anticipated impacts. These surveys covered the following areas:

- Abiotic elements: geophysical and geological analyses (including seabed morphology and identification of raw materials and mineral deposits), hydrological and meteorological measurements, and analyses of climatic conditions and climate change risk, detailed

analyses of the physicochemical properties of water and bottom sediments, an assessment of air quality based on information obtained from available numerical model data, and continuous monitoring of the underwater ambient noise level.

- Biotic elements: mapping of benthic habitats, inventories of phytobenthos and macrozoobenthos, year-round surveys of ichthyofauna (fish and ichthyoplankton), acoustic and visual monitoring of marine mammals (harbour porpoises and seals), advanced surveys of seabirds and migratory birds (including using vertical and horizontal radar), monitoring of bat activity, and analysis of connections with protected areas (Natura 2000).
- Socio-economic conditions: a review of underwater cultural heritage and identification of potential archaeological sites for inventory during preparation for project implementation (based on an analysis of bathymetric and sonar data), as well as analyses of the use of the marine area, including shipping, commercial fisheries and existing technical infrastructure.

The environmental surveys form the basis for describing the baseline environmental conditions and assessing the potential impact of each Project on the environment, taking into account transboundary issues.

The scope of the environmental impact assessment carried out took into account the requirements of Polish legislation, as well as the expectations of affected parties expressed in their responses to the notifications, in accordance with Article 3 of the Espoo Convention.

The comprehensive environmental impact assessment carried out has shown the possibility of transboundary impacts occurring. These concern the following elements:

- Water and bottom sediment quality: A transboundary impact may occur only in emergency situations, such as a ship collision resulting in an oil spill. However, the probability of such events is assessed as very rare, and owing to the implementation of rigorous response plans, the significance of this impact is moderate. The phenomenon of sediment plume dispersion from construction works was also classified as a possible transboundary impact, due to the proximity of the Project area to the boundaries of the exclusive economic zones of other states. The impact assessment showed that this will be a negligible phenomenon.
- Ichthyofauna and marine mammals (harbour porpoises and seals): The most significant impact during the construction phase is the emission of underwater impulsive noise during the piling of turbine foundations. Owing to the high sensitivity of marine mammals (particularly the harbour porpoise, for which the nearby German waters constitute an important breeding area), this noise, without appropriate mitigation measures, could cause behavioural reactions with a significant transboundary range, and even hearing damage.

- Seabirds and migratory birds: The presence of the farm infrastructure will generate a barrier effect for passing birds and a risk of collision with operating wind turbines.
  Although the change in flight routes will lengthen the migration only slightly, these phenomena, considered as a whole and cumulatively, have a transboundary range. They were assessed as ranging from negligible to moderate, depending on the sensitivity of the given species group.
- Bats: The operating rotors will pose a collision and barotrauma risk to migratory bats (migrating from, among other places, Scandinavia), particularly during the peak of autumn migration. The significance of this impact was assessed as moderate.
- Protected areas: The proposed wind farms are located outside the boundaries of Natura 2000 areas, which effectively reduces the risk of direct impact on the conservation objectives and subjects of protection in the territories of neighbouring states (Germany, Denmark and Sweden). The preliminary assessment showed that the only factor that could lead to significant transboundary impacts on foreign protected areas is underwater impulsive noise generated during the construction phase (during piling), which may cause behavioural reactions in marine mammals and fish. The Project will also have an indirect impact on seabirds from Natura 2000 areas, causing behavioural changes in the form of area avoidance and forced modification of flight routes. However, these impacts are short-term, reversible and spatially limited, and will therefore not lead to the loss or deterioration of habitats, nor will they threaten the coherence and integrity of the Natura 2000 network. Ultimately, the impact of the Project on individual foreign protected areas was assessed as negligible or, at most, of low importance.

In order to eliminate or significantly reduce the above impacts (including transboundary impacts), the Investor has provided for the application of a wide range of mitigation measures:

- Noise Reduction System (NRS): This will be mandatorily applied during the driving of foundation piles. It includes a procedure of gradually increasing strike energy (the so-called soft-start) together with the simultaneous use of advanced physical damping systems, such as a double big bubble curtain (DBBC) combined with a close range system (CRS), using, among others, HSD (Hydro Sound Damper) dampers or AdBm curtains. This solution will minimise the risk of hearing damage to marine mammals and fish, effectively preventing exceedances of the TTS (Temporary Threshold Shift) and AINJ (Auditory Injury) thresholds, and will also significantly reduce the disturbance zone.

- Time and organisational restrictions on works: These include adjusting the construction schedule, including limiting simultaneous piling at several Baltic West locations during the summer season (particularly in its southern part), in order to avoid the overlapping of behavioural response zones for harbour porpoises and seals. In addition, continuous environmental supervision (marine mammal observers – MMOs, and ornithological supervision) will be introduced during the construction stage. If marine mammals are detected within the works zone, or if aggregations of sensitive bird species appear (e.g. sea ducks, divers, auks) within a radius of 1.5 km from the piling site – particularly during the migration and wintering period critical for birds (from November to April) – the procedures provide for the commencement of piling to be postponed until these animals have left the area.
- Risk reduction for birds and bats: This involves the use of solutions limiting the emission of strong, artificial light that attracts nocturnal migrants (including reducing upward-directed lighting and limiting it solely to the minimum required for health and safety and navigational requirements). If the results of operational monitoring, in accordance with the adopted methodology, indicate that intensive crane migration is taking place over the offshore wind farm area at collision height, the farms will be equipped with a detection-and-response system enabling selected wind turbines to be slowed down (the so-called temporary shutdown system) during crane migration periods.
- Pollution prevention: This includes the use of appropriate vessels whose hulls are not coated with highly toxic anti-fouling paints containing organotin compounds (TBT). In addition to this, the Investor is required to implement rigorous safety procedures (in accordance with the MARPOL convention) and to develop and approve detailed rescue plans and "Hazard and Pollution Control Plans", ensuring an immediate response in the event of any oil spills.

To sum up, the comprehensive environmental impact assessment carried out, supported by advanced modelling (among other things, noise propagation and collision risk) and the results of the baseline surveys, has clearly demonstrated that, with consistent implementation of the proposed mitigation measures, the construction of the Offshore Wind Farms in the Baltic West area will not cause any significant adverse effects on the environment, including in transboundary terms.

2 INTRODUCTION

2.1 Information about the document

The content of this report has been prepared as part of the ongoing national environmental impact assessment of the project. The national assessment is being conducted in accordance with the procedure set out in the Polish Act of 3 October 2008 *on the Provision of Information on the Environment and its Protection, Public Participation in Environmental Protection, and on Environmental Impact Assessments*, which implements the provisions of Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 *on the Assessment of the Effects of Certain Public and Private Projects on the Environment* (hereinafter: the EIA Directive).

The national environmental impact report contains all the elements required under Polish and EU legislation, in particular:

1) a description of the project, containing information on the location, design, size and other relevant features of the project;
2) a description of the potential environmental impacts of the project, including impacts cumulative with other projects;
3) a description of the features of the project and the measures envisaged to avoid, prevent or reduce any significant adverse environmental effects, and, where possible, to offset such effects;
4) a description of the reasonable alternatives studied by the Investor which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment;
5) any other information necessary for the proper identification of the possible environmental effects of the project;
6) a non-technical summary.

The assessment of possible significant environmental effects was carried out in relation to all environmental elements specified in Article 3 of the EIA Directive.

At all stages of the work related to the environmental impact assessment, the Investor will ensure that all interested parties have access to information on the actions being taken. All significant decisions taken in the matter will be made public. In addition to this, within the national procedure, the environmental impact report will be subject to review by the competent administrative authorities, and, at a further stage of the proceedings, will be subject to consultations, in which the

opportunity to submit comments and obtain explanations will be provided to all interested sections of the public.

This report, concerning the transboundary environmental impact assessment of projects involving the construction of wind-powered electricity generation facilities under the name Offshore Wind Farms in the Baltic West area, fulfils the requirements of the Espoo Convention, which regulates transboundary environmental impact assessment at the international level. In accordance with Article 4 of the Convention, the Party of Origin should prepare and provide the Affected Party with environmental impact assessment documentation. In the case of the project that is the subject of this report, the Party of Origin is Poland, while the Affected Parties are the states which may be affected by the impact of the proposed activity and which have expressed their intention to participate in the transboundary environmental impact assessment. In the case of this procedure, these are: Germany, Denmark and Sweden.

Chapters 3–7 of this report present basic information on the Offshore Wind Farms in the Baltic West area project, such as a description of the project, the legal framework and mechanisms of the Espoo process, and a chapter on risk assessment and the assessment methods applied. The main part of this report is the environmental impact assessment in the transboundary context, contained in Chapter 8. The assessment chapters are divided according to the environmental or socio-economic elements that may act as receptors of the project's impacts. This chapter presents the results of the impact assessment for individual receptors, together with information on the resulting transboundary effects for the Swedish, Danish and German sides. A separate chapter is devoted to the assessment carried out in relation to Natura 2000 areas, their conservation objectives, and the legal principles governing their protection in this regard. The results of the assessment are summarised in the conclusions in Chapter 12. The findings of the report and the results of the Espoo procedure form an integral part of the environmental impact assessment of the proposed Projects.

2.2 Description and justification of the implementation of the project

The proposed complex of projects entitled: Offshore Wind Farms in the Baltic West area (hereinafter: the Baltic West Area), assessed in this document in terms of transboundary impacts, consists of four offshore wind farms: OWF 14.E.1, OWF 14.E.2, OWF 14.E.3 and OWF 14.E.4, which will be assessed under the national procedure within separate proceedings for the issuance of environmental decisions. Notwithstanding the above, bearing in mind the fact that the four adjacent projects form a single common area of environmental pressure, and that their impacts accumulate, may mutually reinforce one another and lead to threshold effects, it was assumed that, for the purposes of the transboundary impact assessment, it is appropriate to present their impact in

cumulative terms, which will enable an assessment of the full scope of the environmental pressure of the proposed complex of Projects. It was considered that a single report would increase the transparency of the transboundary consultations, facilitate the assessment of the actual level of impact and the analysis of effects by the Affected States, and thereby better fulfil the objectives of the Espoo Convention.

This approach is fully justified on the merits and allows the effects of the Project to be captured on a regional scale. The projected, cascading schedule of construction works, spread over a period of 7 years, generates a long-lasting pressure that is sequentially transferred onto mobile fauna (in particular ichthyofauna, marine mammals and avifauna), which precludes a reliable assessment of the projects separately. In the absence of final logistical and contractual strategies, the application of an envelope (Worst-Case Scenario) approach for the entire Baltic West Area simultaneously allows for the use of unified mathematical models, which guarantees the Affected States an objective picture of the maximum scale of potential impacts. Furthermore, during the operational phase, the presence of several hundred wind turbine structures will transform an extensive area of open sea into a mosaic system of hard-substrate habitats and will generate a cumulative spatial barrier effect for migrating and foraging birds. This makes the simultaneous assessment of all four projects a key element in the protection of the international natural resources of the Baltic Sea.

The Baltic West Area is a strategic project from the point of view of Poland's energy security, while also constituting the implementation of measures aimed at increasing the share of electricity generated from renewable energy sources. The Poland's energy policy assumes the construction of offshore wind farms with a total capacity of up to 5.9 GW within the Polish Exclusive Economic Zone (EEZ) by 2030, with potential for approximately 11 GW by 2040.

An important premise for the implementation of the Project is the possibility of generating electricity using a natural source while avoiding the emission of pollutants into the atmosphere. Under the conservative assumption of a 40% capacity utilisation factor and a 55-year operational lifetime, an offshore wind farm with a maximum capacity of, for example, 1000 MW could generate 192.7 TWh/693.7 PJ of electricity, which would avoid the emission of approximately 70 060 000 Mg of CO_2, approximately 944 000 Mg of SO_2, approximately 127 000 Mg of nitrogen oxides, and approximately 2 260 000 Mg of particulate matter in lignite-fired power plants [EEA, 2008].

These indicators for the projects under analysis constitute an important element in Poland's implementation of international regulations and commitments at the global and regional level. This action contributes to the limitation of impacts which, owing to their nature, may affect the environmental conditions of other states.

Among the key regulations, the following should be noted in particular:

- The United Nations Framework Convention on Climate Change, signed in 1992 in Rio de Janeiro and ratified by Poland in 1994, the objective of which is to stabilise greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous changes to the climate system;
- The Paris Agreement, adopted in 2015, constituting the overarching, multilateral instrument governing states' commitments in the field of climate policy, the aim of which is to limit the increase in the global average temperature to well below 2°C above pre-industrial levels. The Agreement was adopted by Poland in 2016.

The proposed projects, involving the generation of electricity from a renewable energy source – wind – in marine areas, are in line with the objectives of the above regulations, as well as with Poland's energy policy, contributing to a reduction in adverse environmental impacts and a reduction in greenhouse gas emissions from the energy sector. This is consistent with the EU's climate and energy policy for the horizon up to 2030 (the climate and energy package), the primary objectives of which are:

- reducing greenhouse gas emissions by at least 40% relative to 1990 levels;
- ensuring that renewable sources account for at least a 32% share of energy generated (the original target of at least 27% was revised in 2018);
- improving energy efficiency by at least 32.5% (the original target of at least 27% was revised in 2018).

The proposed projects, through the generation of energy from a renewable source and the simultaneous reduction of CO_2 emissions, directly contribute to two of the European Union's three objectives in this area.

The proposed projects in the Baltic West area also contribute to the objective of the EU's long-term strategy 'Climate Neutrality by 2050', adopted in November 2018 – achieving net-zero greenhouse gas emissions by 2050 – and to the idea of the European Green Deal. They also fulfil the assumptions of the EU strategy for investment in clean energy, adopted on 10 March 2026, aimed at developing renewable energy sources, transforming the energy system, and increasing energy security.

3 ESPOO CONVENTION

3.1 The ESPOO Convention

The 'Convention on Environmental Impact Assessment in a Transboundary Context of 25 February 1991' (the Espoo Convention) sets out the obligations of Contracting Parties to assess the environmental impact of certain activities at an early stage of project planning. It also imposes on States a general obligation to notify and consult one another on all major projects under consideration that are likely to have a significant adverse transboundary environmental impact. Under the Espoo Convention, transboundary impact means 'any impact, not exclusively of a global nature, within an area under the jurisdiction of a Party caused by a proposed activity the physical origin of which is situated wholly or in part within the area under the jurisdiction of another Party'. The Party of origin is the Contracting Party or Parties to the Convention under whose jurisdiction the proposed activity is envisaged to take place. In this case, this is Poland. The affected Party is the Contracting Party or Parties to the Convention likely to be affected by the transboundary impact of the proposed activity. With respect to the Baltic West Area project, these are Denmark, Sweden and Germany. The Convention obliges the Party of origin to notify, in accordance with the provisions of the Convention, the affected Parties of a proposed activity that is likely to cause a significant adverse transboundary impact.

3.2 The Espoo consultation process

The consultation process provided for in Articles 3–6 of the Espoo Convention is coordinated by the Espoo focal points in each Party of origin. The consultation process consists of the following main stages:

- Notification pursuant to Article 3: In the case of a proposed activity listed in Appendix I that is likely to cause a significant adverse transboundary impact, the Party of origin is required, for the purpose of ensuring adequate and effective consultations under Article 5, to notify any Party to which it refers, that it may be an affected Party as early as possible and no later than when informing its own public about that proposed activity.
- Preparation of environmental impact assessment documentation (the Espoo Report) pursuant to Article 4: the Party of origin is required to provide the affected Party, as appropriate, through a joint body if any, with the environmental impact assessment documentation. The Parties concerned shall arrange for distribution of the documentation to the authorities and the public of the affected Party in the areas likely to be affected, and for the submission of comments to the competent authority of the Party of origin, either directly

to this authority or, where appropriate, through the Party of origin, within a reasonable time before the final decision is taken on the proposed activity.

- Consultation pursuant to Article 5: after the environmental impact assessment documentation has been prepared, the Party of origin is required, without undue delay, to enter into consultations with the affected Party concerning, inter alia, the potential transboundary impact of the proposed activity and measures to reduce or eliminate its impact.

  Such consultations may relate to: (a) possible variants to the proposed activity, including the no-action variant, and possible measures to mitigate significant adverse transboundary impact and to monitor the effects of such measures at the expense of the Party of origin; (b) other forms of possible mutual assistance in reducing any significant adverse transboundary impact of the proposed activity; and (c) any other appropriate matters relating to the proposed activity. At the start of the consultation process, the Parties shall agree on a reasonable time-frame for the duration of the consultation period. Any such consultations may be conducted through an appropriate joint body, where one exists.
- Final decision pursuant to Article 6: In taking the final decision on the proposed activity, the Parties are required to duly take into account the outcome of the environmental impact assessment, including the environmental impact assessment documentation, as well as the comments thereon received pursuant to Articles 3 and 4 and the outcome of the consultations referred to in Article 5. The Party of origin is required to provide to the affected Party the final decision on the proposed activity, together with the reasons and considerations on which it was based. If additional information on the significant transboundary impact of the proposed activity, which was not available at the time a decision was taken with respect to that activity and which could have materially affected the decision, becomes available to a Party concerned before work on that activity commences, that Party shall immediately inform the other Party or Parties concerned. Consultations regarding the need to revise the decision may be held at the request of one of the Parties concerned.

The consultation process and the content of the environmental impact assessment documentation prepared for the Baltic West Area project take into account the recommendations issued by the United Nations Economic Commission for Europe [UNECE, 1996] and the European Commission [European Commission, 2013].

The consultation process was initiated in August 2025, when the Polish side sent written notifications to the countries situated on the Baltic Sea, in accordance with Article 3(1) of the Espoo Convention.

The countries notified were:

- Denmark,
- Estonia,
- Finland,
- Lithuania,
- Latvia,
- Germany,
- Sweden.

All of the above-mentioned countries responded, and Sweden, Denmark and Germany expressed their wish to participate in the transboundary environmental impact assessment process.

A summary of the responses received is presented in table [Table 2].

Table 2 Summary of responses from the notified Parties

COUNTRY	SUBJECT	DATE
Denmark	Energy Agency	10.09.2025
	Danish Defence Command	10.09.2025
	Danish Agency for Green Transition and the Aquatic Environment	11.09.2025
Estonia	Ministry of Climate	04.09.2025
Finland	Finnish Environment Institute	25.09.2025
Lithuania	Ministry of Environment	29.09.2025
Latvia	Energy and Environment Agency	10.09.2025
Germany	State Fisheries Association of Schleswig-Holstein	03.09.2025
	NABU	11.09.2025
	State Office for Agriculture and Environment of Western Pomerania	12.09.2025
	Federal Agency for Nature Conservation	19.09.2025
Sweden	Swedish Geotechnical Institute	no date on the document
	BirdLife Sverige	26.08.2025
	Swedish Meteorological and Hydrological Institute	29.08.2025
	Swedish University of Agricultural Sciences	09.09.2025
	Swedish Pelagic Federation	09.09.2025
	Gotland County Administrative Board	11.09.2025
	Swedish Environmental Protection Agency	15.09.2025

4 DESCRIPTION OF PROJECTS

The proposed undertaking consists of a complex of projects involving the construction and operation of Offshore Wind Farms in the Baltic West area.

This complex comprises four individual projects: OWF 14.E.1, OWF 14.E.2, OWF 14.E.3 and OWF 14.E.4, implemented for the purpose of generating electricity from a renewable energy source – wind.

The scope covers the construction, operation and decommissioning of each of the four offshore wind farms, together with the associated technical, measurement and service infrastructure. The proposed Projects will consist of the following main components:

- Wind turbines consisting of a nacelle with a rotor and a tower, together with single-support foundations (monopile) or multi-support foundations (tripod, quadropod, jacket) or gravity-based structures (GBS), together with a transition piece (where this is not an integral part of the foundation);
- offshore substations (OSS);
- internal power and ICT cables, together with accessories.

The wind turbines, together with the substations and internal cable lines, will be embedded in or founded on the seabed.

Adopting the boundary conditions concept, the basic parameters for the Applicant's Proposed Variants were adopted for each of the four wind farms comprising the Baltic West OWF [Table 3].

Table 3 Basic OWF parameters for the Applicant's Proposed Variant [source: own study]

PARAMETER	UNIT	VALUE				
		14.E.1	14.E.2	14.E.3	14.E.4	Baltic West Area
Maximum number of wind farms	-	54	59	80	80	273
Rotor diameter (values: minimum–maximum)	m	236-350	236-350	236-350	236-350	236-350
Total maximum cable length between wind turbines and the OSS	km	210	210	332	348	1100
Number of offshore substations	pcs.	max. 2 HVAC max. 1 HVDC	max. 2 HVAC max. 1 HVDC	max. 2 HVAC max. 1 HVDC	max. 2 HVAC max. 1 HVDC	max. 8 HVAC max. 4 HVDC

4.1 Location of the Project

The proposed projects are to be implemented in the north-western part of the Polish exclusive economic zone (EEZ), off the localities of Niechorze, Mrzeżyno and Dźwirzyno [Table 4, Figure 1].

Table 4 Location and area of the OWFs for the Applicant's Proposed Variant [source: own study]

PARAMETER	UNIT	VALUE				
		14.E.1	14.E.2	14.E.3	14.E.4	Baltic West Area
Area	km²	82.44	91.80	125.89	147.69	447.82
Approximate distance from the coastline	km	26	33	37	30	26

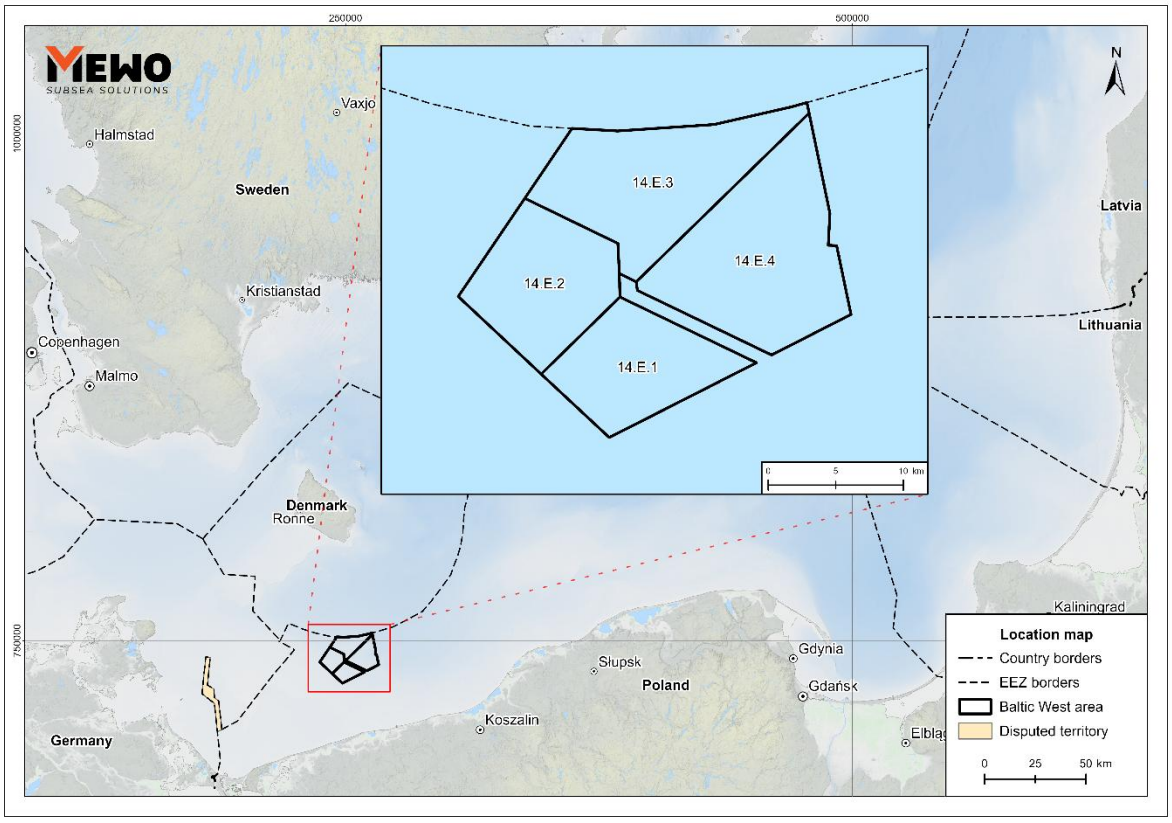


Figure 1 Location of the projects within the Baltic West Area [source: own study]

The distances of the Baltic West Area from the EEZ boundaries of other states are as follows:

- 0 km – from the Danish EEZ;
- over 14 km from the German EEZ;
- over 82 km from the Swedish EEZ;

4.2 Marine environmental surveys

4.2.1 Purpose and type of surveys

The surveys covered the area intended for construction at Baltic Sea for each of the four Offshore Wind Farms, together with the surrounding buffer. The boundaries of the buffer were defined on the basis of the potential range of the project's impact on individual environmental components, while applying the precautionary principle. For this reason, the width of the buffer varied and was adapted to the specific characteristics of the environmental element being studied.

Surveys of abiotic and biotic elements were carried out. The surveys involved measurements and observations of the marine environment. They were carried out during survey vessel cruises and observation flights, within the area of each Project and within the area of its potential impact, in the years 2022–2026.

The surveys, measurements and observations were supplemented by an analysis of available literature data, including archival maps and survey results made available by the Investor or by other entities, as well as the results of other environmental impact assessments carried out, in particular for similar projects proposed or implemented in the Baltic Sea, from which data and information could be relevant to this assessment.

On the basis of desk-based analyses of available source data (including, among others, Central Statistical Office (GUS) statistical databases, fishing registers and vessel traffic monitoring systems), the socio-economic conditions relevant to the implementation of the projects were also identified and determined.

The surveys and analyses covered the following scopes:

- an analysis of the geological structure and the occurrence of raw materials and mineral deposits (based on archival and literature data);
- ambient acoustic background;
- physicochemical surveys of water;
- physicochemical surveys of bottom sediments;

- meteorological, hydrodynamic and hydrophysical conditions;
- climatic conditions (including climate change risk) and an assessment of air quality;
- phytobenthos;
- macrozoobenthos;
- ichthyofauna;
- marine mammals;
- marine and migratory avifauna;
- chiropterofauna (bats).

The environmental surveys formed the basis for describing the baseline environmental conditions and assessing the possible impact of the projects on the environment.

The environmental survey results obtained provided a complete data set of the relevant representativeness, temporal and spatial resolution and allowing the environmental impact assessment of the projects to be carried out.

The periods and frequency of the surveys carried out for individual environmental elements resulted from their specific nature and temporal variability, and took into account the phenological periods of living nature elements and the survey methodologies commonly applied to them. The surveys, to the extent that they were carried out, also correspond to the practice applied for this type of project. The spatial ranges of the surveys of individual elements were based on the assumed ranges of the Projects' potential impact on these elements at each stage of their implementation.

It should additionally be noted that the spatial scope of the surveys took into account the position of the national scoping authority, including with regard to the spatial scope of geophysical, macrozoobenthos and ichthyofauna surveys, and resulted from national conditions. The surveys carried out provided information and knowledge about the elements studied to a degree enabling the environmental impact assessment to be carried out to the extent necessary to determine the impact of the projects on the environment, also taking into account the territory of other states.

4.2.2 Survey methodology

The methodologies applied during the surveys of the environmental elements relevant from the point of view of the potential impacts of each OWF are briefly discussed below. A full description of the methodologies is provided in Appendix 1 to the national EIA Report for each of the projects.

4.2.2.1 Abiotic elements – analyses of geological surveys, occurrence of raw materials and deposits

The analysis of the geological structure and hydrographic conditions of the surveyed area was carried out on the basis of primary data obtained directly by the Contractor, as well as using archival state data, maps and industry literature.

The following source materials were integrated and analysed as part of the work:

- Data obtained by the Contractor: digital side scan sonar (SSS) mosaics and high-resolution bathymetric data from a multi-beam echosounder (MBES).
- State spatial data resources: databases (in .shp format) made available under public information access procedures by the Chief Inspectorate of Environmental Protection (CIEP), the relevant Maritime Office (MO), the Navy Hydrographic Office (NHO) and the National Maritime Museum in Gdańsk (NMM).
- Archival cartographic studies and scientific literature: key monographic and cartographic publications on the geological structure of the seabed [including Gudelis and Jemielianow, 1982; Ryka, Dadlez, 1995; Dadlez, 1995; Dadlez et al., 1995; Uścinowicz, 1995; Kramarska et al., 1999].

An interdisciplinary compilation of remote sensing data (SSS, MBES) with archival geological profiles and spatial information from maritime and environmental administration authorities enabled a comprehensive assessment of the geological structure, as well as of the potential for the occurrence of raw materials and mineral deposits in the Project area.

4.2.2.2 Abiotic elements – measurements of the physicochemical properties of sediments

For the purpose of measuring and assessing the physicochemical properties of bottom sediments, mapping of surface sediment types was carried out first, using hydrographic data, mainly side scan sonar (SSS) mosaics and multi-beam echosounder (MBES) bathymetric data, made available under public information access procedures by the Chief Inspectorate of Environmental Protection (CIEP), the Maritime Office (MO), the Navy Hydrographic Office (NHO) and the National Maritime Museum in Gdańsk (NMM).

Measurement and survey work involving the collection of bottom sediments within the Baltic West area was carried out in 2025 and was divided into two main campaigns:

- The summer campaign for the entire Baltic West area lasted from 27 August to 3 September 2025.

- The winter campaign for the entire Baltic West area was carried out from 8 December to 21 December 2025.

Bottom sediment samples were collected using a Van Veen grab. The sampling position was recorded on an ongoing basis using a GPS system, and depth was measured using an echosounder.

The collected bottom sediments were analysed for the content of organic matter, contaminants and trace elements:

- Basic physicochemical parameters: the average moisture content of the sediments, bulk density and organic matter content were determined.
- Nutrients: total nitrogen and phosphorus concentrations were measured. The methodology focused largely on isolating the so-called labile (bioavailable) phosphorus, i.e. the form susceptible to being released back into the seawater as a result of mineralisation or redox processes.
- Persistent Organic Pollutants (POPs): the sediments were tested for the presence of polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), withdrawn antifouling agents such as tributyltin (TBT), and mineral oils.
- Heavy metals and metalloids: concentrations of, among others, arsenic (As), lead (Pb), copper (Cu), zinc (Zn), nickel (Ni), cadmium (Cd), chromium (Cr) and mercury (Hg) were tested. Not only was the total metal content examined, but an assessment was also made of what proportion of it occurs in the so-called mobile form.
- Radionuclides: radioactivity measurements were carried out by testing the activity of the caesium-137 (^{137}Cs) isotope.

To assess the quality of the sediments and the impact of the Project, a three-tier method of interpreting the measurement data obtained was applied:

- Comparison with legal standards: The measured concentrations of metals and POPs (PAHs, PCBs) were compared directly with the permissible values set out in national legislation. The absence of exceedances of these standards was the basis for classifying the bottom sediments as ‘clean’.
- Comparison with the environmental background: The results obtained were compared with long-term data from the State Environmental Monitoring system and with the literature (e.g. the geochemical characteristics of sandy sediments in the southern Baltic Sea) in order to check whether nutrient and pollutant levels deviate from natural concentrations.

- Simulation of remobilisation during construction: The density, moisture content and labile-form concentration data obtained from the measurements were used to calculate the pollutant loads that could be released into the water during the works. For this purpose, the mathematically predicted volume of sediment that would be disturbed as a result of driving and drilling foundation piles, laying cables using jetting or ploughing methods, and the anchoring of jack-up vessels, was measured.

4.2.2.3 Abiotic elements – measurements of the physicochemical properties of water

The main purpose of the work was to examine the physical, chemical and physicochemical properties of the waters within the area of the proposed construction of the Baltic West offshore wind farms. The surveys were based on a uniform measurement grid with a density of 1 station per 5 km², which ensured the representativeness of the results for the entire sea area. A total of 90 measurement and survey stations were designated, distributed across the areas of the proposed Project [Figure 2]. The survey methodology and water quality assessment were based on the recommendations of the Helsinki Commission (HELCOM guidelines) and on national regulations concerning the monitoring and classification of uniform parts of surface water bodies.

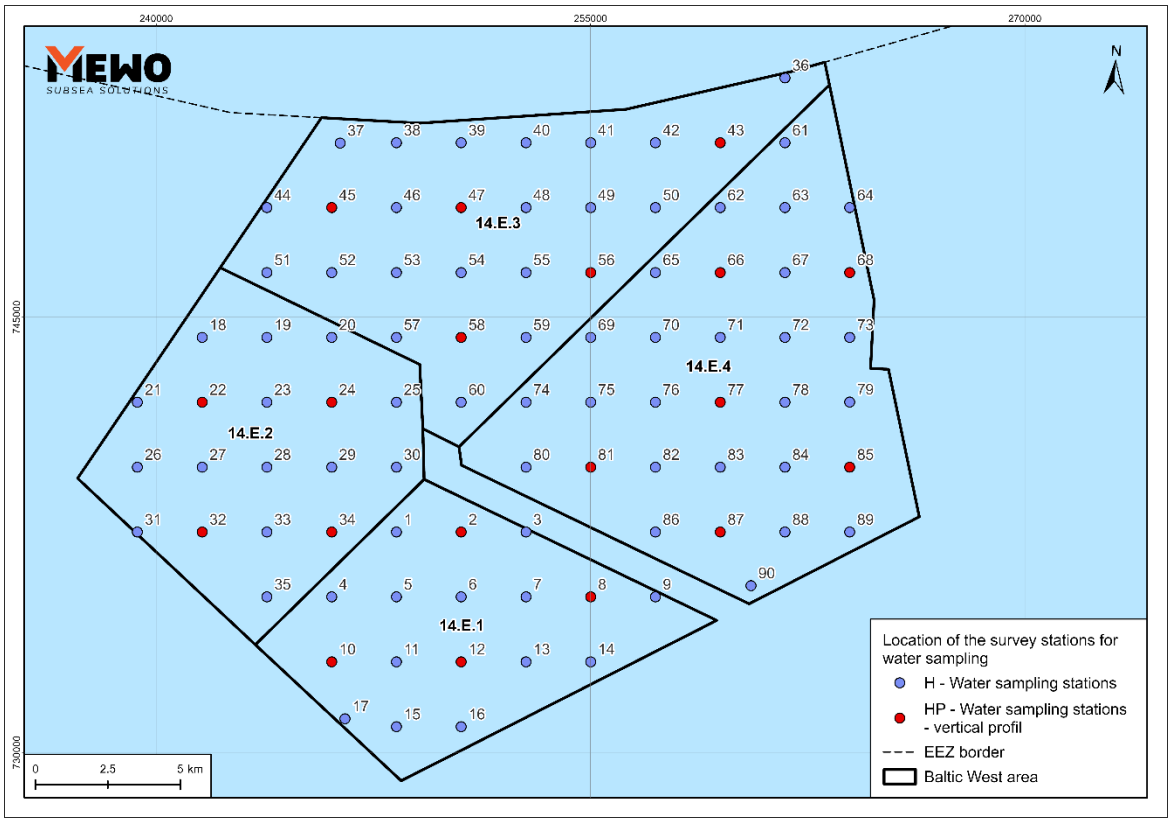


Figure 2 Location of the measurement and survey stations for water sampling within the Baltic West area (source: Investor's data)

Monitoring of the marine environment was carried out in 2025 (from 24 February to 11 November) as part of four survey campaigns. This made it possible to capture the full seasonal variability of water parameters over an annual cycle (spring, summer, autumn, winter).

Environmental data were collected using two complementary methods:

- *In situ* measurements: Vertical water column profile soundings (with a high resolution of every 0.5 m) covering temperature, salinity (conductivity), depth and turbidity.
- Water sampling: Samples were collected from standard layers (near-surface and near-bottom), and at 19 designated profile stations also from intermediate depths. A total of 1128 samples were obtained during the monitoring (collected in accordance with standard PN-EN ISO 5667-9).

The following indicators were analysed as part of the laboratory and field assessment:

- General and oxygen conditions: Dissolved oxygen, BOD5, pH, alkalinity, total suspended solids, TOC.
- Nutrients: Nitrogen compounds (including ammoniacal nitrogen, NO_3, NO_2) and phosphorus.
- Priority and particularly hazardous substances: Heavy metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), petroleum-derived substances, pesticides, cyanides and phenols.
- Radionuclides: Radioactive isotopes of caesium and strontium, collected during the spring campaign.

The results of the laboratory analyses were subjected to statistical processing (determination of minimum, maximum and average values with standard deviation). The final assessment of the state of the marine environment was prepared by comparing the average concentrations obtained with the applicable environmental quality standards for coastal waters and assigning the corresponding quality classes.

4.2.2.4 Abiotic elements – hydrodynamic, hydrophysical and meteorological conditions

In order to precisely characterise the local conditions within the area of the proposed Baltic West projects, in situ measurements were carried out covering meteorological, hydrodynamic and hydrophysical conditions. These measurements were carried out continuously over a period of 13 months (from 30 March 2025 to 29 April 2026).

The survey methodology was based on the use of an integrated system of measuring instruments, comprising three automated measurement buoys together with an AWAC acoustic profiler mounted on the seabed. The range of parameters recorded in this way included:

- Meteorological conditions: continuous measurements carried out using sensors installed on the measurement buoy at a height of approximately 4 m above sea level. Precise values of wind speed and direction, atmospheric pressure, air temperature and relative humidity were recorded.
- Hydrodynamic conditions: measurements carried out using the AWAC device, which enabled a detailed assessment of water mass dynamics. These included recording the height, periods and directions of waves on the free sea surface, as well as the speed and direction of sea currents.
- Hydrophysical conditions and bathymetry: measurements supplemented with vertical water column soundings (also using CTD probes). These included measuring the depth of the seawater, and, within the water column, measuring its temperature, electrolytic conductivity, salinity and turbidity with high resolution in the vertical profile (every 0.5 m).

The comprehensive measurement data collected in this way were used to verify and calibrate the numerical mathematical models used, as well as to precisely define the environmental background (existing state) necessary to assess the impact of the Projects on the dynamics of marine waters and wave processes.

4.2.2.5 Abiotic elements – climatic conditions and air quality

Given the specific nature of the open sea, the methodology adopted combines long-term historical data from monitoring systems, data obtained from advanced mathematical and satellite modelling, and precise in situ field measurements.

In order to precisely characterise the climatic and meteorological conditions in the Baltic West area, a multi-pronged approach was applied:

- Use of long-term historical data: The analysis is based on continuous measurements operationally carried out for several decades by the stations and measurement posts of the Institute of Meteorology and Water Management (IMGW-PIB), located on the coast and on buoys anchored at sea. In addition, data from the Coastal Marine Laboratory of the Polish Academy of Sciences in Lubiatowo (wind, temperature, humidity, sea level) and from the monitoring station of the Institute of Oceanology of the Polish Academy of Sciences in Sopot were used.
- Satellite data and international systems: In order to determine long-term climate trends and the distribution of oceanographic parameters, maps developed under the SatBaltyk project were used (e.g. temperature distributions, ice cover, water turbidity). Tracking of climate

change was also supported by data from the services of the Baltic states affiliated with the BOOS (Baltic Operational Oceanographic System), as well as by the results of global and regional climate models from the EU Copernicus Earth observation programme.

- Direct local (in situ) measurements: In order to verify the models and obtain accurate data for the water bodies themselves, continuous meteorological measurements were carried out over a period of 13 months (from 30 March 2025 to 29 April 2026). These measurements were carried out using 3 automated measurement stations located directly at sea. Using sensors placed at a height of approximately 4 m above sea level, precise values of atmospheric pressure, relative humidity, air temperature and the speed and prevailing directions of wind were continuously recorded.

Given the lack of in situ measurement data on air purity parameters over the Baltic West area, the air quality assessment of the near-surface atmospheric layer for this sea area was carried out on the basis of information obtained from numerical model data available on the ads.atmosphere.copernicus.eu portal, on the CAMS European air quality forecasts page. The above information was used for the full 2025 calendar year in the analysis. The ENSEMBLE indicator was applied (the median of 11 European forecasting models, including CHIMERE, EMEP, GEM-AQ and SILAM), subject to continuous assimilation of data from European ground stations.

Technical parameters and modelling scope:

- Temporal and spatial resolution: hourly time step (1 h), grid with a side length of 0.1° (approx. 10–20 km) covering the Project area.
- Reference height: 50 m above sea level (free atmospheric layer, eliminating the influence of turbulence and aerosol generated by sea waves).
- Scope of substances: nitrogen dioxide, nitrogen oxide, ozone, sulphur dioxide, carbon monoxide, and PM10 and PM2.5 particulate matter.

In the absence of separate air quality standards for marine areas, the results obtained (average and maximum 1-hour concentrations) were compared with the classification of the Polish Air Quality Index of the Chief Inspectorate of Environmental Protection (CIEP), which allowed for a standardised assessment of the state of the atmosphere in the area of the project.

4.2.2.6 Abiotic elements – ambient acoustic background

The surveys were carried out across the entire Baltic West area [Figure 3].

The surveys were carried out continuously over the course of a year, from 15–16 March 2025 to 17 March 2026. The measurement system was based on specially deployed stations, taking into account differences in depth across the individual areas:

- For areas 14.E.1 and 14.E.2: Measurements were characterised on the basis of data from the shared reference station FPOD15_SM4M, located in area 14.E.2 at a depth of approximately 28 m.
- For area 14.E.3: Two stations with different installation depths were used: FPOD01_SM4M (depth approx. 35 m) and FPOD04_SM4M (depth approx. 51 m).
- For area 14.E.4: Two measurement stations were likewise used: FPOD07_SM4M (depth approx. 31 m) and FPOD09_SM4M (depth approx. 45 m).

Sound recording was carried out using autonomous underwater sound recorders, model SM4M (manufactured by Wildlife Acoustics Inc.), which enabled broadband data recording in the range from 2 Hz to 192 kHz.

To assess the impact of hydrometeorological conditions on the propagation of acoustic waves, continuous wind force measurements were systematically carried out, together with periodic surveys using a CTD probe. This made it possible to measure the physical parameters of seawater and to determine vertical sound speed profiles.

Underwater noise was analysed in third-octave bands within the range from 20 Hz to 20000 Hz. In accordance with EU directives (MSFD) and the guidelines of expert groups (HELCOM EG Noise, TG Noise), particular attention was focused on the bands with centre frequencies of 63 Hz and 125 Hz (key for assessing noise from ship traffic) and 2000 Hz (relevant from the point of view of marine mammals). On the basis of the power spectral density (PSD) of the noise, the broadband sound pressure level (SPL) was also calculated for the range from 2 Hz to 96 kHz, providing an overall picture of the background in the surveyed areas.

As part of the noise survey, surveys of the acoustic climate (airborne noise) were also carried out. The acoustic climate measurements were carried out using the reference method of continuous recording from 7 to 12 March 2026. Sound level meters (SVAN-979) installed at a height of 4 m above ground level were used for this purpose. The surveys were carried out at a total of four designated points: three of them were located directly at sea, on measurement buoys (designated M1, M2 and M3) within the area of the proposed farms, while the fourth one served as a land-based reference point (M4), situated in the locality of Dźwirzyno. In addition, the acoustic recording was accompanied by parallel measurements of meteorological conditions. The field measurements were

supplemented by numerical modelling of noise propagation. These simulations were used to determine the ranges of impact and to assess the impact of acoustic emissions from operating wind turbines during the operational phase.

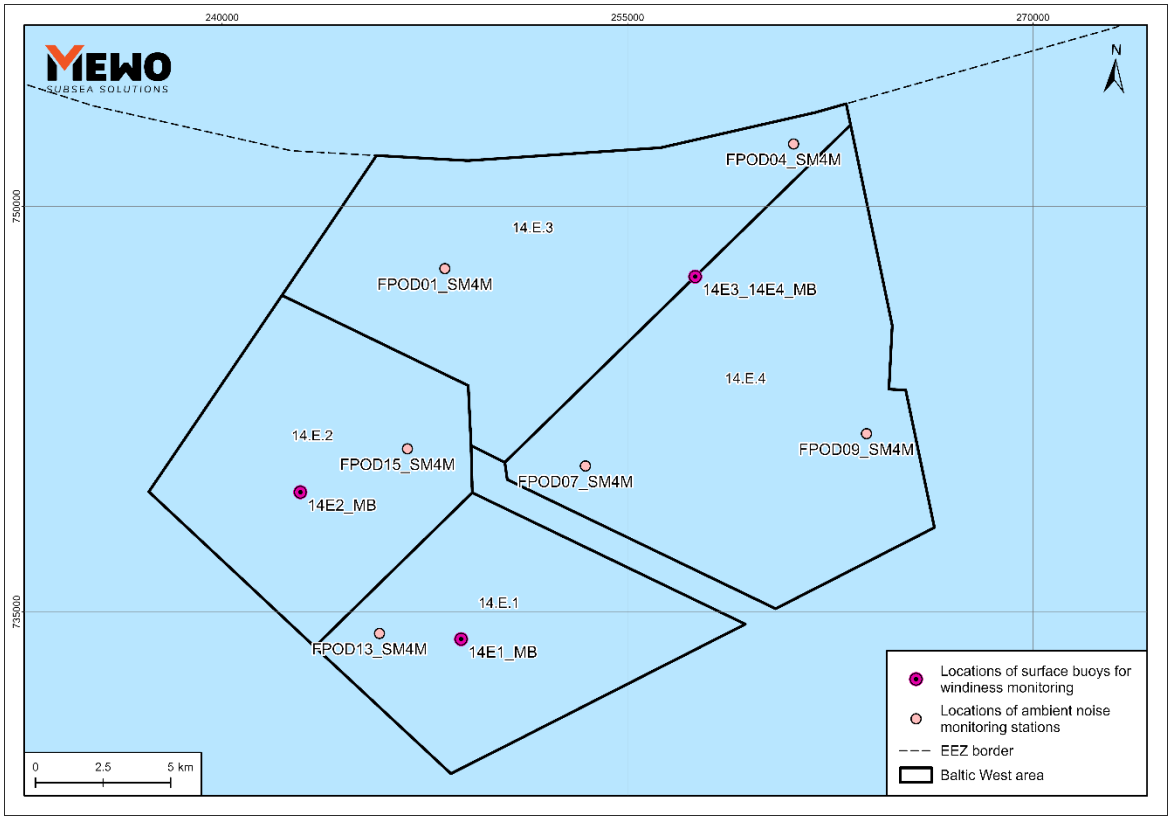


Figure 3 Location of the measurement stations within the Baltic West area [source: Investor's data]

4.2.2.7 Biotic elements – phytobenthos

The phytobenthos survey methodology for the entire Baltic West area was based on direct visual inspection of the seabed for the presence of underwater vegetation.

Main methodological assumptions:

Timing: The environmental surveys were carried out in June 2025.

Spatial scope: The inventory covered the target water bodies of all four wind farms, together with the surrounding buffer zone with a width of 1 Mm.

Survey technique: The primary survey tool was filming (video recording) of the seabed.

Sample size: The surveys were carried out along designated transects, each at least 100 metres long.

The transects were located primarily in the shallowest areas of the surveyed water bodies, since the distribution of phytobenthos (underwater vegetation) is limited to the so-called euphotic (light-penetrated) zone, while also taking into account the occurrence of different substrate types [Figure 4]:

- OWF 14.E.1 area: 2 transects were surveyed, located on a sandy substrate, within a depth range of 21.9 to 23.6 m.
- OWF 14.E.2 area: A total of 4 transects were surveyed – three of which were conducted on a sandy substrate (at depths of 20.7–23.6 m), and one was located on a hard substrate (at depths of 37.5–38.3 m).
- OWF 14.E.3 area: Filming was carried out along 3 transects delineated on a rocky substrate, within a depth range of 31.3 to 38.3 m.
- OWF 14.E.4 area: 3 transects were surveyed, located both on a sandy substrate (depth 27.3–27.4 m) and on a rocky substrate (depths 32.1–32.8 m).

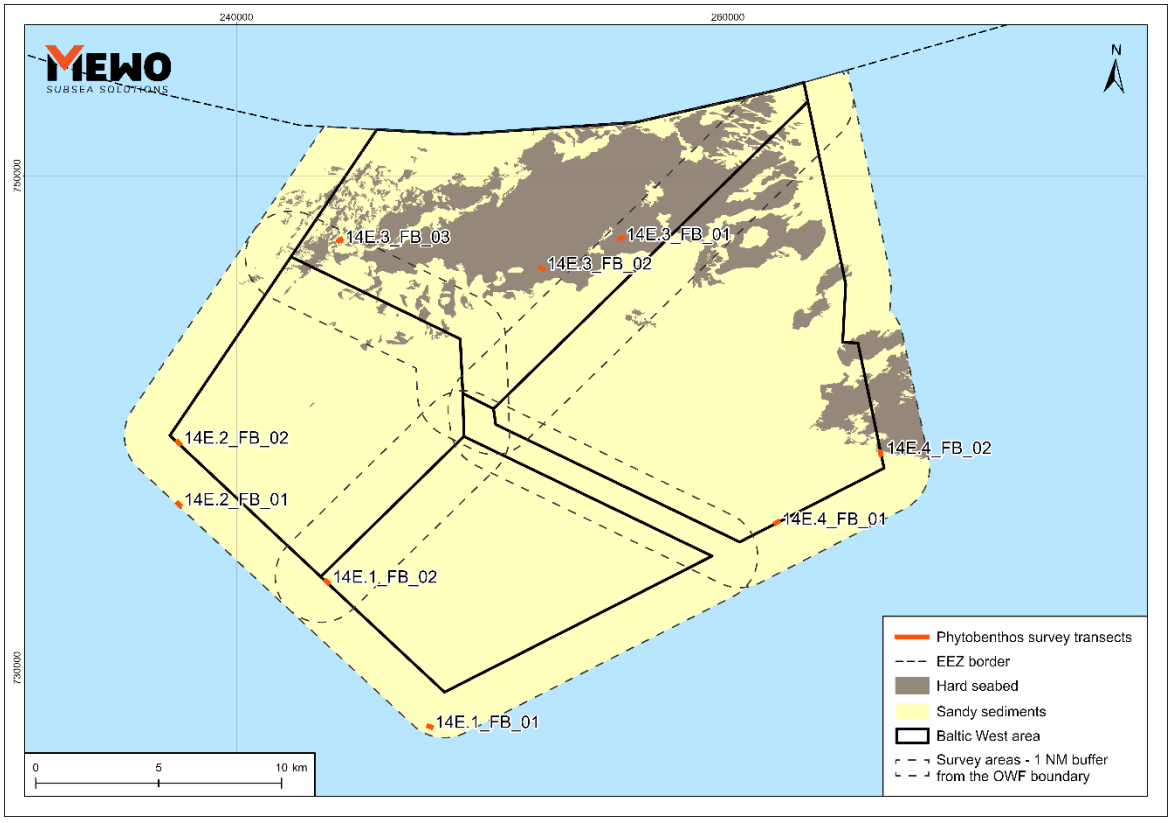


Figure 4 *Location of the phytobenthos survey transects against a background map of surface sediment types within the Baltic West area [source: Investor's data]*

The next methodological step was a detailed analysis of the video footage obtained. It was used to verify the possible presence of macroalgae growing on the hard substrate or of vascular plants on the sandy substrate.

The methodology applied, based on a total of 12 transects for the entire Baltic West area, made it possible to conclusively establish the absence of phytobenthos in the area analysed, irrespective of depth and the type of bottom sediment.

4.2.2.8 Biotic elements – macrozoobenthos

The pre-investment macrozoobenthos (bottom fauna) survey methodology for the entire Baltic West area (covering areas 14.E.1, 14.E.2, 14.E.3 and 14.E.4, together with their 1-NM buffer zones) was based on a comprehensive field inventory carried out in 2025 (with respect to soft-bottom habitats) and in April 2026 (with respect to hard substrate habitats). The purpose of the surveys was to obtain comprehensive data for the qualitative and quantitative analysis of benthic invertebrate communities and to assess the ecological quality status of seabed habitats.

The surveys took into account the variability of bottom sediments in the Bornholm Basin, and the assessment was therefore carried out separately for the soft bottom (predominantly sandy circalittoral sediments in the area analysed) and for the hard substrate occurring at isolated points (irregularly distributed stones, boulders and coarse-grained sediments).

A total of 768 macrozoobenthos samples were collected across the entire Baltic West area, distributed as follows for the individual areas:

- OWF 14.E.1: 165 samples from the soft-bottom (depth range 22–34 m). No hard substrate was identified in this sea area.
- OWF 14.E.2: 168 samples from the soft-bottom and 1 sample from the hard substrate (depth range 21–39 m).
- OWF 14.E.3: 175 samples from the soft-bottom and 10 samples from the hard substrate (depth range 29–56 m for the soft-bottom and 34–44 m for the hard substrate).
- OWF 14.E.4: 246 samples from the soft-bottom and 3 samples from the hard substrate (depth range 27–56 m).

The survey material collected was subjected to a detailed analysis in order to determine the qualitative and quantitative structure of the communities. The methodology involved determining the following benthic fauna parameters for all samples collected:

- Taxonomic composition (identification of rare, protected, as well as consistently constant and alien species).
- Abundance (expressed in individuals per m^2).
- Biomass (expressed in grams of wet weight per m^2).

Indicators standardised for the Water Framework Directive and the State Environmental Monitoring system, adapted to the type of habitat, were used to classify the ecological quality status of the seabed. For soft-bottom habitats, the multimetric B index was applied, the results of which were

compared against a five-point scale resulting from national law (Regulation of the Minister of Infrastructure of 25 June 2021 on the classification of the ecological status of waters). For hard substrate habitats, on the other hand, the typical species presence index (TSPI) was used, where the assessment on a five-point scale depended on the number of taxa identified as typical of a hard substrate structure.

Owing to the absence, prior to 2022, of State Environmental Monitoring (SEM) stations for macrozoobenthos operating in this region, the assessment methodology was based on a comparison with the most recent available information. The following were used as a comparative background:

- data from the project 'Mapping of benthic habitats of Polish marine areas using the seabed mosaic sonar method in 2021–2023', covering habitat delimitation according to the EUNIS classification and underwater filming footage from 2022;
- the results of pre-investment surveys for the Baltic Pipe pipeline from 2018;
- cross-benchmarking of the results of the 2025 macrozoobenthos inventory between all four neighbouring water bodies of OWFs 14.E.1, 14.E.2, 14.E.3 and 14.E.4.

4.2.2.9 Biotic elements – ichthyofauna

The main purpose of the work was to determine the characteristics of the ichthyofauna assemblage present over the annual cycle across the entire area intended for the construction, operation and decommissioning of the offshore wind farms under the Baltic West project, together with their zone of potential impact, defined as a 1 NM buffer. The scope of the surveys covered a comprehensive analysis of the species composition and abundance of ichthyoplankton, an estimation of the occurrence and density of pelagic fish, a determination of the occurrence of demersal (bottom-dwelling) fish, and the collection of biological data key to the stock assessment (length, age, sex, weight, sexual maturity, degree of stomach fullness). The methodology was based on the rigorous standards of the International Council for the Exploration of the Sea (ICES), including the guidelines for BIAS/SPRAS acoustic surveys and BITS bottom trawl surveys.

The surveys were carried out over a full annual cycle in order to capture the seasonal dynamics of the fish assemblage. The inventory was divided into four main survey campaigns:

- Summer campaign: July–August 2022;
- Autumn campaign: September–October 2022;
- Winter campaign: January–March 2023;
- Spring campaign: April–June 2023.

Data were collected using precisely selected, complementary methods:

- Ichthyoplankton surveys: Samples were collected at 29 survey stations evenly distributed across the entire Baltic West project area [Figure 5]. Tows were carried out using a Bongo net, conducted at an average speed of approximately 3 knots, from a depth of 5 m above the bottom to the surface itself. The volume of water filtered was measured using flowmeters, and the water column was sounded (temperature and salinity measurement using a CTD probe) before each tow.

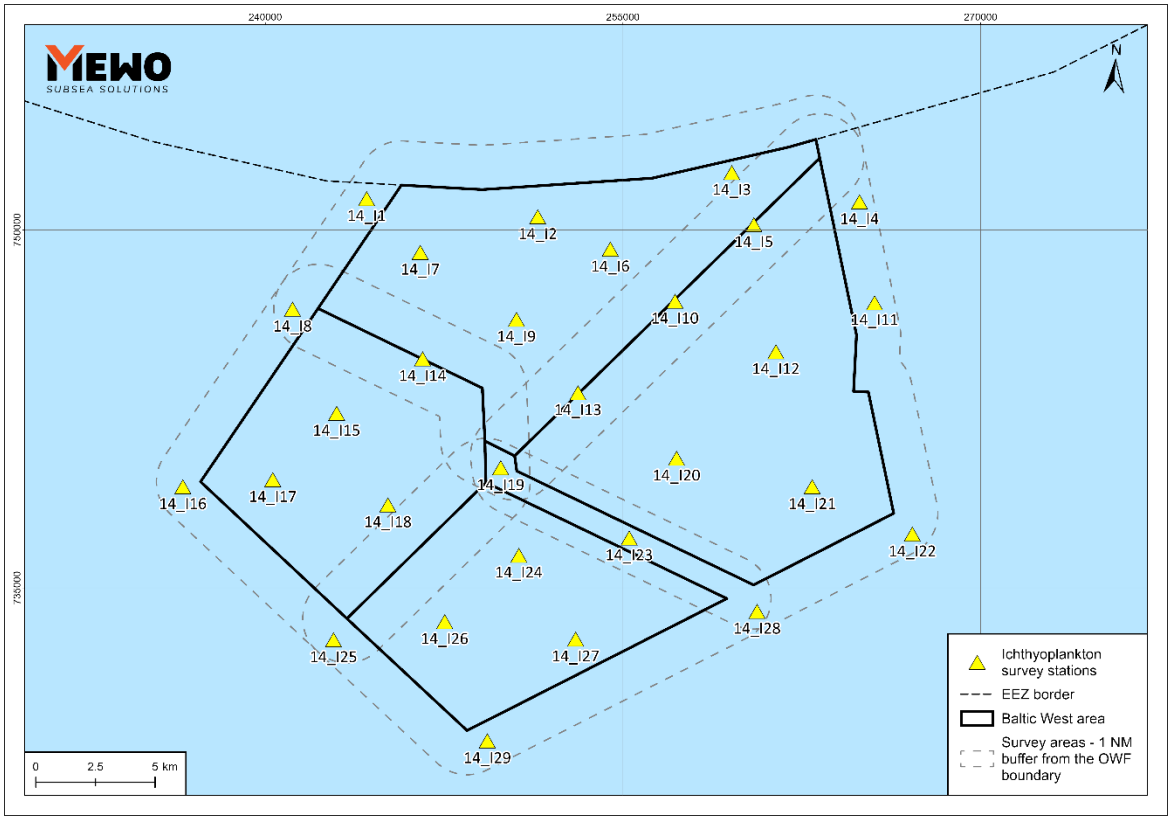


Figure 5 Location of the survey stations within the Baltic West area and the area of potential impact [source: Investor's data]

- Pelagic fish assemblage: A hydroacoustic method integrated with control catches was applied. The total length of the acoustic transects carried out across all four areas was 124 NM per season (28 NM for 14.E.1, 27 NM for 14.E.2, 30 NM for 14.E.3 and 39 NM for 14.E.4) [Figure 6]. In parallel with the echo-sounding, control pelagic tows were carried out at locations where concentrations of fish were recorded. To ensure the full coverage of the survey area, a total of 35 pelagic trawl catches were carried out across all campaigns, with trawling times of between 15 and 30 minutes, conducted at a speed of around 3 knots.

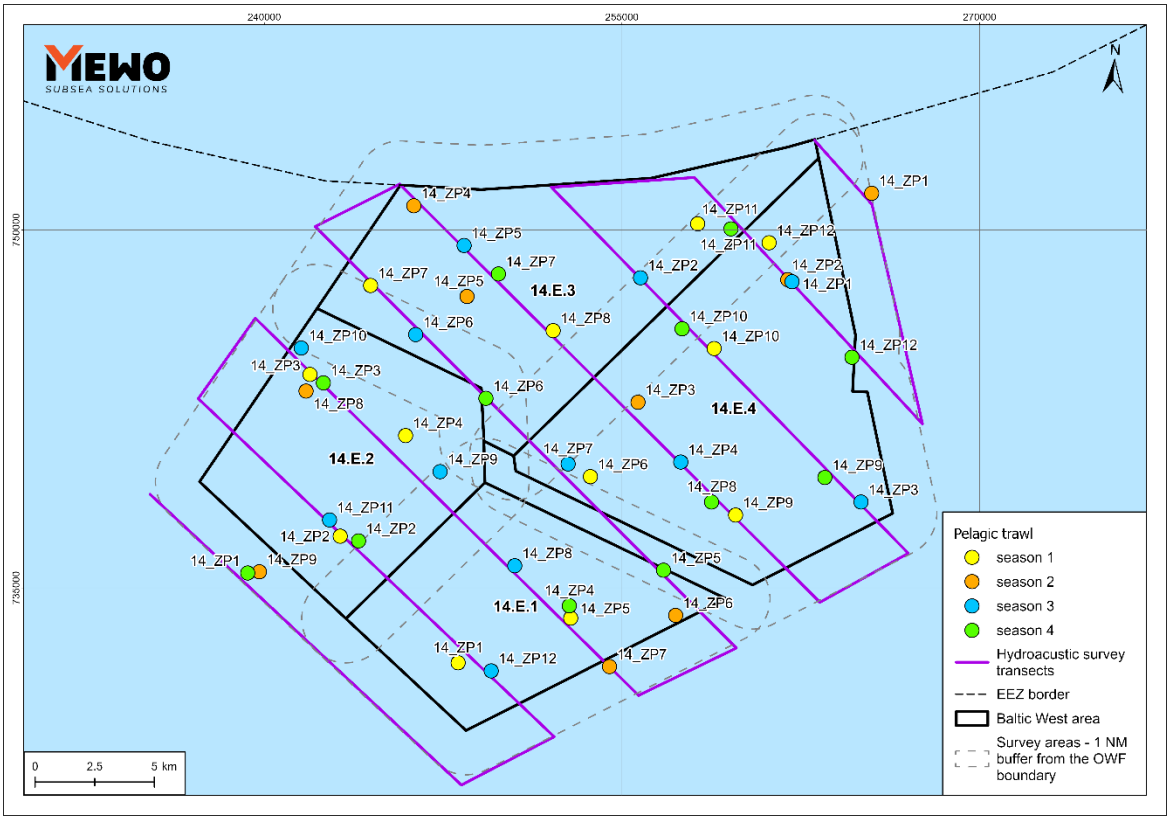


Figure 6 Location of the pelagic tows and hydroacoustic transects within the Baltic West area and the area of potential impact [source: Investor's data]

- Demersal (bottom-dwelling) fish assemblage: The primary survey tool was control bottom trawl tows. These were carried out at a total of 46 stations designated across the entire Baltic West area (10 stations in area 14.E.1, 9 stations in area 14.E.2, 12 stations in area 14.E.3 and 15 stations in area 14.E.4) [Figure 7]. At locations showing the presence of natural obstacles or a seabed morphology precluding the operation of a trawl (mainly in areas 14.E.2, 14.E.3 and 14.E.4), the methodology was supplemented with catches using bottom-set gillnet gear, which was left in place for a minimum of 12 hours on each occasion, taking into account the strategic periods of fish activity – dawn and dusk.

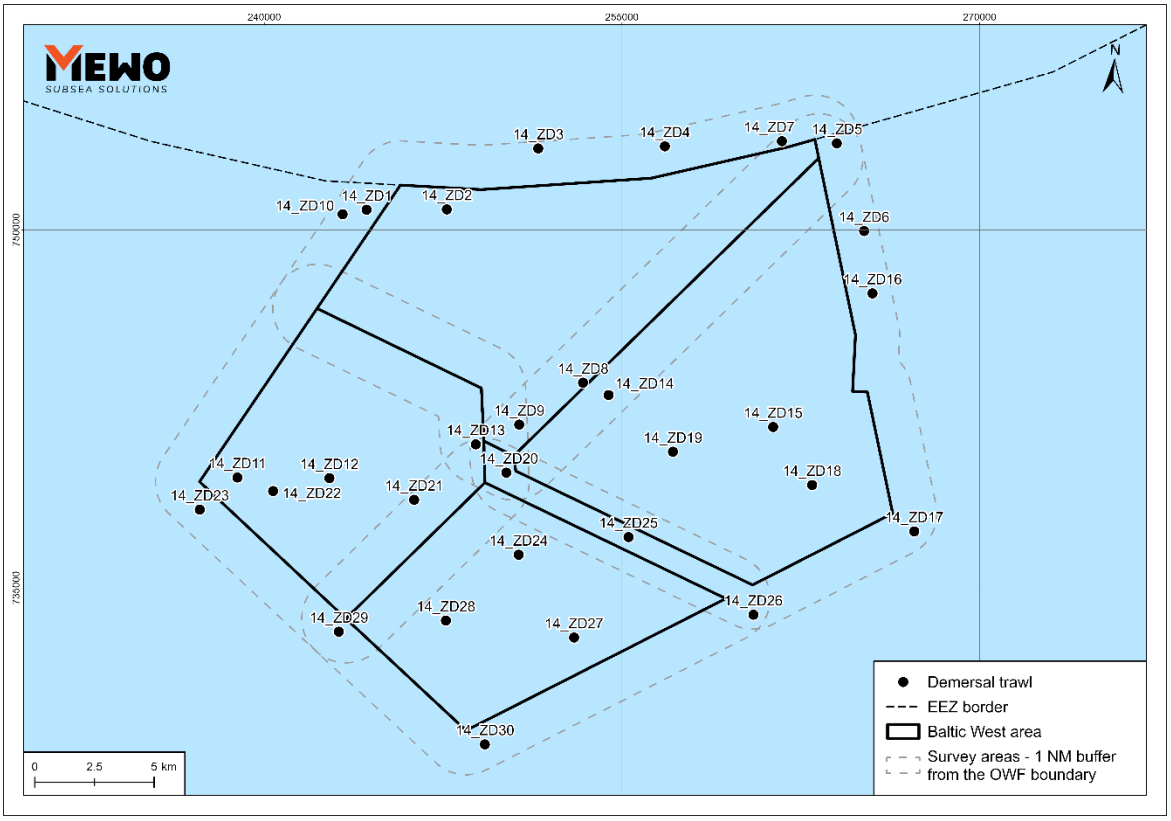


Figure 7 Locations of the bottom trawl tows within the Baltic West area and the area of potential impact [source: Investor's data]

The field surveys were carried out using specialist research vessels and fishing cutters, applying the following integrated methods:

- Ichthyoplankton surveys: Quantitative and qualitative collection of fish eggs and larvae over the seasonal cycle using plankton nets, combined with the recording of the physicochemical parameters of the water (CTD sounding).
- Hydroacoustic sounding: Continuous acoustic profiling of the water column in order to assess the distribution and size of fish shoals, coupled with specialist detection software.
- Trawl (control) catches: Pelagic (mid-water) and bottom (near-bottom) tows carried out using standardised verification trawls in order to determine the species and size structure of the fish.
- Stationary catches (gillnets): Selective control catches using sets of multi-panel survey nets and dedicated nets (for cod and flatfish), used to assess the structure of the ichthyofauna assemblages of benthic zone.

The biological and acoustic material collected was subjected to standardised analytical procedures, ensuring the comparability of results on a regional scale:

- Ichthyoplankton: Taxonomic analysis and biometric measurements of the larvae were carried out under laboratory conditions using optical methods. The abundance of ichthyoplankton was standardised and converted to a standard unit of area (per 10 m^2 of water surface).
- Hydroacoustic data: The sounding data were processed using specialist software (NASC). On the basis of the species and size structure obtained from the control catches, the surface density and biomass of individual fish taxa in the midwater were matrix-calculated.
- Biological analyses of adult fish: The control catches were used to determine the age structure (based on otolith readings), the size and weight structure, reproductive maturity and the degree of stomach fullness (assessment of the food base). In order to obtain a representative picture for the entire region, these parameters were analysed collectively for the populations inhabiting the shared sea area of the Baltic West Area.

4.2.2.10 Biotic elements – marine mammals

Monitoring of marine mammals was carried out within the Baltic West area together with the buffer zone. Across the entire Baltic West area, monitoring was carried out using the same methodology and during the same measurement and survey periods (2022–2023 – visual surveys, 2025–2026 – acoustic monitoring).

In the case of acoustic monitoring, measurements using F-POD detectors were carried out continuously at stations within the OWF areas and in the buffer zone, over the period from 15 March 2025 to 18 March 2026. The buffer zone constituted an area common to all the OWF locations surveyed, extending between 6 km and 35 km from the OWF boundaries, depending on the location [Figure 8].

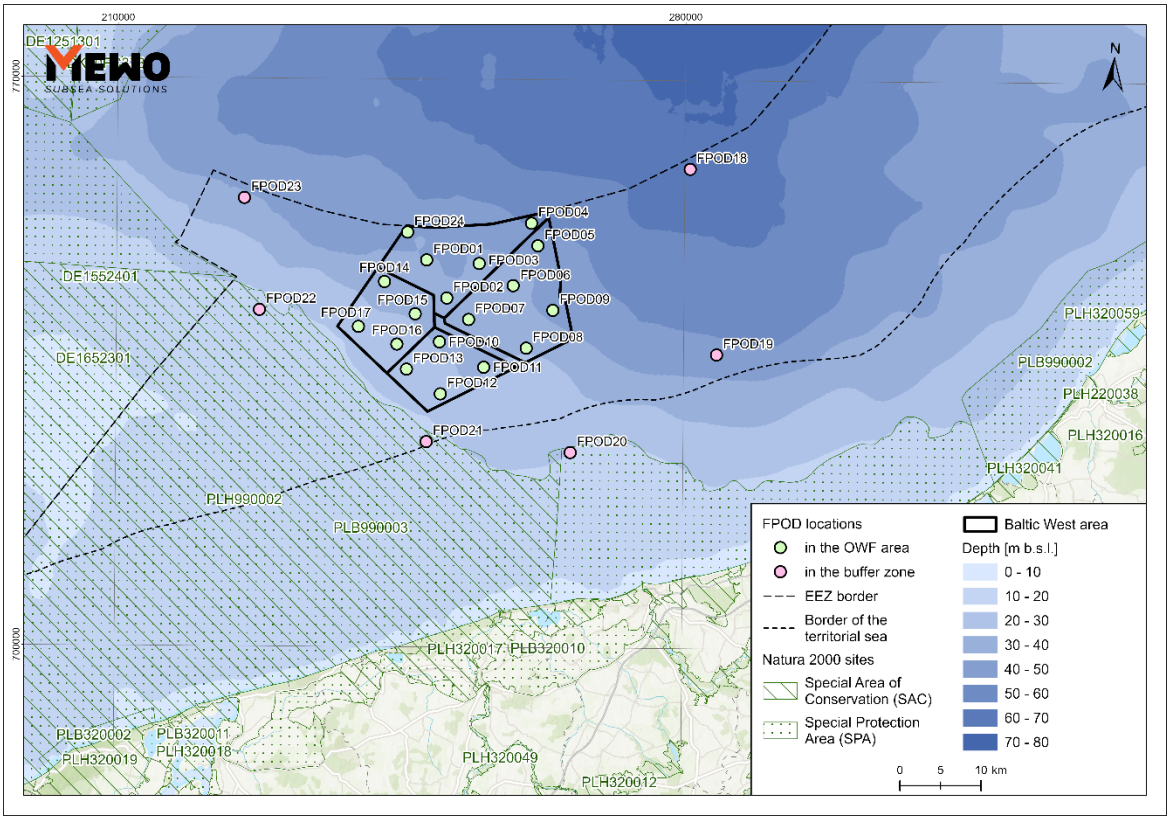


Figure 8 *Location of the measurement stations during acoustic monitoring of harbour porpoises within the Baltic West survey area [source: own study]*

Visual observations of marine mammals from a vessel were carried out on an opportunistic basis, in conjunction with the seabird surveys. They were carried out from a moving vessel along designated transects within the OWF areas and in the buffer zone up to 2 NM from the individual locations (a separate buffer zone was designated for each OWF location). For the purposes of the aggregate analysis, the buffer zone was considered in relation to the entire Baltic West area [Figure 9].

This inventory was additionally supplemented with aerial observation campaigns using an aircraft (equipped with the DAVIS digital aerial survey system), which commenced in January 2026. As with the vessel surveys, these flights were planned to cover the Baltic West area together with the buffer zone, and although they are dedicated primarily to avifauna, they also allow for the simultaneous (opportunistic) recording of marine mammals.

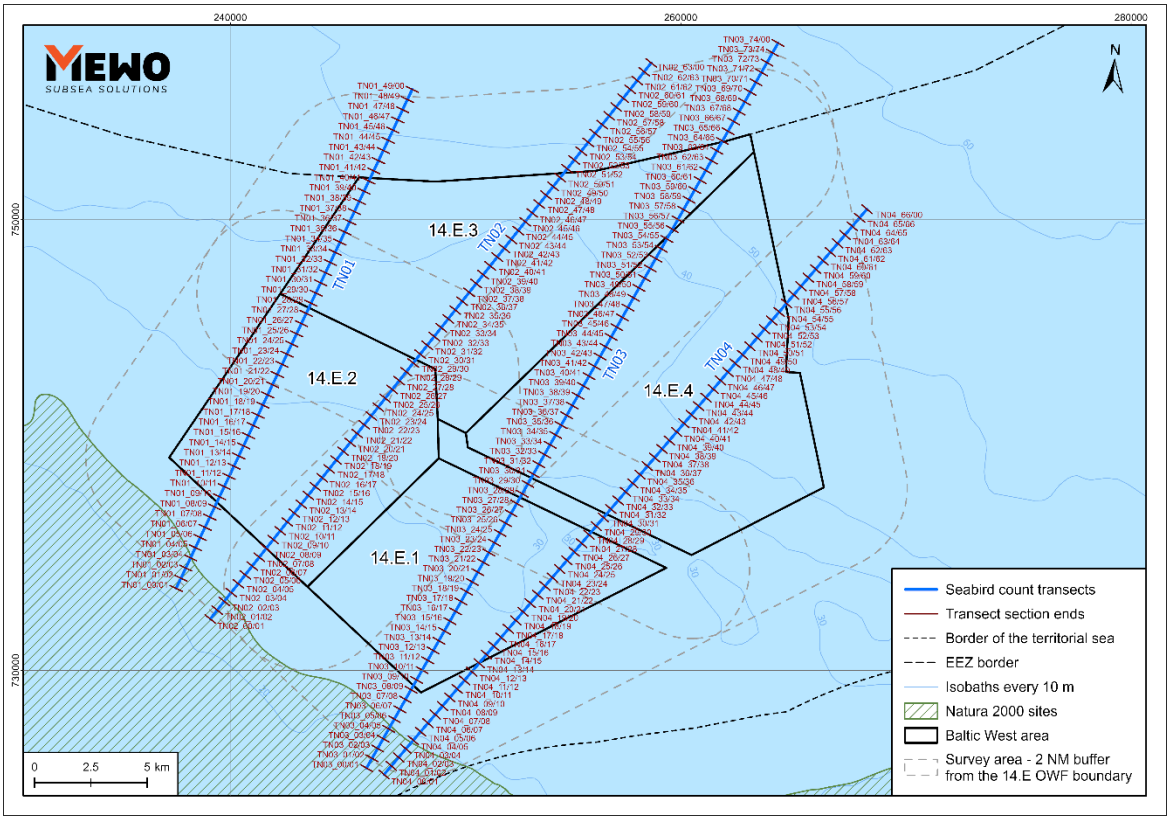


Figure 9 Location of the observation transects during vessel-based seabird monitoring within the Baltic West area and the buffer zone, under which visual observations of marine mammals were also carried out [source: own study]

4.2.2.11 Biotic elements – migratory birds

Surveys of migratory bird movements within the Baltic West area were carried out during three main periods: spring (March–May 2025), autumn (July–November 2025) and winter (December 2025–January 2026). The purpose of the surveys was to characterise the spring and autumn migration of seabirds through the survey area and local movements during overwintering, i.e. to determine the timing of passage, species composition, flight altitude and direction, and the intensity of passage – defined as the 'migratory stream'.

Field data were collected from on board vessels during 24 to 25 dedicated survey cruises (depending on the sub-area). These measurements covered a total of 46 observation days during the spring and autumn migration periods (in which the full package of methods was applied: visual, radar and acoustic) and between 10 and 12 observation days during local winter movements (using visual and radar observations).

Comprehensive, complementary methods were applied:

- Visual observations using a laser rangefinder: these allowed not only for the identification of species composition, but also the precise determination of the actual flight altitude of

individual birds and flocks (which made it possible, among other things, to establish that the vast majority of the bird groups assessed passed at safe altitudes below 20 m above sea level).

- Horizontal radar tracking (supported by visual species identification): this involved the continuous tracking of passing birds and the recording of their flight path (track). This enabled the precise determination of migration directions for different groups (confirming, among other things, the uniformity of passage to the east and north-east in spring and to the west and south-west in autumn).
- Vertical radar tracking: this was used for round-the-clock monitoring of flight altitude and for assessing the overall use of airspace by birds in the vicinity of the survey station.
- Acoustic recordings: these enabled species identification on the basis of their vocalisations (calls) during spring and autumn migration. The use of this method was particularly important for supplementing data for the night-time hours, making it possible to identify nocturnal migrants (mainly small passerines and Charadriiformes).

The data on migratory stream and flight directions collected using the above methodology were used as input for the subsequent collision risk assessment modelling and barrier effect analysis. Species for these key simulations were selected on the basis of specific criteria: the highest recorded abundance, high species protection status, and also taking into account expert knowledge (e.g. for the crane, which is rarely recorded from sea level but passes at higher altitudes).

4.2.2.12 Biotic elements – seabirds

Observations of seabirds within the Baltic West area were carried out separately for the four water bodies 14E.1, 14E.2, 14E.3 and 14E.4, together with their 2NM buffer zones, as well as for the reference area [Figure 10]. The reference area is located approximately 30 km south-east of the aforementioned Baltic West area and was selected so that the environmental conditions would be similar to those of the proposed project area, enabling a direct comparison of the avifauna grouping inhabiting them. Visual and radar observations along vessel-based transects were carried out over the period from June 2022 to May 2023. The detailed methodology and survey results for these areas are provided in Appendix 1 to the EIA Reports for OWF 14.E.1, OWF 14.E.2, OWF 14.E.3, OWF 14.E.4.

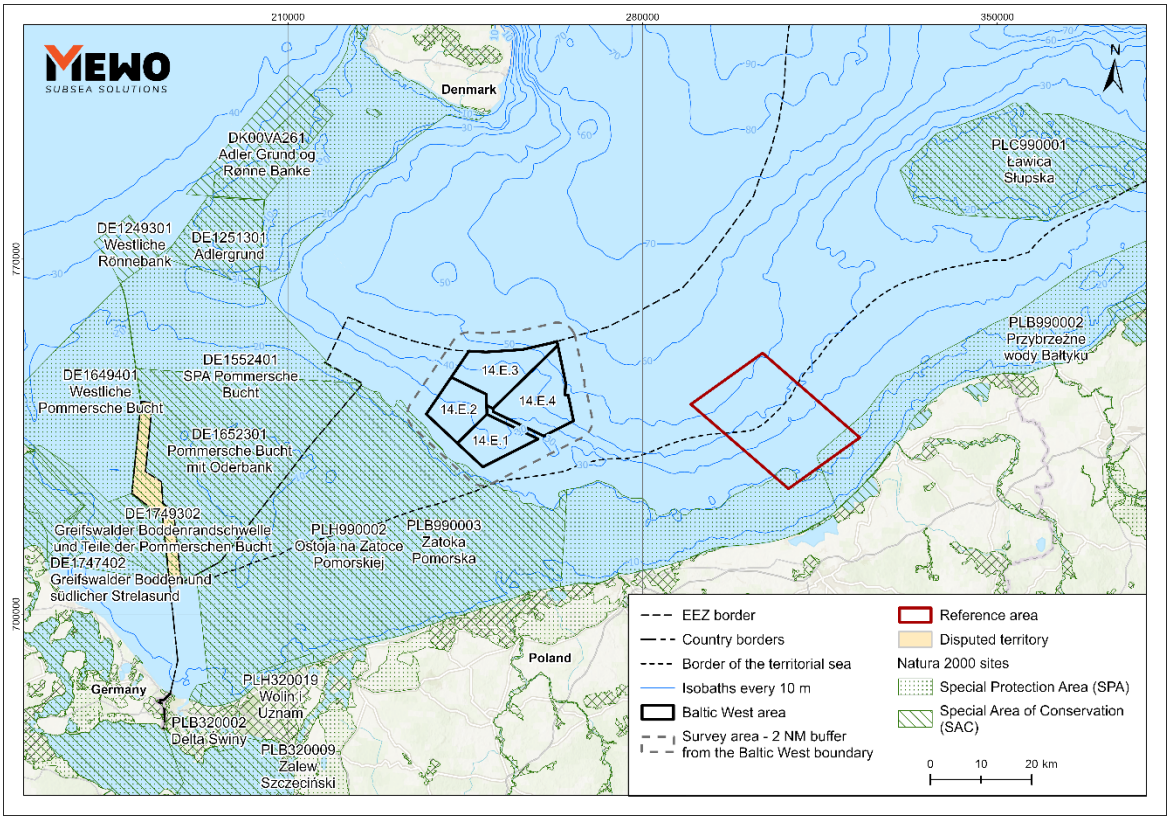


Figure 10 Location of the Baltic West area with a 2 NM buffer and the reference area [source: own study]

The methodology was based on standard guidelines for at-sea surveys [Komdeur et al. 1992), described in detail in the methodological guide issued by the General Directorate for Environmental Protection entitled 'Monitoring of waterbirds during migration periods' [Meissner, 2011]. The surveys were carried out using a line transect methodology, designated to be representative of the changing conditions resulting from variations in depth. In order to provide an objective point of reference for the results obtained, a reference area located south-west of the Project area (near Darłowo) was designated in parallel, characterised by a similar depth range and bottom type.

Avifauna observations were carried out over an annual cycle (12 months), which made it possible to track the changes occurring in seabird groupings during four key phenological periods: summer, autumn migration, overwintering and spring migration.

A total of 24 full survey campaigns were carried out as part of the inventory, each consisting of one or two cruises per month. The timing of each cruise was precisely planned on the basis of weather windows, in order to avoid the influence of unfavourable conditions on bird detectability. The cruises were carried out mainly at sea states of 1–2 on the Douglas scale, with states exceeding 3 (which could slightly reduce detectability) accounting for a small proportion of the observations.

Data were collected using the method of counting birds from the deck of a moving vessel, taking into account both birds sitting on the water and those in flight. The transects were divided into smaller

control sections 500 m long [Figure 11, Figure 12]. Observations were carried out simultaneously by two observers (one on each side of the vessel), while a third team member recorded the GPS position, depth and current meteorological conditions. In order to minimise the risk of double counting the same individuals, the spacing between adjacent transects was not less than 0.6 km.

The width of the transect strip along which counts were carried out was 600 m (300 m on each side of the vessel).

This band was divided into four distance zones, which made it possible in subsequent analyses to correct the results for the decline in bird detectability with the increasing distance. The distance of birds from the vessel was assessed in accordance with the Heinemann distance estimation procedure (1981), based on the relationship between the horizon and the observer's eye height.

For birds in flight, the flight altitude was recorded within four zones, which, in relation to the maximum parameters of the proposed wind turbines (the envelope), are as follows:

- A – up to 20 m (the zone below the rotor working area, a safe zone),
- B – 20 to 100 m (the lower range of the rotor sweep),
- C – 100 to 250 m (the middle range of the rotor sweep),
- D – above 250 m (the zone covering the upper range of the rotor sweep up to their maximum height of 370 m above sea level, and the airspace for free flight above the turbines).

Birds in flight were counted using the 'snapshot' technique (an instantaneous record of birds present within a given transect zone), the frequency of which was calculated on an ongoing basis depending on the vessel's speed. This made it possible to avoid overestimating the densities of mobile birds.

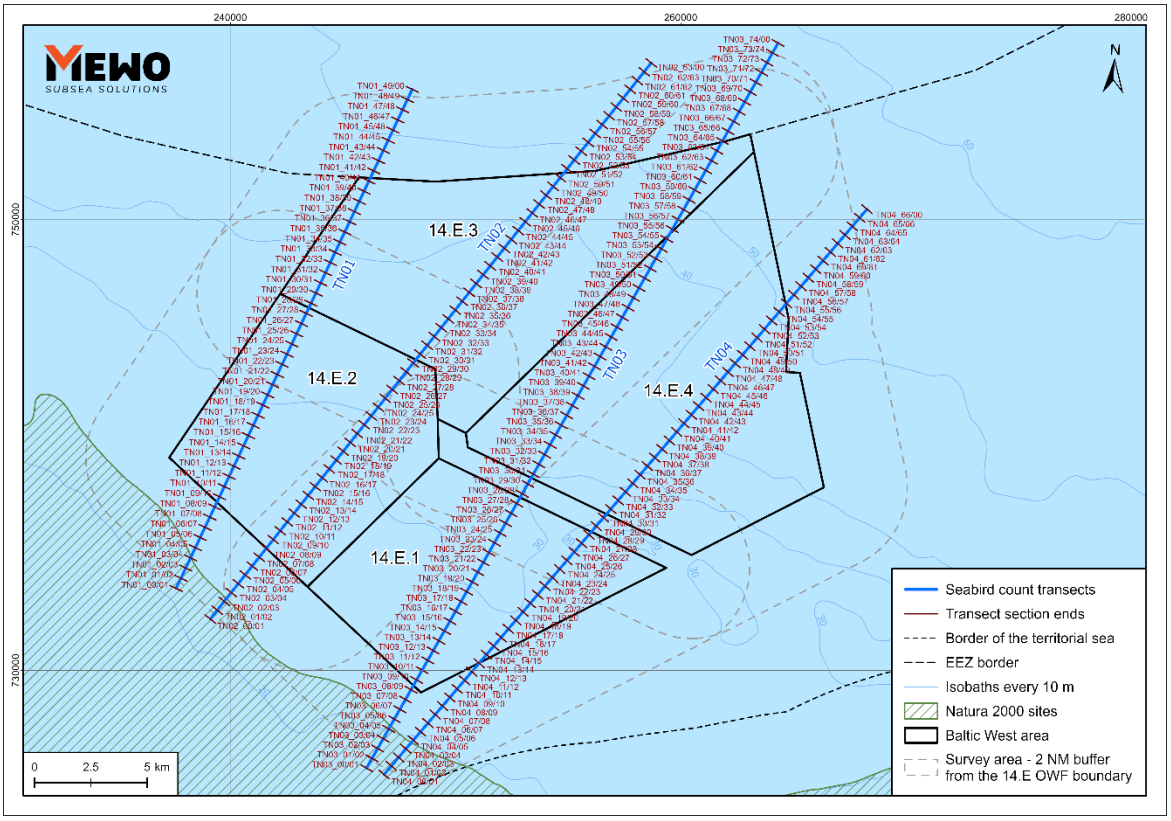


Figure 11 Location of the observation transects along which seabird counts were carried out within the Baltic West area [source: own study]

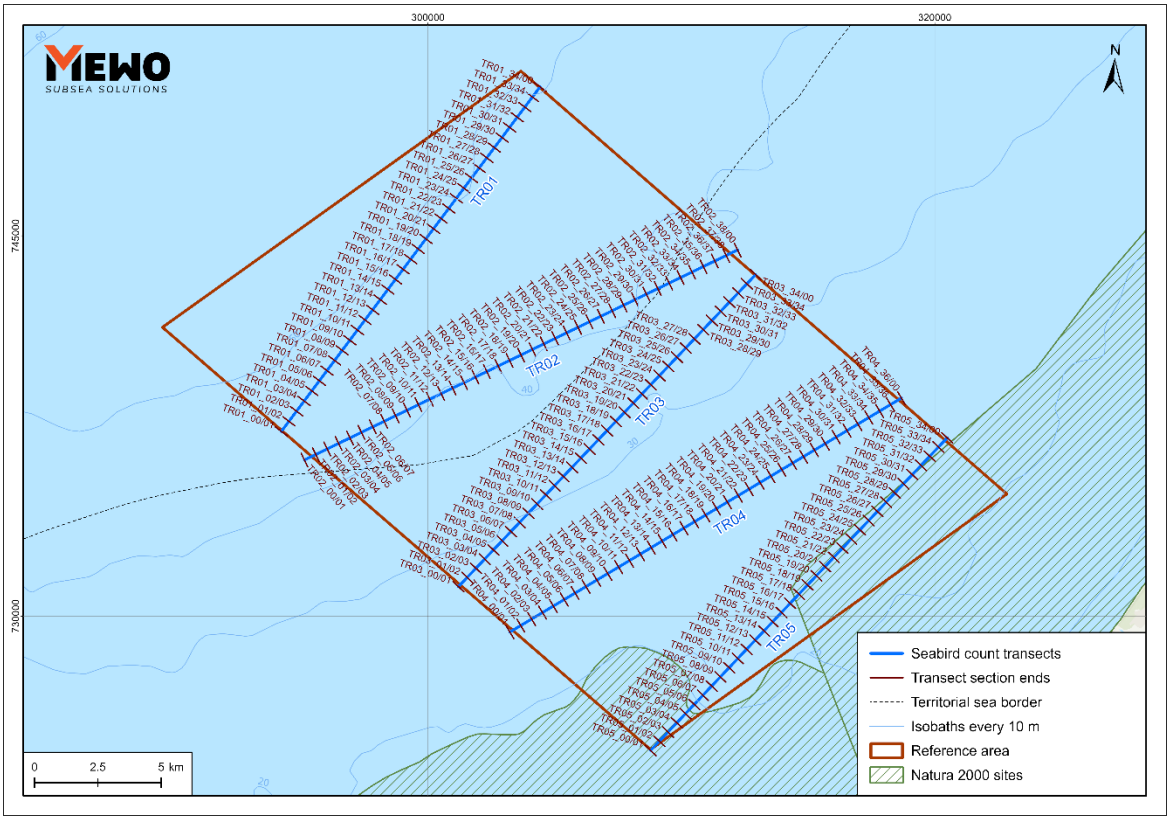


Figure 12 Location of the observation transects along which seabird counts were carried out within the reference area [source: own study]

All of the at-sea survey campaigns were carried out from on board a research vessel, which, during transect counts, moved at a constant speed of between 8 and 10 knots. The observer's eye height ranged from 2.5 to 5 m above the water surface. The following were used for technical support of the measurements and navigation:

- GPS receivers for continuous monitoring of the vessel's route, heading and speed.
- An on-board echosounder for continuous readings of the sea area's depth.
- An appropriately calibrated calliper or ruler, held at a constant distance from the observer's eye, used to determine the width of the transect strip and to estimate the distance of birds based on the horizon line.

As part of the quantitative analysis, birds were assigned to one of three ecological groups: typical seabirds, waterbirds (less frequently encountered in the pelagic zone), and birds associated with terrestrial environments, treating the sea area solely as a migratory barrier. The data collected were subjected to verification and analytical correction:

- Calculation of densities (Distance Sampling): The abundances obtained from the counts were corrected using Distance 6.0 software [Thomas et al. 2010], which was used to model the detectability decline function. The best models were selected using Akaike's criterion. As a result, the ESW (effective strip width) was determined for the most abundant species.
- Spatial mapping and interpolation: Bird densities were visualised on maps for the entire Baltic West area. Spatial models were generated in ArcGIS Pro software using the ordinary kriging interpolation method, which enabled a reliable estimation of the distribution of densities between the designated transects and eliminated errors from local overestimation of values.
- Abundance indices: In order to reliably compare water bodies with survey routes of different lengths, a standardised abundance index was applied, defined as the average number of birds per 10 km of transect.
- Assessment of conservation status: The recorded taxa were evaluated on the basis of national legislation, the list of species in Annex I to the EU Birds Directive, the global (IUCN) and Baltic regional (HELCOM) threat categories, and the SPEC (Species of European Conservation Concern) status assigned by BirdLife International.

In addition to this, seabird surveys are currently also being carried out using an aircraft [Figure 13], applying the DAVIS (Digital Aerial Video Imaging System), in accordance with the StUK4 guidelines. The surveys began in January 2026, and the layout of the transects was planned so as to cover the Baltic West area together with the 2 NM zone of potential impact, as well as an extensive area of the

western Baltic extending beyond the POM and covering the adjacent waters of the exclusive economic zones of Denmark and Germany. The transect layout adopted for these surveys ensured even spatial coverage and comparability of the results obtained in successive survey campaigns. These surveys will provide a broader view of the locations of large seabird concentrations and will allow the densities recorded within the Baltic West area to be related to densities in other parts of the surveyed sea area, including within Natura 2000 Areas. The surveys are being carried out on an annual cycle. For the purposes of this report, partial survey results were used, covering the most significant period – the overwintering of birds in the Baltic. These are presented in detail in Appendix 1 to the EIA Reports for each MFW, which is also an appendix to the Espoo Report.

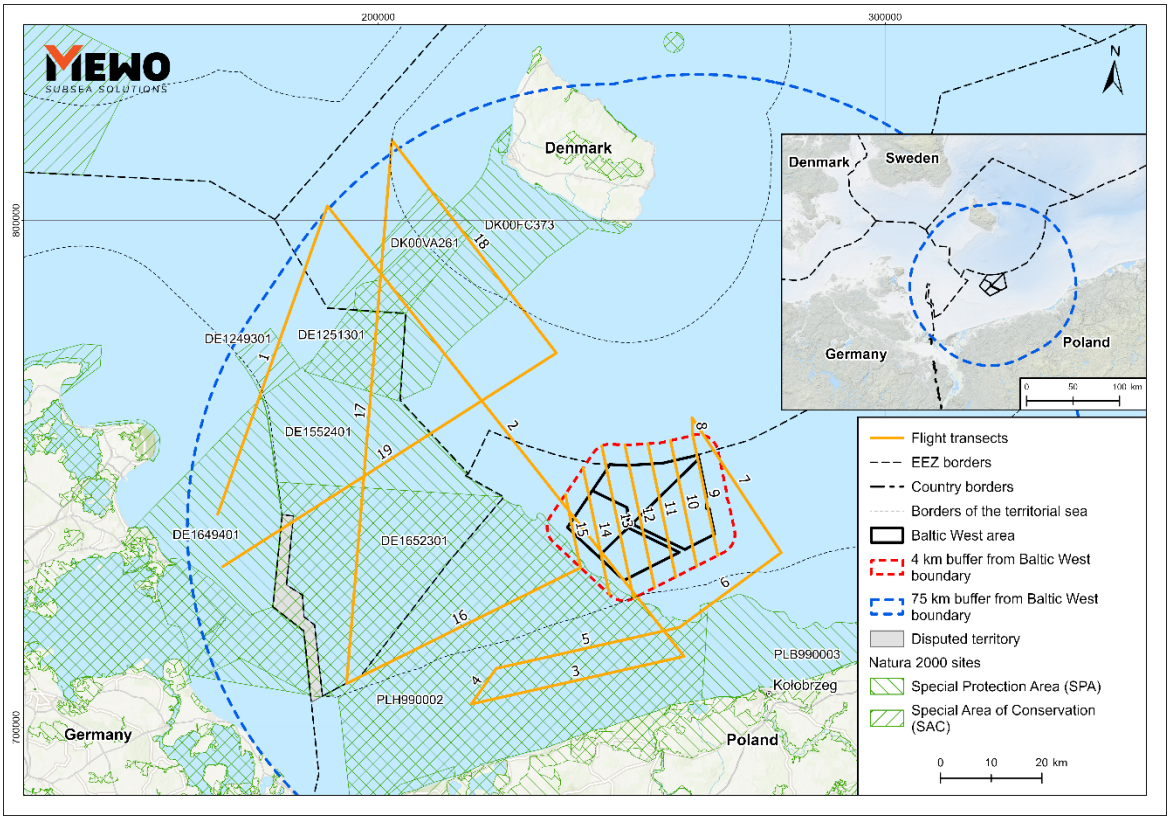


Figure 13 Layout of the winter aerial survey transects (detailed flight routes for individual dates in Appendix 3) [source: own study]

4.2.2.13 Biotic elements – bats

The survey methodology and analysis of bat activity were based on national guidelines and on the international standards set out in the Annex to Resolution 7.5 of the Agreement on the Conservation of Populations of European Bats (EUROBATS) (Rodrigues et al. 2015). The surveys were carried out across the entire Baltic West area, together with the 2 NM zone of potential impact. The surveys were carried out at 3 stationary listening points located on buoys and from vessels sailing along designated transects. The total length of the survey transects designated was 53.034 km.

The inventory was carried out during two key periods of bat migratory activity:

- Spring migration (26 March–31 May 2025): during this period, 6 transect surveys were carried out, and surveys were conducted at the buoy listening points over 67 nights;
- Autumn migration (1 August–31 October 2025): during this period, 8 transect surveys were carried out, and surveys were conducted at the buoy listening points over 92 nights. Furthermore, 2 further stationary surveys were carried out in September using listening points located on the vessel.

The minimum interval between cruises was at least 7 days.

Data were collected using two main detection methods [Figure 14]:

- Mobile listening transects (listening from the vessel): Monitoring cruises were carried out only under suitable weather conditions: with wind below 6 m/s, no precipitation or fog, and temperatures above freezing. To minimise the impact of water noise on the recording quality, the vessel's speed did not exceed 8 knots (approx. 15 km/h). Each transect survey began no earlier than 15 minutes before sunset and ended no later than 15 minutes after sunrise. The direction of travel along the transects was alternated (starting from different ends of the area) so that recordings on each section of the route covered different times of night.
- Stationary listening points (measurement buoys and points on the vessel): Fixed survey stations installed on three measurement buoys were used across the entire Baltic West area. The recorders on the buoys operated every night from sunset to sunrise, regardless of prevailing weather conditions. The detectors were activated fully automatically using built-in software tracking the position of the sun. Additionally, two rounds of dedicated listening sessions were carried out in September at a stationary point on the vessel, from 2 to 4 hours before sunset and after sunrise, which was aimed at capturing the specific migration pattern of noctule bats.

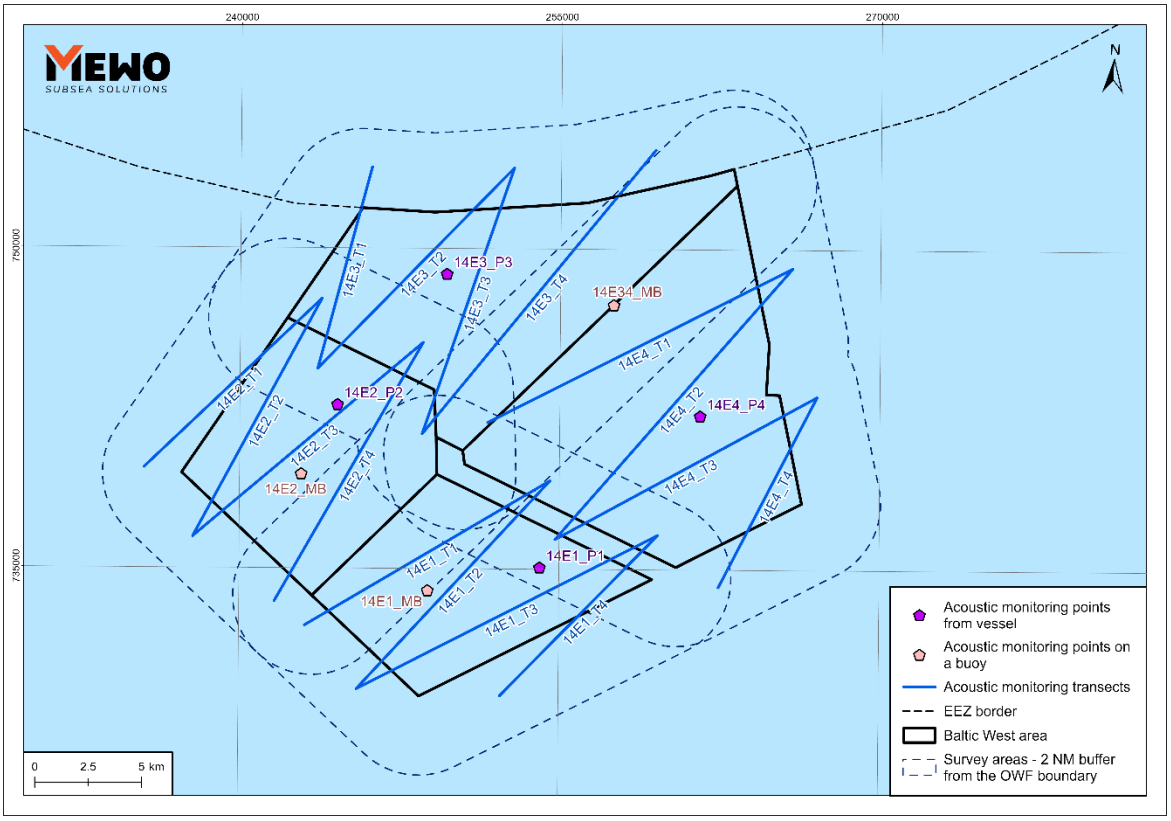


Figure 14 Location of the listening points and transects within the Baltic West area and the area of potential impact [source: own study]

Ultrasonic recorders, enabling sound to be recorded in the lossless WAV format, were used to detect bat echolocation signals. Two independent devices (a main and a backup recorder) were installed on the buoy in order to eliminate the risk of losing the survey data. On the vessel, in turn, the microphones were mounted in locations free of detection field restrictions, away from water splashes, as well as away from areas with high levels of electromagnetic and acoustic interference (e.g. loose items striking the deck).

The sound material collected (files in the *WAV format) was subjected to a detailed two-stage analysis:

- Automatic analysis: Using the Kaleidoscope Pro software, potential echolocation signals were automatically identified and files containing only ambient noise were filtered out;
- Manual verification: The extracted files were subjected to manual verification in order to correctly identify the signals and eliminate software errors. Recorded individuals were identified to species level where possible, and where this was not technically feasible – to genus level (e.g. Pipistrellus spp.) or to morphological groups (Nyctalus/Eptesicus/Vespertilio) with a similar degree of exposure to collision with turbines.

The measure used for the assessment was the Activity Unit (AU), defined as an uninterrupted sequence of signals from a single individual lasting no more than 5 seconds. Longer sequences were divided proportionally by 5 (rounded up). On the basis of this data, the Activity Index (Ix) was determined, expressed as the number of passes per hour (AU/h), according to the formula: Ix = Lx * 60 / T, where Lx is the number of activity units and T is the recording time in minutes. The activity indices collected were then compared against standard category thresholds determining whether a given level of bat activity at sea is low, moderate, high or very high, based on the scales of Kepel et al. (2013).

4.3 Spatial development and use of the sea areas potentially covered by the impact of the project

For the purposes of the analysis of the development and use of areas in the wider and closer surroundings of the proposed Project, the available planning documents were analysed in detail – for Poland, as well as for the neighbouring countries, i.e. Germany, Denmark and Sweden.

A map showing the manner of development of the Baltic Sea waters within the part covered by the analysis is provided below [Figure 15].

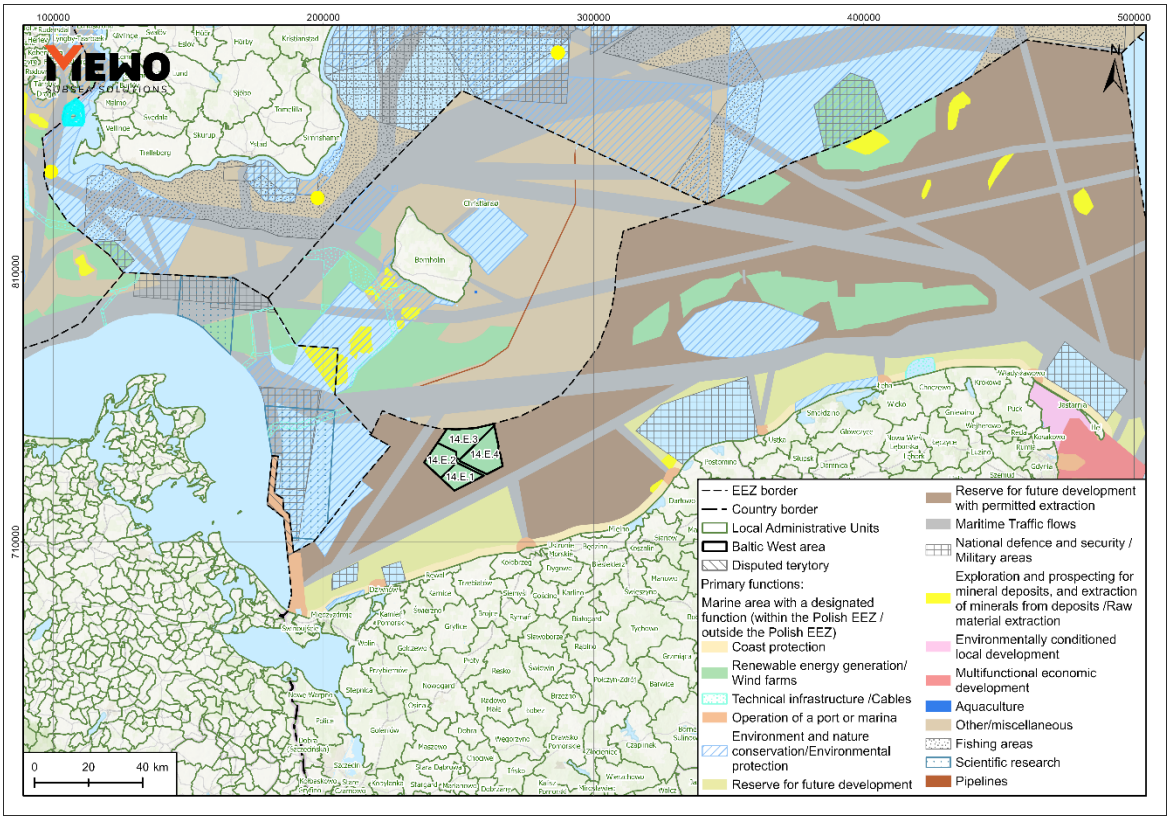


Figure 15 The Baltic West area against the background of the spatial development plan for the southern part of the Baltic Sea [source: own study]

4.3.1 Poland

The Baltic West area is located within the POM.14.E sea area designated by the Regulation of the Council of Ministers of 14 April 2021 on the adoption of the spatial development plan for Polish internal marine waters, the territorial sea and the exclusive economic zone at a scale of 1:200000 (Journal of Laws 2021, item 935, as amended). Renewable energy generation has been designated as the primary function for this sea area, while also allowing for the future implementation of other activities, such as: aquaculture, scientific research, cultural heritage, technical infrastructure, the exploration and identification of mineral deposits and the extraction of minerals from deposits, fisheries, artificial islands and structures, transport, and tourism, sport and recreation. All permissible functions within the sea area may be carried out provided that the primary function is treated as overriding.

During the implementation of the Project, shipping and fishing will be restricted. Safety zones with a prohibition on anchoring (except in emergency situations and during installation and servicing works) will also be established during this period. After completion of the implementation, safety zones will be maintained in the sub-areas designated for the laying and operation of linear technical infrastructure elements, in accordance with the decision of the territorially competent director of the maritime office. In addition, during the operational phase, safety zones will also be established around individual offshore wind turbine structures and offshore substations (or their groups), restricting shipping and fishing in the immediate vicinity of the facilities. In the Polish MSP, for the 'scientific research', 'artificial islands and structures', 'exploration and identification of mineral deposits and extraction of minerals from deposits' and 'technical infrastructure' functions, a restriction has been indicated limiting their implementation to methods that do not compromise the ecological function of spawning grounds and the survival of the early developmental stages of fish (eggs and larvae) of commercial species. For the 'cultural heritage' and 'tourism, sport and recreation' functions, on the other hand, no prohibitions or restrictions have been established.

4.3.2 Germany

The boundary of German territorial waters lies at a distance of approximately 22 km from OWF 14.E.1, approximately 14 km from OWF 14.E.2, approximately 17.7 km from OWF 14.E.3, and approximately 26.1 km from OWF 14.E.4.

On the basis of current planning documents, in particular the official publications of the German Federal Maritime and Hydrographic Agency (BSH) [Figure 16] (covering materials in the field of the marine environment, navigation, marine cartography, and the planning and use of marine areas),

the existing spatial development trends within the water bodies belonging to the territorial waters of the Federal Republic of Germany have been defined.

In the immediate vicinity of the entire Baltic West area, forms of spatial development have been identified that could potentially generate impacts cumulative with the proposed Projects. These include water bodies in which four operating offshore wind farms are located (with an additional farm under construction and another at the planning stage), zones serving military functions (used, among other things, for drills and training activities), and protected areas within the Natura 2000 network (special areas for the protection of birds and habitats).

In the vicinity of the proposed Projects (though, owing to the alignment of their routes, at a safe distance) there are subsea transmission pipelines and (high-voltage) power cables. International fibre-optic telecommunications infrastructure is also located in the region (including the Denmark-Poland 2 and Eastern Light fibre-optic cables), as well as elements of navigational infrastructure, i.e. a traffic separation scheme, a deep-water route, a coastal traffic zone, and an anchoring area.

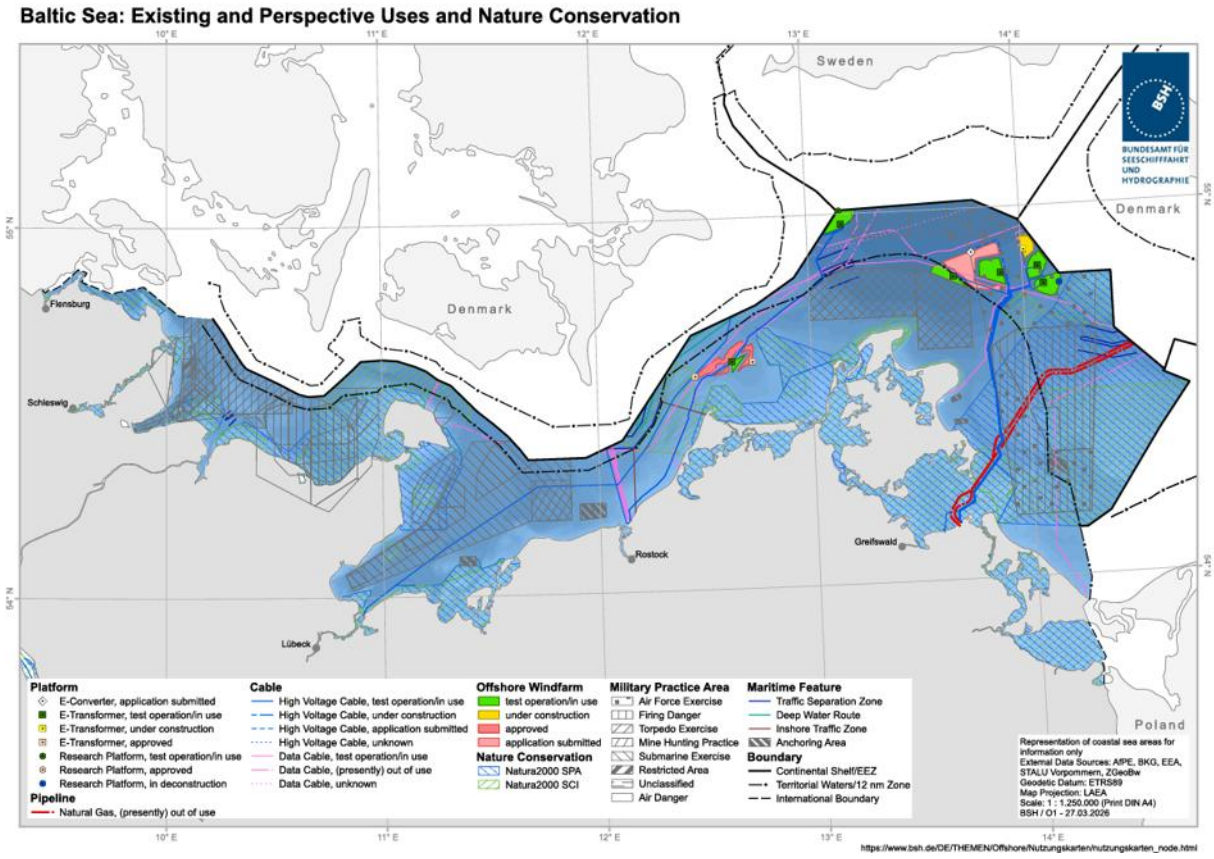


Figure 16 Spatial development in the Baltic Sea within the German Exclusive Economic Zone [source: Baltic Sea: Existing and Perspective Uses and Nature Conservation]

4.3.3 Denmark

The northern boundary of OWF 14.E.3 runs along the boundary line between the Polish and Danish exclusive economic zones. The remaining projects are situated away from from the Danish EEZ, by

approximately 0.8 km from OWF 14.E.4, approximately 5.5 km from OWF 14.E.2 and approximately 12 km from OWF 14.E.1.

The spatial development trends within the area of the nearest-located territorial waters of the Kingdom of Denmark were determined on the basis of current, official planning documents, in particular the Danish marine spatial planning system (Danmarks Havplan) [Figure 17], constituting a digital spatial information system that presents the legally binding spatial development plan for Danish marine waters and their functional designation.

The main forms of development of the sea area analysed include: a general use zone (allowing for angling, shipping and associated activities and facilities, tourism and recreation, among others), nature and environmental protection areas, including: Natura 2000 areas (both habitat and bird protection sites), Ramsar sites, nature reserves and others, shipping corridors, and areas for the development of renewable energy together with associated infrastructure. Other identified forms of spatial development of the sea area include: areas designated for the cultivation and relocation of marine organisms (in particular mussels and oysters), energy islands (designed as technical installations, artificial sand islands or similar), areas for the extraction of natural resources (stone, gravel and sand, etc.), areas for the protection of air operations and radar systems, and infrastructure corridors for power and telecommunications cables.

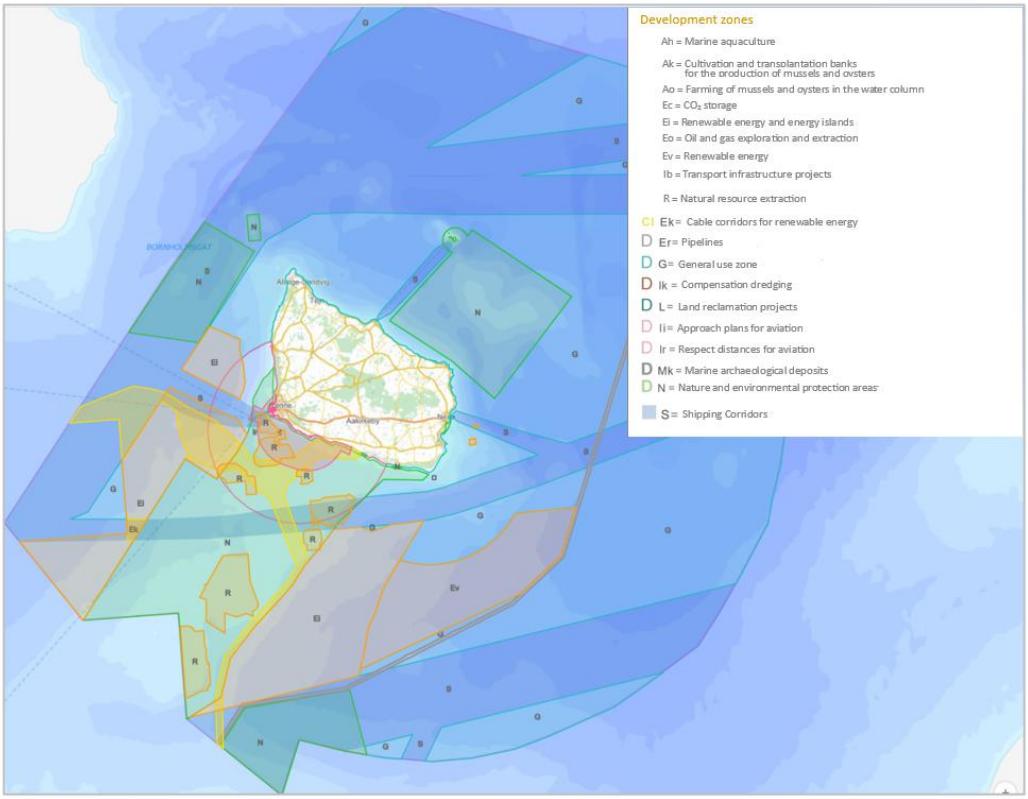


Figure 17 Spatial development in the Baltic Sea in Denmark, the part bordering the Polish exclusive economic zone [source: Danmarks Havplan [źródło: https://havplan.dk]

4.3.4 Sweden

Of the neighbouring states subjected to a detailed spatial development analysis, the Swedish territorial areas are the most distant from the Baltic West area (over 82 km from the Swedish EEZ). Between the Project area and Swedish territorial waters lies an area belonging to Denmark.

The spatial development trends within the Swedish territory were determined on the basis of official planning documents, in particular publications of the Swedish Agency for Marine and Water Management (Havs- och vattenmyndigheten). The national marine spatial plans, adopted in 2022, set out the principles and directions for the use of the waters of the Baltic Sea, the Gulf of Bothnia and the Skagerrak/Kattegat area, together with an assessment of their environmental, economic and social effects. These plans are currently undergoing an update process.

The marine areas have been divided into planning units covering different parts of the Baltic Sea. The analysis carried out for the purposes of the report took into account the areas of the southern and south-eastern part of the Baltic and the Öresund Strait. The following were identified as located closest to the proposed Project: general use zones, nature protection areas, areas with a defence function, and areas designated for offshore energy research and development, which could potentially be most exposed to impacts from the proposed Project.

Furthermore, other forms of development are present within these water bodies, such as: power transmission infrastructure (subsea power cables, e.g. NordBalt, connecting Nybro in Sweden with Klaipėda in Lithuania), energy development areas (covering both existing offshore wind farms and numerous planned and processed projects), areas designated for offshore energy research and development, areas with a defence function, nature protection areas (including Natura 2000 areas and areas protected under the HELCOM convention and national forms of protection), areas for the recreational use of the sea, areas for the extraction of mineral resources (sand and gravel), areas designated for shipping infrastructure and routes (leading to domestic and foreign ports), commercial fishing areas, and general use zones (allowing for various forms of activity while maintaining the principles of the coexistence of functions).

4.4 Technological development of wind energy

Owing to its dynamic technological development, offshore wind energy is characterised by continuous progress in technical solutions relating to individual farm components, in particular wind turbines and foundations. Consequently, at the current stage it is difficult to unambiguously determine which specific technologies will be available and which solutions will prove optimal at the project implementation stage.

It is to be expected that wind turbines with higher unit capacities will be developed in the coming years, which will affect their technical parameters. As a result, it will be possible to increase the efficiency of electricity generation from turbines located within the same area, compared with the technological solutions currently available.

Technological progress favours the implementation of new solutions that contribute to improving the design and increasing the operating efficiency of wind turbines.

4.5 Description of the production process

Offshore wind turbines are devices used to generate energy from renewable sources by converting the kinetic energy of wind into electrical energy. The energy generation process begins in the wind turbine, where the kinetic energy of the air stream acting on the rotor blades is converted into the mechanical energy of rotational motion.

The rotational motion of the rotor is then transmitted to the generator, where the mechanical energy is converted into electrical energy. The electrical energy generated in this way is transported via internal cables to the offshore substation (OSS), where, after transformation to a higher voltage level, it is transmitted further to the electricity grid on land.

The power grid connection and the onshore substation will constitute a separate project, subject to a separate environmental impact assessment procedure.

4.6 Description of individual Project components

An offshore wind farm consists of three main components, connected to one another functionally and structurally [Figure 18]:

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

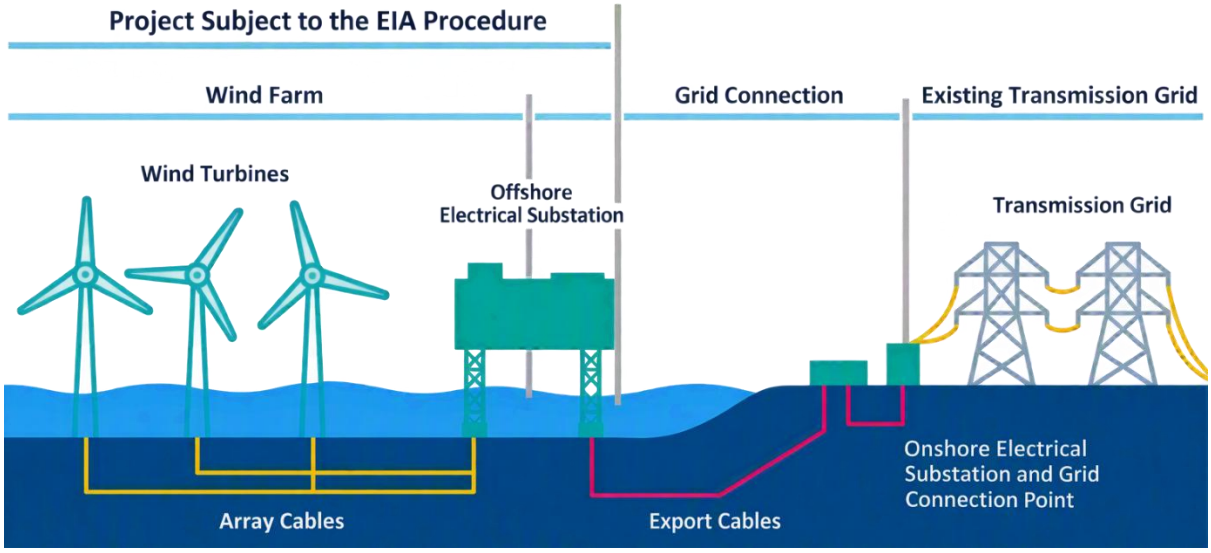


Figure 18 Basic components of an offshore wind farm together with the transmission infrastructure

The table below [Table 5] sets out the detailed range of parameters characterising the Baltic West area and each of the four OWFs.

Table 5 Summary of the key OWF parameters under the Applicant's Proposed Variant

PARAMETER	DATA CHARACTERISING THE PARAMETER	UNIT	VALUE				
			14.E.1	14.E.2	14.E.3	14.E.4	Baltic West Area
Number of turbines	*maximum*	pcs.	54	59	80	80	273
Rotor diameter	*maximum*	m	350	350	350	350	350
Clearance between the rotor working area and the water surface	*minimum*	m	20	20	20	20	20
Wind turbine height	*maximum*	m	370	370	370	370	370
Length of OWF internal array cables	*maximum*	km	210	210	332	348	1100
Number of offshore substations	*maximum*	pcs.	2	2	2	2	8
Seabed footprint	*maximum*	m^2/%	646 757 / 0.78	681 065 / 0.74	1 143 661/0.91	1 171 661/ 0.79	3 643 144 / 0.81
Volume of sediment for replacement/removal	*maximum*	m^3	422 230	459 929	618 265	618 265	2 118 689

4.6.1 Wind turbines

The basic components of offshore wind turbines are:

- the nacelle with the rotor
- the tower – the structural element connecting the nacelle to the support structure
- the support structure with the foundation

The figure [Figure 19] shows a diagram of the structure of an offshore wind turbine together with an example support structure.

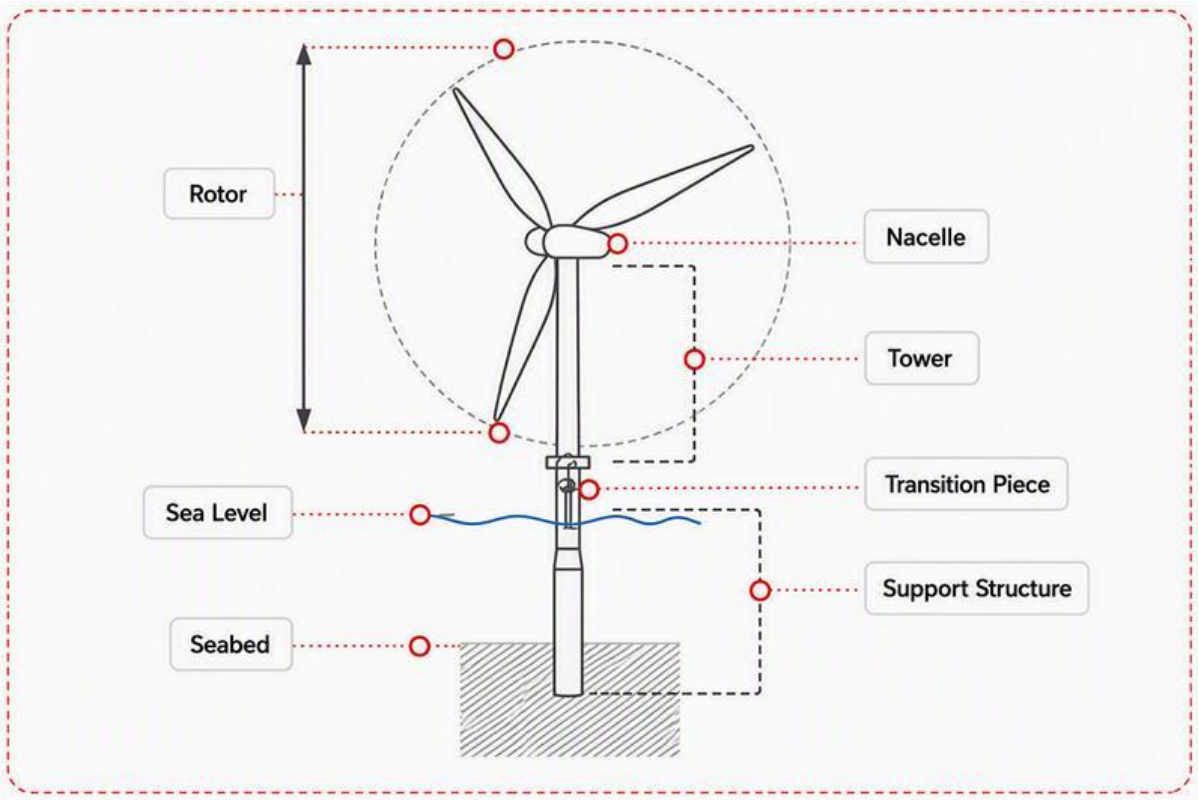


Figure 19 Diagram of the structure of a single wind turbine together with an example support structure

The development of offshore wind turbine technology means that, at this stage of Project implementation, it is not possible to define the detailed technical and structural parameters of the wind turbines that will be used within the Baltic West area. For this reason, the environmental impact assessment was carried out in such a way as to take into account the maximum boundary conditions, constituting the worst-case scenario, the parameters of which cannot be exceeded. This means that the actual environmental impact of the implemented projects may prove to be lower than that demonstrated in the environmental impact assessment carried out.

Offshore wind turbines currently being installed achieve rated capacities of around 12–15 MW, with units of around 15–16 MW already available on the market and being used in ongoing projects. At the same time, intensive development work is under way on turbines with higher capacities, exceeding 15 MW.

The latest demonstration and prototype designs achieve capacities of around 18–20 MW, and solutions with capacities of up to 20–25 MW are also at the design and testing stage.

An analysis of development trends indicates that, by the time supplies for the offshore wind farms are contracted, it will be possible to use turbines with a capacity exceeding 15 MW, although the highest unit capacities will initially be available mainly on a limited commercial scale.

Taking into account the possibility of using units with capacities of up to 25+ MW, the maximum rotor diameter is projected to be 350 m. It has been assumed that the minimum distance between the lowest point of the rotor blade and the sea surface will be 20 m, while the maximum overall height of a single wind turbine will reach 370 m above sea level.

The number of offshore wind turbines comprising the Baltic West OWF will depend on the rated capacity of the units selected. The maximum number of turbines will be up to 273 units for the APV and up to 294 units for the RAV.

4.6.2 Foundations and support structures

In the case of the proposed projects, the wind turbine is permanently connected to the seabed by means of a steel or concrete support structure (single-support or multi-support). The choice of an appropriate support structure depends on the size and mass of the wind turbine, and on the environmental conditions prevailing at the OWF location, including: the depth of the sea area, the geotechnical conditions of the seabed, and other environmental conditions, i.e. wave action, currents, ice cover, and biotic values. Additionally, in locations where the seabed is subject to hydrodynamic processes, it may be necessary to protect the seabed surface around the foundation with a protective layer, e.g. riprap (scour protection).

Within the OWF area, the following types of foundations are being considered for the installation of the turbines and offshore substations:

- large-diameter piles (monopile),
- multi-support foundations (jacket), and/or
- gravity-based structures (GBS).

Foundation technology is a field that is continually being optimised. The available technology is changing, and it will be further detailed before the proposed construction of the OWF begins.

For this reason, the detailed choice of the type of foundation for the support structures will be made at later stages of project implementation, following geotechnical surveys of the OWF area and the selection of the target type of wind turbine and OSS.

In order to minimise the negative impact of underwater noise during the installation of pile foundations, the application of various noise reduction solutions is envisaged, which will together

constitute a Noise Reduction System (NRS). The technical NRS solutions, together with appropriately planned underwater noise monitoring, will be submitted to the locally competent Regional Director for Environmental Protection at least 2 months before the piling commences.

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

- the schedule of works, including piling works carried out in other areas of the offshore wind farms comprising the Baltic West area,
- piling locations, including locations of simultaneous piling at neighbouring projects within the Baltic West complex,
- the parameters of the pile driver (type, maximum energy and energy values over the operating cycle, frequency and number of blows) or of another technical solution used to drive the pile into the seabed,
- the parameters of the driven piles (geometry and materials),
- the geotechnical parameters of the seabed,
- seasonal variability of environmental conditions (including underwater noise propagation parameters).

Depending on the above conditions, the Noise Reduction System may include:

- visual and acoustic observation of marine mammals and a soft-start system for the pile driver;
- passive noise reduction systems with parameters suitable for minimising noise, e.g. air bubble curtains, cofferdams, sound insulation, or other similar technologies available at the time of the Project implementation;
- the organisation of the works, taking into account the schedules of works at other projects within the Baltic West complex.

The selected Noise Reduction System (NRS) should minimise the impact of underwater noise on marine mammals and fish, guaranteeing control of the noise level generated during the piling of foundations throughout the year in such a way that:

- at a distance of 6.7 km from the piling location, in the most favourable direction of propagation, the noise level set as the threshold for cumulative TTS is not exceeded, i.e. 144 dB re 1 μPa^2s SEL_{cum} weighted using the VHF function (a function for marine mammals with high sensitivity to very high frequency sounds – the harbour porpoise);

- at the boundary of the Polish Natura 2000 site '*Ostoja na Zatoce Pomorskiej'* and at the boundaries of other Natura 2000 sites (where marine mammals are a conservation objective), the cumulative TTS thresholds are not exceeded, namely: 144 dB re 1 µPa²s SEL_{cum} weighted using the VHF function for the harbour porpoise, and 168 dB re 1 µPa²s SEL_{cum} weighted using the PW function for pinniped marine mammals (grey seal and harbour seal).

If exceedances of the threshold levels are found, or if the noise mitigation measures applied prove ineffective, the causes will be analysed without delay and mitigating measures will be implemented. Any exceedances of the established underwater noise levels will be reported without delay to the locally competent Regional Director for Environmental Protection.

4.6.3 Offshore substations

The offshore substations (OSS) will consist of the following basic components:

- a support structure (a multi-support foundation, a large-diameter pile, or a gravity-based foundation) used to found the offshore substation and to transfer the loads generated during its operation to the seabed,
- a topside structure – placed on top of the support structure.

The OSS may be implemented using either AC or DC technology.

The OSS is equipped with the devices and installations necessary for voltage conversion and transmission.

In the case of alternating current (AC) substations, these include, among others: transformers, high- and medium-voltage switchgear, backup generators, reactors, and AC filters.

In the case of direct current (DC) substations, on the other hand, these include, among others: converter systems consisting mainly of thyristors and/or power transistors, harmonic filters, transformers, capacitor banks, compensating reactors, and backup generators.

In addition to the main equipment, substations contain other auxiliary and associated elements necessary for the station's operation, including, among others, technical and storage rooms, social facilities, control and communication rooms, lifting equipment, antenna masts, and helicopter landing pads.

The number of OSSs depends, on the one hand, on economic factors, and, on the other, on the technology used to transmit electricity from the OWF to shore.

The offshore substation (the above-water part) will be a structure with the following dimensions:

- for an HVAC OSS – a maximum of 45 m by 50 m, with a maximum height of 80 m above sea level;
- for an HVDC OSS – a maximum of 80 m by 110 m, with a maximum height of 90 m above sea level.

4.6.4 Internal cable lines

Internal cable lines with a rated voltage of up to 132 kV will be used in the projects being designed. It is proposed to use cables consisting of three insulated cores (copper or aluminium), additionally equipped with fibre-optic cables. The use of newer technologies, available at the time the projects are implemented, is permitted.

4.7 Preliminary and preparatory works

Preliminary and preparatory works will involve activities related to the preparation and organisation of the construction site facilities and storage yards, and the preparation of the seabed prior to the commencement of construction works.

Prior to the commencement of construction, surveys will also be carried out for the presence of unexploded ordnance (UXO) on the seabed. If any is encountered, the relevant authorities will be notified and the measures they indicate will be implemented.

The Applicant plans the following preliminary and preparatory works preceding construction:

- removal/displacement of boulders from the routes of the internal cables and within the installation zone of the turbine foundations and offshore substations;
- removal/displacement of other obstacles, e.g. ropes, cables and fishing nets, using a special grapnel towed along the seabed, e.g. a Pre-Lay Grapnel Run (PLGR);
- preparation of cable crossing points with third-party infrastructure, involving reinforcement and appropriate protection;
- stabilisation of the seabed using rock dumping, both for the foundations (e.g. scour protection) and along the cable route;
- preparation of the seabed for the foundations where unfavourable ground conditions are found;

- preparation of embankments/protective structures (gravel pads) for jack-up installation vessels;
- displacement of layers of bottom sediments;
- other sediment-related works.

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

4.8 Construction

The construction phase of a single project is expected to last approximately 3 years, whereby this time does not include any potential breaks in the works. The investment process may be carried out on a parallel or sequential schedule, with the total duration of the construction and installation works for the entire Baltic West area estimated at a maximum of 7 years.

This phase will involve the largest number of vessels, equipment and human resources. It will be necessary to establish a complex supply chain process for both goods and specialist services in various areas: manufacturing, transport, construction, assembly and installation. The precise coordination of individual activities will be required, taking into account the specific conditions resulting from the implementation of the Project at sea. The construction phase will comprise the following set of activities:

- transport and installation of large-diameter, multi-support or gravity-based foundations in the seabed;
- transport and installation of transition pieces, wind turbine components and substations on large-diameter, multi-support or gravity-based foundations;
- transport and laying of the internal cable connections linking the individual OWF structures;
- protection of foundations and cable crossing points with third-party infrastructure against scour (so-called scour protection), at locations where this is required;
- protection of cable lines laid on the seabed;
- seabed clearance.

Depending on the Project implementation strategy adopted, the above stages and their activities may be carried out sequentially or in parallel. For example, once a foundation has been installed, turbine assembly may be carried out at the same time as piling for the next foundation. The organisation of the construction process may therefore assume that individual works are carried out sequentially across the entire Project area or within a specific part of it. In practice, this means that

seabed preparation works will be carried out in parallel at several (or all) wind turbine and substation locations. Piling will then begin, and once installation has been completed, the seabed around the individual structures will be cleared.

4.9 Commissioning and operation

The operational phase will begin with the commissioning of the first offshore wind farm within the Baltic West area – i.e. with the wind turbines beginning to generate electricity. Each OWF is expected to be in operation for up to 55 years.

The wind farm will be operated from a land-based operations centre. Although the operation of the OWF will not require the permanent presence of personnel within the farm area, planned and ad hoc inspections, servicing works and, where necessary, repair works will be carried out during the operational phase, including in the area of servicing, maintenance and the replacement of major components.

In addition to the general set of activities and conditions for the use of the sea area applicable to all project phases, the operational phase is characterised by issues relating to maritime transport, electromagnetic field emissions, and the emission of heat generated by the cables.

4.10 Decommissioning

In technical terms, the decommissioning phase is the reverse of the OWF construction phase. In the reverse order to the construction phase, the individual OWF components will be removed and transported to sites for management or disposal. The decommissioning of each of the four wind farms comprising the Baltic West Area is assumed to take approximately 2 years.

The number of specialist marine operations associated with the decommissioning phase of each project is proportional to the number of structures installed and built within the OWF area. Consequently, the number of operations and their effects (e.g. fuel consumption, transport-related emissions) will be lower for the APV than for the RAV.

It is anticipated that the structures within the project area will be decommissioned down to seabed level, i.e. the sections of the foundations driven into the seabed will remain in place, since they do not cause environmental impacts, whereas their removal could cause such impacts – for example, where removal methods using explosives are applied (the section of the piles above the seabed will be cut off or burnt off during the decommissioning). At the same time, the underwater components of the OWF may serve as a habitat for communities of marine organisms.

As regards waste generation during the decommissioning phase of the projects, this will be associated primarily with the physical removal of used OWF components and with the standard operation of the vessels used in the decommissioning process.

The possibility of repowering – i.e. the dismantling of wind turbines and their replacement with next-generation turbines – is not excluded.

4.11 Preliminary construction works schedule

The period of construction works alone for each of the wind farms comprising the Baltic West Area is assumed to be approximately 3 years, with some of its stages overlapping, although this time does not include any potential breaks in the works. The duration of the construction works for the entire Baltic West Area is estimated at a maximum of 7 years.

The schedule for the project implementation phase comprises the following components:

- preliminary and preparatory works;
- construction/installation works.

The construction stage must be preceded by the preparation of the seabed prior to the installation of the foundations or support structures for the wind turbines and OfSS, and the laying of the internal cables.

The type of preparatory works will depend on the characteristics of the seabed, the geological conditions at the foundation locations, the cable routing, and the type of foundation and technology used. The Applicant permits the preparatory works to be carried out either sequentially or in parallel.

The OWF operational phase will last a maximum of 55 years.

Upon completion of the operation, the decommissioning of the OWF is assumed, with the expected duration of these works being approximately 2 years; this period does not include any potential breaks in the works, in the same way as for the implementation phase.

4.12 Mitigation measures

The environmental impact assessment carried out for each of the OWFs indicates that no significant adverse environmental impacts will occur as a result of the implementation of these projects.

In order to reduce or eliminate the identified environmental impacts during the construction phase, the following minimisation measures are proposed:

- The application of the Noise Reduction System, whose effectiveness guarantees strict compliance with the absolute emission limits, intended to ensure that noise propagation is limited so that, at the locations specified in the summary below, the threshold values for hearing damage in harbour porpoises and seals, according to the NMFS (2024) criteria, are not exceeded:
    - at a distance of 6.7 km from the piling location, the noise level set as the threshold for cumulative TTS should not be exceeded – 144 dB re 1 µPa²s SEL_{cum} weighted using the VHF function for mammals with high sensitivity to very high frequency sounds, including the harbour porpoise [NMFS, 2024];
    - at the boundary of the Polish Natura 2000 site '*Ostoja na Zatoce Pomorskiej*' and at the boundaries of Natura 2000 sites where the harbour porpoise is a conservation objective, the noise level set as the cumulative TTS threshold should not be exceeded – 144 dB re 1 µPa²s SEL_{cum} weighted using the VHF function for the harbour porpoise; and 168 dB re 1 µPa²s SEL_{cum} weighted using the PW function for the grey seal and harbour seal [NMFS, 2024];
    - implementation of a Marine Mammal Observer (MMO) and/or passive acoustic monitoring (PAM) programme, in order to verify that no animals are present in the exclusion zone before the start of works. If harbour porpoises or seals are found to be present within this zone, the commencement of piling must be suspended;
    - application of the soft-start procedure during piling, in accordance with the NRS provisions;
    - restriction of simultaneous piling in situations where the ranges of behavioural response of harbour porpoises during the summer season could extend to the boundaries of Natura 2000 sites where the harbour porpoise is a conservation objective, with this period defined as the months of June–October for the OWF 14.E.1 and OWF 14.E.2 areas, and as the months of July–August for the OWF 14.E.3 and OWF 14.E.4 areas.

Simultaneous piling during the summer season in the southern parts of individual sites within the Baltic West area, given the risk of disturbance zones overlapping with Natura 2000 sites and the cumulative deterrent effect on potential porpoise feeding grounds, shall be permitted only on condition that, in the NRS description, submitted to the Regional Directorate for Environmental Protection (RDOŚ) in Szczecin at least two months before the start of works, the Investor

unequivocally demonstrates that the behavioural response threshold for porpoises will not be exceeded. This level, set at a threshold of 103 dB re 1 µPa (SPL_{125ms} weighted by the VHF function), must not be exceeded at the boundaries of Natura 2000 sites where the porpoise is a protected species (in particular the *Ostoja na Zatoce Pomorskiej* PLH990002).

The use of ADD (acoustic deterrent devices) as a method of limiting the impact of noise on marine mammals is not recommended, owing to their possible adverse effect on harbour porpoises.

- Ornithological supervision will be carried out during piling in the period when bird concentrations occur, i.e. from the beginning of November to the end of April. If the ornithological supervision does not observe the presence of groupings of sea ducks, auks or divers within an area with a radius of 1.5 km from the location of piling, works preceded, in each case, by the soft-start procedure may commence.
- Restriction, at night, of strong light sources directed upwards and, as far as possible, sideways. This applies primarily to bird migration and overwintering periods. Light emission should be limited to the level necessary, resulting from applicable occupational and traffic safety regulations and standards.
- Directing vessel traffic along existing, operational shipping routes or along the route of the proposed approach fairway to Świnoujście, in order to limit the bird disturbance, restricted solely to areas of increased traffic.

The proposed minimisation measures during the operational phase include:

- If an OSS (using DC technology) uses a cooling system based on seawater, an Anti-Fouling Prevention System (AFPS) will be implemented in the cooling water circuit. The use of chemical agents, such as sodium hypochlorite, will require the application of appropriate mitigation solutions ensuring full compliance of the installation with national regulations and international marine environmental protection standards. This applies in particular to compliance with the permissible quality parameters of the discharged water and to the maintenance of continuous supervision.

  A complete technical description of the AFPS, together with an operational monitoring programme, will be submitted to the Regional Director for Environmental Protection in Szczecin at least 2 months before operation commences.

- If jacket foundations are used, their above-water elements will be painted a bright colour in order to minimise the risk of collision with birds.

- If the results of operational monitoring, in accordance with the adopted methodology, indicate that intensive crane migration is taking place over the OWF area at collision height, the OWF must be equipped with a detection-and-response system enabling selected wind turbines to be slowed down (the so-called temporary shutdown system) during crane migration periods. Intensive migration is understood to mean migratory stream values reaching or exceeding 1% of the biogeographic crane population migrating over the course of a year (spring migration and autumn migration) across the entire OWF area within the Baltic West area. The need to apply a temporary shutdown system during crane migration, and any algorithm for its operation, will be determined following the completion and presentation of the results of the post-implementation monitoring (carried out during the first few years of the MFW's operation) to the Regional Directorate for Environmental Protection in Szczecin.
- Recommendations for restricting, at night, strong light sources directed upwards and, as far as possible, sideways. This applies primarily to bird migration and overwintering periods. Light emission and lighting intensity should be limited to the level necessary, resulting from applicable regulations and occupational and traffic safety standards. The use of light colours and intensities that are less attractive to birds, provided that the requirements for marking aviation and navigational obstacles allow their implementation.

The proposed minimisation measures during the decommissioning phase include:

- Removal of any remaining residues and contaminants from the seabed following the completion of the dismantling of the wind turbines and OSS, unless otherwise agreed with the maritime administration.
- Removal of successive turbines starting from one location, so that the sea area occupied by the OWF is progressively freed of structures.

5 RISK EVALUATION

5.1 Introduction

This chapter summarises the results of the assessment of the risk of accidents and failures affecting the environment, and of the risk to the population (third-party risk or societal risk). The term 'risk' is taken to be defined as the probability of an accidental event occurring, together with its consequences. The risk assessment carried out does not cover occupational environment issues or the risk borne by workers involved in construction works. The framework principles for risk control during construction and operation are set out in the Investor's occupational health and safety and environmental protection management system.

In order to prevent the occurrence of failures and accidents, appropriate safeguards will be applied, discussed further in this chapter, as well as the mitigation measures specified in Chapter 5.2.5 of this report.

The mitigation measures and safeguards will be taken into account already at the farm design stage, so that the risk to human safety and to the environment is below the risk acceptance criterion. In addition to this, measures have been implemented to further reduce the risk to the lowest possible level. This applies both to the construction phase and to the farm's operational phase. For each of the OWF projects, risk analyses were carried out as part of the Polish environmental impact assessment, for all stages of the project.

5.2 Risk of major failures or natural and construction-related disasters

5.2.1 Types of failure resulting in environmental contamination

The project, comprising the implementation, operation and decommissioning of an offshore wind farm (OWF), is a project with a multi-year time horizon, carried out both on land and at sea.

The OWF does not involve the storage of hazardous substances in quantities warranting its classification as an establishment with an increased or major risk of a serious industrial accident, in accordance with the Regulation of the Minister of Development of 29 January 2016. Consequently, the implementation and operation of each of the projects will not involve the risk of industrial accidents within the meaning of the above regulations.

The production of OWF components and spare parts will take place on land. At sea, preparatory, construction, installation, operational, servicing and decommissioning works will be carried out, using specialist vessels (transport, installation and service vessels).

Ports, in which the large-format components of the wind turbines, foundations, towers and offshore substations will be manufactured or assembled, play an important role in the project implementation process. The technologies and production processes used do not create a significant risk of failures resulting in significant pollutant emissions. Likewise, no events posing a threat to the environment are anticipated at the OWF decommissioning and waste management stage.

The main potential environmental hazard during the implementation, operation and decommissioning of the OWF is spills of petroleum-derived substances, in particular diesel, hydraulic, transformer and lubricating oils, used by the vessels and technical installations. During the operational phase, oil spills constitute the primary potential cause of marine water pollution, which could lead to long-term impacts on fauna, flora, fisheries and coastal areas.

In order to reduce the risk of such events, the OWF installations will be equipped with appropriate safeguards against the spillage of hazardous substances.

Spills of petroleum-derived substances can be classified as follows:

Tier I (up to 20 m^3) – spills of a local nature, which can be removed using the operator's own resources and do not constitute a significant threat to the environment;

Tier II (20–50 m^3) – spills requiring coordinated action within the area of the competent maritime office;

Tier III (over 50 m^3) – spills of a catastrophic nature, requiring the involvement of the forces and resources of more than one maritime office.

5.2.2 Course of a failure with an assessment of potential effects

5.2.2.1 Leakage of petroleum-derived substances during normal vessel operation

During the normal operation of vessels, minor leaks of petroleum-derived substances (diesel and lubricating oils, petrol) may occur, which should be classified as Tier I spills.

Protected areas, including Natura 2000 sites, in particular the *Zatoka Pomorska PLB990003* site, are particularly sensitive to potential contamination. Owing to the predominant westerly wind directions and coastal currents, sections of the coastline, together with tourist localities and the ports of Kołobrzeg, Ustka and Łeba, could also be exposed to risk.

The scale of the impact is determined primarily by the location of the spill rather than by its size – even minor leaks can cause significant ecological losses in areas of seabird concentration. At the same time, it should be noted that bird densities in the area of the proposed OWF are relatively low,

and, in the case of Tier I spills and appropriate organisation of vessel traffic, the probability of contamination reaching ecologically valuable areas is low.

The actual extent of any spills can only be determined during the event itself, on the basis of the prevailing meteorological conditions and the type and quantity of substance involved. For this reason, a more detailed assessment of the impact on marine organisms is not possible at the EIA Report stage. The probability of leaks occurring remains directly proportional to the number of vessels involved in the implementation, operation and decommissioning of the Project.

5.2.2.2 Leakage of petroleum-derived substances (in emergency situations)

During the implementation, operation or decommissioning of the OWF, leakage of petroleum-derived substances may occur, leading to the contamination of marine waters and bottom sediments. Potential sources of leaks include failures or collisions of vessels, their contact with OWF components, operational leaks, and leaks from the oil installations of the wind turbines and substations.

In an extreme case, Tier II spills could occur during the implementation or decommissioning stage. However, the probability of serious accidental events is very low, estimated at between 10^{-5} and 10^{-2}. Assuming the worst-case scenario (release of 200 m^3 of diesel oil), the anticipated extent of contamination will not exceed 5–20 km from the OWF area.

In accordance with the Act of 18 August 2011 on Maritime Safety, the detailed principles for the prevention and control of pollution will be agreed with the competent maritime administration before the application for a construction permit for the Project is submitted.

5.2.2.3 Release of chemical agents and waste

During the implementation of the OWF, waste will be generated on vessels, at the construction facilities in port, and at the Project implementation site. This may include, among others, damaged OWF components, cement, grout, mortars, binders and other chemical substances used during construction works, which, as a result of incidental events, could be released into the sea.

Cement is packed in bags with a capacity of approximately 1 m^3; it is assumed that up to 5 m^3 of material could be lost overboard during transhipment. Grouts, mortars and binders (e.g. epoxy-based) may contain hazardous substances which, once they enter the water, sink to the bottom owing to their high density and may pose a threat to marine organisms.

The risk of waste or chemical substances being released into the environment is proportional to the intensity of the works being carried out and the extent to which chemical agents are used.

5.2.2.4 Deliberate jamming of the GPS signal

Since 2023–2024, the phenomenon of GPS signal interference (jamming and spoofing) has been increasing, constituting an additional threat to navigational safety in the Baltic Sea. Jamming involves the jamming of the GPS signal, while spoofing involves its falsification, which can lead to incorrect or completely lost positioning of vessels.

This interference makes the planning and conduct of offshore works more difficult and may cause delays or the temporary suspension of OWF construction and servicing works, extending the duration of impacts. Given the high probability of such interference occurring, it is necessary to allow for time reserves when planning operations.

5.2.3 Other types of releases

5.2.3.1 Release of municipal waste or household sewage

During the construction of the wind farm, waste – mainly municipal and other waste not directly related to the construction process – as well as household sewage will be generated on board the vessels and at the land-based construction facilities (in the port supporting the implementation of the project). Waste and sewage could be accidentally released into the sea during collection from vessels by another unit, or in the event of a failure, causing a local increase in nutrient concentrations and a deterioration in water and sediment quality.

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

5.2.3.2 Contamination of the water column and bottom sediments with antifouling agents

Antifouling paints containing biocidal substances, including copper, mercury and organotin compounds, are used to protect ship hulls against fouling, and these may leach into the water and bottom sediments. The emission of these substances is assessed as insignificant, with organotin compounds being the most toxic to aquatic organisms.

The use of tributyltin (TBT) is currently prohibited; however, its presence in the coatings of older vessels cannot be excluded. This impact can be limited through control of the type of protective coatings used by vessels operating in the OWF area. It is anticipated that potential emissions will not have a significant effect on the structure, functioning or mortality of marine organisms within the Project area.

5.2.3.3 Release of contaminants from anthropogenic objects on the seabed

On the basis of an analysis of geophysical and bathymetric data (CIEP, MO, NHO), more than 100 objects and anomalies on the seabed (specifically 103 selected points) have been identified within

the OWF area, the vast majority of which are of anthropogenic origin. Among these, the following have been identified in particular:

- 6 identified shipwrecks and 1 anomaly probably constituting a wreck. These include the aforementioned historic wrecks: WK-0610 (from the first half of the 20th century) and WK-0605 (a remnant from the Second World War), as well as the wrecks WK-0609, WK-0631, WK_0288 and WK_0233, located within and in the immediate vicinity of the individual water bodies;
- numerous unidentified objects (a total of approximately 40 objects selected as a cluster for further non-invasive surveys), including potential remnants of former shipping, cargo, nets or ballast stones, which could potentially constitute underwater cultural heritage sites and archaeological monuments.
- 0 unexploded ordnance items (pUXO) at the preliminary survey stage.

The risk of contaminants being released from objects lying on the seabed (e.g. lost ship cargoes, containers or barrels that could contain hazardous chemical substances) cannot be entirely excluded. There is also the possibility of new objects being discovered (including pUXO and chemical weapons) during detailed preparatory works.

All key archaeological sites will be avoided or protected. The Investor has committed to developing a Hazardous Object Management Plan. Its priority will be to protect human health and to prevent the spread of marine pollution by avoiding or safely removing potential sources of contamination.

5.2.4 Environmental hazards

5.2.4.1 Implementation phase

On the basis of experience from other OWF projects, potential accidental events during the implementation phase that could have an adverse effect on the environment have been identified, including: leaks of petroleum-derived substances (e.g. as a result of vessel collisions), accidental releases of waste, sewage, materials or chemicals, contamination by antifouling agents, and failure of the noise reduction system.

These events could directly contaminate mainly marine waters (less frequently bottom sediments), and indirectly affect marine organisms. The release of waste or sewage is of a short-term, local and reversible nature, of negligible significance.

The greatest hazard is a leak of hazardous substances as a result of a vessel collision, which could increase the mortality of organisms; however, its probability is low, and response procedures limit its effects. No significant impact on the environment or on Natura 2000 sites is anticipated.

Failure of the noise reduction system could increase noise emissions and adversely affect marine animals, but this is unlikely. The application of procedures (e.g. soft-start) minimises the effects of such events.

5.2.4.2 Operational phase

During the OWF operational phase, environmental hazards may arise in connection with the contamination of water and bottom sediments, including by petroleum-derived substances, antifouling agents, waste, sewage and operational chemicals. Waste and sewage are generated mainly during the servicing of the installation and the operation of service vessels.

The most serious risk is a leak of hazardous substances as a result of a collision or failure of vessels, which could increase the mortality of marine organisms. However, the probability of such events is low, and the response procedures implemented significantly limit their effects.

The impacts resulting from an emergency situation during the operational phase are the same as the impacts that could occur during the OWF implementation phase. The only somewhat different aspect concerns the accidental release of chemical agents and waste. During the operation of the OWF, its facilities will be serviced. The accidental release into the sea of small quantities of waste or operational fluids cannot be excluded. However, these impacts are minor and local in nature and do not significantly affect the functioning of the ecosystem.

For Natura 2000 sites as well, the main hazard remains potential oil spills; however, given the low probability and the application of preventive measures (i.e. a collision and spill response plan), no significant impact on protected areas is anticipated.

5.2.4.3 Decommissioning phase

During the OWF decommissioning phase, environmental hazards may arise in connection with the contamination of water and bottom sediments, including as a result of the accidental release of installation components, waste, sewage, petroleum-derived substances and antifouling agents.

It is also possible for sewage to enter the water during its transfer or in the event of a failure, which could temporarily deteriorate water quality; however, the contaminants will disperse quickly and will not cause lasting changes.

These impacts are similar to those occurring during the implementation phase. The most serious risk is posed by leaks of hazardous substances as a result of a collision or failure of vessels, which could adversely affect marine organisms. However, the probability of such events is low, and the procedures implemented limit their effects, meaning that the hazard is considered insignificant.

5.2.5 Accident prevention

Accident prevention comprises the full range of measures related to the protection of human health and life, the environment and property, as well as the reputation of all parties involved in the processes associated with the implementation, operation and decommissioning of the OWF. These measures include, among others:

- developing plans for the safe implementation, operation and decommissioning of the OWF in accordance with applicable legislation;
- developing rescue plans and training crews and personnel, including the principles for updating and verifying these through regular drills, in particular defining procedures for the use of the operator's own units and external units, including helicopters;
- developing a plan for counteracting hazards and pollution arising during the construction, operation and decommissioning of the OWF;
- the selection of suppliers and certified materials and components for the OWF;
- the designation of protective zones;
- the precise marking of the OWF area, its structures, and vessels moving within the OWF;
- the planning of marine operations;
- the application of the standards and guidelines of the International Maritime Organization (IMO), recognised classification societies, and the recommendations of the maritime administration;
- developing plans for safe navigation within the OWF and for voyages to ports;
- providing appropriate navigational support in the form of charts and navigational warnings;
- providing direct or indirect navigational supervision using a guard vessel or remote radar surveillance and the Automatic Identification System (AIS);
- continuous monitoring of vessel traffic within the OWF, whether direct or remote, throughout the entire period of implementation, operation and decommissioning of the OWF;
- establishing a coordination centre overseeing the implementation, operation and decommissioning of the OWF;
- maintaining permanent communication lines between the OWF coordination centre and the offshore works coordinator and other coordination centres (the Maritime Search and Rescue

Coordination Centre in Gdynia and the Auxiliary Coordination Centre in Świnoujście, and the maritime administration).

5.2.6 Design, technological and organisational safeguards planned for use by the Applicant

Design, technological and organisational safeguards include a navigational risk assessment and the development of plans relating to human safety (evacuation, rescue), fire protection, pollution prevention (including oil pollution), and counteracting construction-related disasters. The obligation to have appropriate plans applies both to the OWF infrastructure and to the vessels involved in its construction, operation and decommissioning.

In accordance with the Act of 18 August 2011 on Maritime Safety, before obtaining a construction permit, the Investor is required to develop and obtain approval for, among other things: a navigational assessment, assessments of the impact on communication, rescue and maritime safety systems, a rescue plan, a hazard and pollution response plan, and assessments of the project's impact on the state's defence systems and the Border Guard.

5.2.7 Potential causes of failure, including extreme situations, and the risk of natural and construction-related disasters

OWF structures are designed to operate under extreme conditions and are adapted for many years of operation. The systems are continuously monitored, and, in the event of any irregularities being detected, servicing measures are automatically initiated, or operation is restricted or halted (e.g. in the case of excessively strong wind). Regular servicing ensures the safe functioning of the installation.

The greatest risk occurs during the implementation phase; however, this is minimised through the planning of operations taking into account weather conditions and their limitations. The only consequence of unfavourable conditions may be an extension of the works and increased fuel consumption, without significant environmental hazards.

5.3 Risk of major failures or natural and construction-related disasters, taking into account the substances and technologies used, including risks related to climate change

The risk of a serious failure resulting in the emission of hazardous substances into the marine environment is minimal and falls within the acceptable range. The probability of a vessel collision has been classified as a very rare event (estimated to take place once every 100 years), while the risk of a vessel making direct contact with a Baltic West structure is even lower (once every 200 years). In the case of an emergency scenario assuming the release of up to 200 m^3 of diesel oil, the potential

environmental damage is assessed as insignificant. Owing to the dynamics of the marine environment, the contamination slick will disperse completely within 12 hours of the release, which drastically limits the possibility of long-term or transboundary effects on the ecosystem.

The risk analysis also takes into account the conditions resulting from the climate change, which in the southern Baltic will result, among other things, in an increase in the frequency and intensity of storms and a more frequent occurrence of extreme wind and wave phenomena. Nevertheless, the risk of a construction-related disaster on this account is assessed as minimal, since offshore wind farm structures are designed from the outset for many years of operation under difficult weather conditions. Each component is subject to continuous monitoring, and, in the case of winds exceeding safe values, rotor operation is automatically stopped. The greatest challenges related to extreme weather phenomena may arise during the project implementation phase; however, owing to rigorous planning of marine operations taking current conditions into account, these will result, at most, in an extended implementation cycle and increased fuel consumption, rather than in a failure. The other projected consequences of climate change (including a faster increase in water temperature, a decrease in salinity, progressive eutrophication, and an increase in the area of anoxic zones near the seabed) could have an adverse effect on the marine ecosystem itself, but remain without direct impact on the safety and failure risk of the wind farm structures.

5.4 Immediate emergency response plan

Immediate response plans will be developed and implemented by the Investor before the commencement of the construction and operational stages, respectively. The immediate response plan will be tailored to the scope of the proposed activities and the risk associated with these activities as described above.

6 SUMMARY OF THE PROJECT VARIANTS ANALYSED

Under Article 5 of the Espoo Convention, the Investor is required to assess variants of the project implementation, including the variant in which the project is not implemented.

Under the national environmental impact assessment procedure, the Investor is also referred to as the Applicant.

The variants for each of the four wind farms comprising the Baltic West Area comprise the main variants relating to the application of technological solutions and taking into account the most effective use of the area designated for project implementation. The Applicant's Proposed Variant (APV) assumes the use, to the greatest extent possible, of optimal technological solutions available on the market at the stage of the construction design. This means that this variant involves the use of wind turbines currently at the early analysis and design stage, in accordance with the parameters announced by manufacturers. The fundamental assumption of the Rational Alternative Variant (RAV), on the other hand, was the adoption of currently existing technological solutions that are applied and available on the market on an industrial scale.

The OWF investment process takes many years (often exceeding 10 years from the start of preparations to the actual commencement of construction), and therefore, owing to the dynamic development of technology during this time, it is not possible to define all of the target parameters of the installation. For this reason, the EIA Reports apply the so-called envelope of boundary conditions approach, defining the minimum and maximum technical assumptions for its implementation.

It is not possible to consider location variants for the Projects, since their location, owing to site-related conditions (the area of the Baltic Sea), has already been determined in the PCAI (Permit for the Construction and Use of Artificial Islands). The permissible locations for offshore wind farms within Polish maritime areas have been indicated in the Regulation of the Council of Ministers of 14 April 2021 on the adoption of the spatial development plan for Polish internal marine waters, the territorial sea and the exclusive economic zone at a scale of 1:200000 (Journal of Laws 2021, item 935, as amended); however, implementation of the project in another part of the water bodies designated for offshore renewable energy is not possible without obtaining a permit through a resolving procedure, under which the Minister of Infrastructure, after evaluating competing applications, grants a permit to the Investor achieving the highest number of points. Consequently, any other location variants cannot be considered reasonable, since their implementation does not depend solely on the Investor's decision.

Two feasible variants have been adopted for each of the four projects:

- the variant proposed for implementation – i.e. the variant proposed by the Applicant (APV), which, under the environmental impact assessment, also proved to be the most environmentally favourable variant;
- the Rational Alternative Variant (RAV).

The projects have been characterised by determining, for each variant:

- the maximum number of turbines – a parameter defining the maximum number of turbines with the adopted parameters;
- the maximum wind turbine rotor diameter – a parameter defining the diameter (size) of the rotor;
- the minimum clearance between the rotor working area and the water surface – a parameter defining the distance from the tip of the offshore wind turbine blade in its lowest position relative to mean sea level;
- the maximum height of the wind turbine structure including the rotor – a parameter defining the maximum height of the wind turbine structure, from mean sea level to the tip of the offshore wind turbine blade in its highest position;
- the maximum length of the OWF internal cable lines – a parameter defining the total horizontal length of the internal cables;
- the volume of sediment requiring removal or filling for the proper installation of the foundation – a parameter defining the volume of material to be removed/added;
- the maximum seabed footprint – a parameter defining the area of seabed occupied for the implementation of the OWF.
- the maximum number of offshore substations (OSS) – a parameter defining the maximum number of transformer stations located at sea.

The table below [Table 6] presents a summary of the key parameters of each offshore wind farm comprising the Baltic West Area for the Applicant's Proposed Variant (APV) and the Rational Alternative Variant (RAV)

Table 6 Comparison of the basic technical parameters of the OWF under the APV and the RAV

OWF	PARAMETER	UNIT	14.E.1	14.E.2	14.E.3	14.E.4
APV	**Maximum number of turbines**	pcs.	54	59	80	80
	Maximum wind turbine rotor diameter	m	350	350	350	350

OWF	PARAMETER	UNIT	14.E.1	14.E.2	14.E.3	14.E.4
	Minimum clearance between the rotor working area and the water surface	m	20	20	20	20
	Maximum height of the wind turbine structure including the rotor	m	370	370	370	370
	Maximum permanent seabed footprint	m^2	646 757	681 065	1 143 661	1 171 661
		%	0.78	0.74	0.91	0.79
	Maximum volume of sediment for replacement/removal	m^3	422 230	459 929	618 265	618 265
	Maximum number of offshore substations	pcs.	2 HVAC 1 HVDC	2 HVAC 1 HVDC	2 HVAC 1 HVDC	2 HVAC 1 HVDC
RAV	**Maximum number of turbines**	pcs.	58	64	86	86
	Maximum wind turbine rotor diameter	m	236	236	236	236
	Minimum clearance between the rotor working area and the water surface	m	20	20	20	20
	Maximum height of the wind turbine structure including the rotor	m	256	256	256	256
	Maximum permanent seabed footprint	m^2	692 954	734 124	1 184 832	1 258 332
		%	0.84	0.80	0.94	0.85
	Maximum volume of sediment for replacement/removal	m^3	452 389	497 628	663 504	663 504
	Maximum number of offshore substations	pcs.	2 HVAC 1 HVDC	2 HVAC 1 HVDC	2 HVAC 1 HVDC	2 HVAC 1 HVDC

6.1 No implementation of the projects

The non-implementation of the Projects will adversely affect the achievement of the effects expected under numerous policies and strategies, in particular those relating to environmental protection (the reduction of pollutant emissions, the achievement of adopted environmental and climate targets), sustainable development (the use of renewable energy sources) and energy security (reducing dependence on external energy sources). Consequently, the non-implementation of the Baltic West Project will have an adverse effect on, among other things, the national electricity supply system and Poland's achievement of its assumed sustainable development indicators and the target of increasing energy generation from renewable energy sources.

The non-implementation of the Projects therefore corresponds to leaving the area in question in the baseline environmental conditions described in the EIA Report. This scenario is often referred to in practice as the 'zero variant'.

Analysing the impact of the scenario in which the Projects are not implemented, from a climate perspective, it should be noted that the non-implementation of the OWF means that no reduction in emissions will occur, and consequently no reduction in the climate impact resulting from the use of fossil fuels will take place.

In analysing the Projects, it was shown that, under the conservative assumption of a 40% capacity utilisation factor and the assumed OWF operational lifetime, significant emissions of carbon dioxide, sulphur dioxide, nitrogen oxides and particulate matter at lignite-fired power plants could be avoided. The non-implementation of the OWF therefore precludes a significant reduction in emissions harmful to the environment, regardless of the approach used to calculate them. It also means departing from the policy objectives relating to limiting emissions to air from combustion sources and failing to move in the direction of measures relating to the development of and transition to renewable energy sources. In summary, under the variant based on the assumption of not undertaking the Project, the climate benefits are not realised, which translates into a failure to achieve the climate and environmental targets adopted both for Poland and for the EU.

The Applicant permits the implementation of the Projects either as a continuous process or in stages. This assumption does not apply to the scenario based on the assumption of not undertaking the Project.

6.2 Alternative variants considered

For the APV variants, parameter values corresponding to the maximum parameters of each project were adopted – these variants are based on the use of wind turbines with the maximum parameters that are planned to be brought to market during the years covering the project's implementation.

In the RAV variants, on the other hand, the turbine parameters correspond to those currently being installed. This assumption makes it possible to carry out an environmental impact assessment that takes into account the highest expected level of environmental impact of the project, associated with the technological progress anticipated over time.

6.2.1 Applicant's proposed variant (APV)

The Applicant's Proposed Variant assumes the use, to the greatest extent possible, of optimal technological solutions available on the market at the stage of the construction design. This means that the variant involves the use of wind turbines currently at the early analysis and design stage, in accordance with the parameters announced by manufacturers. In terms of the foundation technology, the use of large-diameter piles, truss foundations and/or gravity-based foundations is planned.

The parameter values corresponding to the maximum parameters of the projects under the APV are set out in the table [Table 6].

The Applicant's Proposed Variant takes into account the steady, and in recent years intensive, development of technology in the field of OWFs, moving in the direction of increasing the size of rotors, generators and structural components, and increasing the efficiency of the technical and technological solutions applied.

In accordance with the results of the environmental impact analyses presented in this report, the APV is a more environmentally favourable variant than the RAV.

6.2.2 Rational Alternative Variant (RAV)

The fundamental assumption of the Rational Alternative Variant (RAV) was the adoption of currently existing technological solutions that are applied and available on the market on an industrial scale.

Owing to the use of turbines with a lower unit capacity in this variant, a larger number of them are anticipated to be installed. This consequently means a greater degree of environmental interference compared with the Applicant's Proposed Variant (APV), reflected, among other things, in a larger maximum permanent seabed footprint and a larger total rotor swept area of the wind turbines.

The RAV assumes the possibility of using a single type of wind turbines on various types of foundation (large-diameter piles, truss foundations, or gravity-based foundations).

The parameter values corresponding to the maximum parameters of the projects under the RAV are set out in the table [Table 6].

7 METHODOLOGY FOR CARRYING OUT THE TRANSBOUNDARY ENVIRONMENTAL IMPACT ASSESSMENT

In general terms, the methodology for carrying out the transboundary impact assessment is analogous to the methodology applied in the national environmental impact assessment. This assumption ensures an appropriate quality and level of detail of the environmental impact assessment and allows the affected Party and the Party of origin to be treated equally. However, this report focuses geographically on the maritime border zones between Poland and the affected Party.

The environmental impact assessment covers the potential environmental and social impact of all phases of the project – implementation, operation and decommissioning – in relation to the relevant environmental and social elements. The assessment covers the direct, indirect and secondary, cumulative and transboundary, permanent and temporary, and positive and negative effects of the project's impact, taking into account the objectives defined at EU level (e.g. the Marine Strategy Framework Directive, the Water Framework Directive, the Birds Directive and the Habitats Directive) and at national level. Impacts will be analysed in terms of their nature, range and intensity, and in relation to (socio-economic and environmental) receptors. The impact analysis will determine the sensitivity of the receptor and the magnitude of the impact, and, on this basis, the significance of the impact will be estimated. The methodology applied to the environmental impact assessment takes into account the following criteria for classifying environmental and social impacts:

- the sensitivity of the environmental element/receptor;
- the nature, duration, range, type and intensity of the impact;
- the scale of the impact;
- the overall significance/materiality of the impact.

The environmental impact assessment methodology serves to characterise the identified impacts and determine their overall significance.

In this report, in the course of the impact assessment, the results of the Polish environmental impact assessment were taken into account, as well as the positions of the affected Parties, with particular attention focused on the environmental elements indicated in the positions of Denmark, Sweden and Germany.

7.1 General environmental impact assessment methodology

7.1.1 Basis of the assessment

Environmental impact assessments must always be based on a thorough identification and description of the environment to which the potential impact relates (the baseline situation). The level of detail with which the baseline situation is presented within the assessment depends on various factors, such as the nature of the project's impact effects and the characteristics of the receptor. These have been determined individually for each receptor. In certain cases, it is sufficient to use external data from the scientific literature and unpublished materials and data, including data from public institutions and monitoring results. In other cases, additional surveys are necessary. The table below [Table 7] sets out the elements of the marine environment constituting receptors of the impacts that may be generated by the project involving the construction of each of the OWFs, as well as the scope of the specific surveys carried out under the project forming the basis for the assessment of their baseline status. The survey methodology is described earlier in this report, in Section 4.2.2. Extensive literature surveys were carried out for all the environmental elements identified in this way.

Table 7 Marine environmental elements constituting impact receptors, and a summary of the surveys carried out under the OWF projects

ENVIRONMENTAL ELEMENT	SURVEYS/ANALYSES
Abiotic elements of the marine environment	
Seabed depth and morphology, nature of the seabed surface, sub-surface seabed structure, deeper geological structures,	Analysis of hydrographic data, comprising digital sonar mosaics (side scan sonar) and high-resolution bathymetric data (multi-beam echosounder, MBES) obtained from CIEP. Supplemented by an analysis of other state spatial databases (including MO, NHO, NMM) and archival scientific and cartographic studies (including an assessment of the geological structure based on the literature).
Hydrology and meteorology	Measurements of the speed and direction of sea currents and waves (height, period, direction on the free sea surface). In situ measurements of wind speed and direction, pressure, air temperature and humidity carried out by automated stations at sea. Vertical water column soundings using a CTD probe to determine, among other things, temperature, salinity, conductivity and turbidity.
Physicochemical properties of water	In situ measurements: vertical water column profile soundings (with a high resolution of every 0.5 m) covering temperature, salinity, depth and turbidity. Sampling from the near-surface, near-bottom and intermediate-depth layers. General and oxygen conditions: dissolved oxygen, BOD5, pH, alkalinity, total suspended solids, total organic carbon (TOC). Nutrients: nitrogen compounds (including ammoniacal nitrogen, NO_3, NO_2) and phosphorus. Priority and particularly hazardous substances: heavy metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), petroleum-derived substances, pesticides, cyanides and phenols. Radionuclides: radioactive isotopes of caesium and strontium.
Physicochemical properties of sediments	Macroscopic description, grain size analysis, moisture content, loss on ignition (LOI), total organic carbon (TOC), metal content (Pb, Cu, Zn, Ni, Cd, Cr, As, Hg) and their labile fraction, aluminium, polycyclic aromatic hydrocarbons (16 PAHs), polychlorinated biphenyls (7 PCB congeners: 28, 52, 101, 118, 138, 153,

ENVIRONMENTAL ELEMENT	SURVEYS/ANALYSES
	180), mineral oils, ^{137}Cs radioactivity, organotin compounds (TBT, DBT, MBT), nutrient content (total nitrogen and total phosphorus)
Climatic conditions and climate changes	Analysis of long-term historical data provided by the Institute of Meteorology and Water Management. New surveys were supplemented with satellite data (the SatBaltyk project), climate modelling (the EU Copernicus programme and the BOOS system), and the operator's own continuous local measurements carried out directly at sea.
Air quality	The pollutant background (NO_2, NO, O_3, SO_2, CO, PM10 and PM2.5 particulates) at sea was assessed on the basis of numerical model data obtained. Verified satellite-numerical data and the ENSEMBLE indicator from the Copernicus (CAMS) service were used, referenced against CIEP standards.
Ambient acoustic background	Underwater noise recording
Biotic elements of the marine environment	
Phytobenthos	Seabed inspection and filming
Zoobenthos	Seabed sampling
Ichthyofauna	Collection of ichthyoplankton samples, hydroacoustic sounding, pelagic and demersal survey trawl catches. In morphologically difficult areas, catches were supplemented with specialist bottom-set gillnets.
Marine mammals	Surveys of the harbour porpoise and three seal species – grey, harbour and ringed – using passive acoustic monitoring (harbour porpoises) and visual methods (harbour porpoises and seals)
Seabirds	Observations from vessels and digital aerial survey using an aircraft (aerial photogrammetry / DAVIS system)
Migratory birds	Visual observations (including using a laser rangefinder), radar surveys (vertical and horizontal radars), and acoustic monitoring/recording
Chiropterofauna	Listening surveys on transects and at listening points
Natura 2000 sites	SDF and literature data analysis
Socio-economic elements	
Archaeology, cultural heritage	An underwater cultural heritage search carried out on the basis of an analysis of available data (bathymetric and sonar), aimed at identifying potential archaeological sites for inventory planned at later stages of the Project.
Shipping	Analysis of HELCOM AIS data
Fisheries	Analysis of catch volume and value and fishing effort (days and number of fishing vessels), based on data collected under the National Fisheries Data Collection Programme
Mineral extraction sites	Analysis of data contained in the Central Geological Database
Technical infrastructure	Geophysical surveys, SIPAM data analysis

7.1.2 Potential environmental impact of the Projects

This Espoo Report focuses on the activities carried out within the territory of the Polish EEZ in the context of the Baltic West Area, which could potentially cause adverse environmental effects within the territories of the affected Parties – Sweden, Denmark and Germany.

The table [Table 8] sets out the environmental elements that could be exposed to impacts, and which were therefore subjected to further analysis within the Polish environmental impact assessment, and subsequently within this report.

Table 8 Environmental elements subject to the Polish environmental impact assessment

PHYSICO-CHEMICAL ENVIRONMENT	BIOLOGICAL ENVIRONMENT	SOCIO-ECONOMIC ENVIRONMENT
Geological structure Bottom sediments Raw materials and mineral deposits Quality of marine waters and bottom sediments Climatic conditions Air quality Electromagnetic field Ambient acoustic background	Phytobenthos Macrozoobenthos Ichthyofauna Migratory birds Seabirds Marine mammals Bats Protected areas and their conservation objectives	Cultural heritage Fisheries Shipping Landscape, including cultural landscape Population, human health and living conditions

Environmental impacts have been preliminarily described and classified according to their nature (adverse or beneficial), type, range, duration and intensity. The type makes it possible to determine whether the impacts are direct, indirect, secondary, cumulative or transboundary. The range makes it possible to identify the extent of the impact in spatial and functional terms. The degree of intensity, on the other hand, indicates the effect on the structure and function of the receptor within the area of impact.

The assessment of the scale of impact took into account the identification of the area on which each of the projects could have an impact, including the possible impact on protected areas and species. In determining the range of individual impacts, it was taken into account that this may vary depending on environmental conditions (e.g. the type of sediment), environmental elements (e.g. the sensitivity of receptors) and the type of impact (e.g. the range of noise impact).

As the final result of the impact assessment carried out, the significance of a given impact on individual environmental elements was obtained, as a resultant of the scale of the impact and the sensitivity of the receptor.

The values assigned to the impacts were determined on the basis of standardised criteria, survey results, available scientific knowledge, and expert assessment.

The general procedure applied during the assessment is presented in the figure [Figure 20].

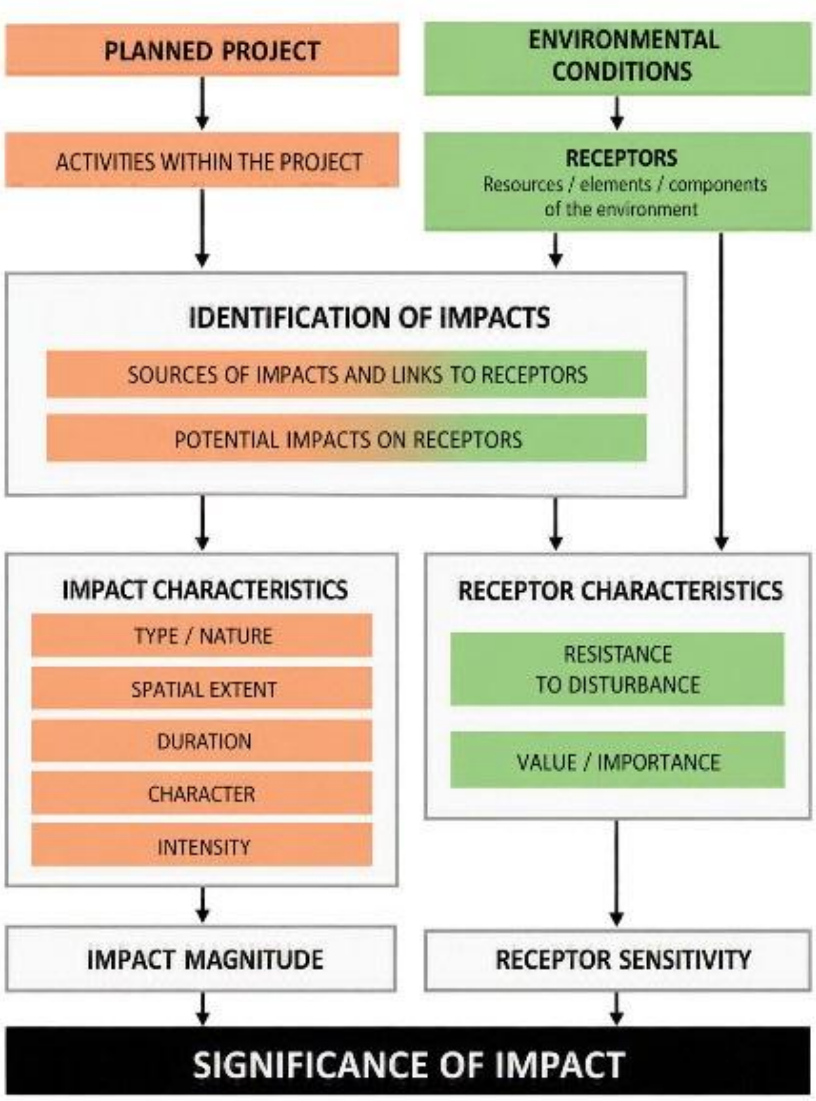


Figure 20 Diagram of the identification of environmental impacts and the impact assessment, together with the determination of impact significance [source: own study]

Actual environmental impact can only be said to occur where a specific sensitive receptor is present within the range of the impact.

At the first stage of the assessment, the activities that could have an effect on individual receptors, arising from the construction, operation and decommissioning phases of the proposed projects, were determined. On the basis of the environmental and inventory surveys carried out for the purposes of the national EIA Reports, the receptors that could be affected by these activities were also determined. At the second stage of the assessment, on the basis of the literature and expert experience, the links between the sources of potential impacts and the individual receptors were identified.

The identified impacts were assigned characteristics within five categories [Table 9]:

Table 9 Characteristics of the impacts of the projects on receptors [source: own study]

CATEGORY	CHARACTERISTIC	DEFINITION
Type	**Direct**	An impact resulting from direct interaction or physical interference between activities arising from the implementation, operation or decommissioning of the Project and environmental elements
	Indirect	An impact on one environmental element via a direct impact on another environmental element, resulting from the implementation, operation or decommissioning of the Project.
	Secondary	An impact resulting from the implementation, operation or decommissioning of the Project on environmental elements, delayed in time, which may occur as a consequence of a direct or indirect impact
	Cumulative	Impacts resulting from the overlapping of impacts of the same nature and type, occurring within a similar time and space (range of impact), on the same environmental elements identified as receptors sensitive to a given pressure, originating both from the Project and from projects implemented by third parties
	Transboundary	An impact the effects of which are felt beyond the borders of Poland, within the territory of other states
Spatial or population range	**Local**	An impact that occurs within the Project area or in its immediate vicinity *owing to the specific nature of the marine environment, the spatial range of a local impact may vary for individual impacts; where impacts extending beyond the Project area are identified, the specific distance from the Project boundary will be defined in the description of the given impact
	Regional	An impact that extends beyond local effects, but is not global in nature
	Global	An impact that may affect global ecosystems, resources, populations and economies.
Duration	**Short-term**	An impact that is limited in time, the effects of which will be noticeable (measurable) for a relatively short period of no more than 1 year or 1 vegetative cycle from the commencement of the activity associated with the Project
	Medium-term	An impact that is limited in time, the effects of which will be noticeable (measurable) continuously or cyclically for more than 1 year up to 3 years, or 1 vegetative cycle up to 3 vegetative cycles, from the commencement of the activity associated with the Project
	Long-term	An impact that will occur over a longer period, i.e. its effects will be noticeable (measurable) continuously or cyclically for more than 3 years or 3 vegetative cycles from the commencement of the activity associated with the Project
	Permanent	An impact that will not cease once the activity associated with the Project has ended
	Temporary	An impact that is limited to the period during which the activity associated with the Project is carried out
Nature	**Adverse**	Impacts causing unfavourable changes in the environment, affecting the deterioration of environmental quality (measured, for example, against applicable quality standards arising from legal regulations), a reduction in valuable biodiversity, disruption of the balance within a natural habitat or a species' habitat, deterioration of the key structures, processes or (infringement of) key functions performed by a given habitat, impacts harmful to health, but also impacts causing nuisance and affecting property
	Beneficial	Impacts causing favourable changes in the environment, improving environmental quality (e.g. through the removal of a given stressor or

CATEGORY	CHARACTERISTIC	DEFINITION
		environmental nuisance, e.g. the elimination of a noise source, an increase in species abundance, an improvement in habitat quality, or the permanent elimination of alien invasive species occurrences)
Intensity	**No impact**	No effect on the structure or function of the receptor within the area of impact
	Low intensity	A minor effect on the structure or function of the receptor within the area of impact, but the basic structure and function of the receptor will not be compromised
	Medium intensity	A partial effect on the structure and function of the receptor within the area of impact will occur. The structure and function of the receptor will be partially lost.
	High intensity	The structure and function of the receptor will be completely altered. A loss of the receptor's structure and function will be visible within the area covered by the impact.

In the next step, the above characteristics of the individual impacts were assigned to each of the identified environmental elements.

For each identified potential impact, the resistance of the receptors to the individual impacts was determined, together with their significance and the role they play in the environment, including their conservation status in relation to environmental elements. In estimating the sensitivity of the receptors, account was taken of how the identified impact affects the size and significance of the exposed population or receptor within the range of the impact. The level of protection of the receptor and an expert index, which makes it possible to take into account specialist knowledge and the context of local conditions in situations where quantitative data are insufficient or require clarification, were also taken into account.

The above analyses ultimately resulted in the determination of environmental (receptor) sensitivity, which was defined on a five-point scale: (1) negligible, (2) low, (3) moderate, (4) high and (5) very high.

At the next stage of the assessment, taking into account the assigned magnitude (scale) of impact and the sensitivity of the receptor, likewise on a five-point scale, the significance of the given impact on the receptor was determined [Table 10]:

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

Table 10 Matrix determining the significance of impact in relation to the scale of impact and the sensitivity of the receptor [source: own study]

IMPACT SIGNIFICANCE		Receptor sensitivity				
		Irrelevant	**Low**	**Moderate**	**High**	**Very high**
Impact scale / magnitude	Irrelevant	Negligible	Negligible	Negligible	Negligible	Low
	Low	Negligible	Negligible	Low	Low	Moderate
	Moderate	Negligible	Low	Low	Moderate	Important
	High	Negligible	Low	Moderate	Important	Significant
	Very high	Low	Moderate	Important	Significant	Significant

Impacts were considered major where they would adversely, permanently and irreversibly affect the functioning of the ecosystem or the favourable conservation status (for resources covered by nature conservation forms, including within the Natura 2000 network). This group included all impacts the nature and scope of which would contribute to irreversible changes in the environment.

Where a significant adverse environmental impact was identified, mitigation measures were proposed (Chapter 4.12), the effects of the application of which will be taken into account in the final assessment result.

The methodology described above was developed in order to standardise the environmental impact assessment of different types of activities and emissions, and in relation to different types of receptors. This approach enabled an effective comparative assessment of all the environmental impacts of the project, as well as an assessment of the project as a whole. Owing to the algorithm of the methodology adopted, it was necessary to quantify both the scale of the environmental impact and the sensitivity of the receptors.

The impact assessment took into account information on the cumulation of impacts of the projects comprising the Baltic West Area, as well as of other projects being implemented, already implemented or planned, for which an environmental decision has been issued, located within the area where the project is planned to be implemented and within the project's area of impact, or the impacts of which fall within the area of impact of the proposed project – to the extent that their impacts could lead to a cumulation of impacts with the proposed project.

The next step was to use the results of this assessment in a multi-criteria analysis of the variants under consideration, in order to identify the most environmentally favourable variant. Within the analysis of each environmental element, an independent and holistic assessment of the impact of the proposed Project on that element was carried out, and the methodology presented enables the assessment process to be standardised and the impacts of the Project's variants to be compared with one another.

In accordance with the purpose of this report, it focuses on the impacts identified as transboundary at the stage of the Polish environmental impact assessment. In addition to this, the identified impacts were analysed in light of the issues raised in the positions of the affected Parties, expressed in accordance with Article 3 of the Convention. The characteristics of the transboundary environmental impacts are presented in Chapter 8, while the conclusions in the context of the expectations of the affected Parties are presented in Chapter 12.

7.2 Assessments concerning Natura 2000 sites

The assessment of the impact of the Baltic West OWF on Natura 2000 sites was carried out in accordance with the guidelines of the European Commission, namely: 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). In accordance with these documents, the first stage of the analyses involved a preliminary screening, under which it was determined whether – and if so, which – impacts of the proposed Project, alone or in combination with other projects, could potentially give rise to significant effects on Natura 2000 sites. Impacts for which the possibility of significant effects could not be excluded were subjected, at the next stage, to an appropriate assessment.

In the course of preparing the EIA Reports, the recommendations set out in the 2025 publication of the General Directorate for Environmental Protection, entitled *Guidelines on the environmental impact assessment of offshore wind farms*, were also taken into account.

The assessment of the anticipated impact of the proposed Projects on the sites of the Natura 2000 European Ecological Network was carried out through the lens of the conservation objectives and conservation subjects designated for the individual sites. The analyses carried out covered direct, indirect, secondary, cumulative, short-, medium- and long-term, and permanent and temporary impacts – in accordance with the methodology adopted within the multi-faceted and multi-criteria impact assessment of the Baltic West area.

Taking into account the indications arising from the decisions of the Regional Director for Environmental Protection in Szczecin determining the scope of the environmental impact report for each OWF, the impact of the projects in question on the conservation subjects of the following Natura 2000 sites was analysed: *Zatoka Pomorska PLB990003, Ostoja na Zatoce Pomorskiej PLH990002, Ławica Słupska PLC990001, Przybrzeżne wody Bałtyku PLB990002, Zalew Szczeciński PLB320009, Delta Świny PLB320002, Wolin i Uznam PLH320019*; the German sites: *SPA Pommersche Bucht DE1552401, Westliche Pommersche Bucht DE1649401, Pommersche Bucht mit Oderbank*

DE1652301, Adlergrund DE1251301, Greifswalder Bodden und südlicher Strelasund DE1747402, Westliche Rönnebank DE1249301, Greifswalder Boddenrandschwelle und Teile der Pommerschen Bucht DE1749302; the Danish site: *Adler Grund og Rønne Banke DK00VA261*; and the Swedish site: *Hoburgs Bank och Midsjöbankarna SE0330308.*

7.3 Assessments under Appendix IV to the Habitats Directive

Article 12 of the Habitats Directive provides for the establishment and implementation of a system of strict protection for the animal species listed in Appendix IV(a) to the Habitats Directive, throughout the territory of the Member States.

In accordance with the Directive, the following are prohibited in respect of strictly protected species:

- all forms of deliberate capture or killing of specimens of these species;
- deliberate deterioration or destruction of breeding sites or resting places;
- deliberate disturbance of these wild fauna species, particularly during the period of breeding, rearing, hibernation and migration, to the extent that such disturbance would be significant in relation to the objectives of the Convention;
- deliberate taking or destroying of eggs from the wild, even if empty;
- keeping and internal trade in these animals, whether alive or dead, including stuffed animals and any readily recognisable part or derivative of such animals, if this would contribute to making the provisions of this Article effective.

Assessments of the impact of each proposed Project on the status of species listed in Annex IV were included in the national EIA Report and are summarised in Chapter 8.3 of this report.

8 TRANSBOUNDARY ENVIRONMENTAL IMPACT ASSESSMENT

8.1 Preliminary assessment of potential transboundary impact

This Espoo Report covers project-related activities carried out within Polish maritime territory (the EEZ) that could cause potential adverse impacts on the affected Parties: Denmark, Sweden and Germany. The report has taken into account and analysed not only the typical impacts identified as being transboundary in nature, but also those issues that did not strictly meet this condition (e.g. owing to their limited physical range or negligible significance), but which the affected Parties raised during the procedure (i.e. the impact on fisheries).

The national EIA Reports carried out and documented a detailed assessment of every relevant potential impact on marine receptors. On the basis of the results of this detailed assessment, the Espoo Report presents a preliminary assessment of these same impacts in terms of their potential transboundary environmental impact. In many cases, owing to the limited range of most project-related impacts, significant transboundary impact can be confidently excluded. These impacts have therefore not been analysed in detail in this chapter.

The table below [Table 11] constitutes a matrix indicating all the impacts analysed and assessed in the national EIA Reports. It indicates those impacts for which transboundary environmental impact cannot be excluded. The identified transboundary impacts shown in the table below are described and assessed in detail further in this Espoo Report.

Table 11 List of potential environmental impacts analysed and assessed in the national EIA Reports

ENVIRONMENTAL ELEMENT (RECEPTOR)	POTENTIAL ENVIRONMENTAL IMPACT	ASSESSMENT IN TERMS OF TRANSBOUNDARY ENVIRONMENTAL IMPACT
Abiotic elements		
Geological structure	Physical changes to the seabed structure (Sections 5.1.1.1.1, 5.2.1.1.1 of the EIA Report). Presence of OWF infrastructure elements (Sections 5.1.2.1.1, 5.2.2.1.1 of the EIA Report).	These impacts are assessed as negligible and will occur only locally, within the farm development area. Transboundary impact can therefore be excluded.
Bottom sediments	Changes in the nature of surface sediments (Sections 5.1.1.1.1, 5.2.1.1.1 of the EIA Report).	These impacts are assessed as negligible and will occur only locally, within the farm development area. Transboundary impact can therefore be excluded.
Raw materials and mineral deposits	Restriction or prevention of access to deposits and possible sand and gravel extraction (Sections 5.1.2.1.1, 5.1.3.1.1, 5.2.2.1.1, 5.2.3.1.1 of the EIA Report).	The impact is assessed as negligible and local. Since it relates solely to the OWF area, the transboundary impact can be excluded.
Quality of marine waters and bottom sediments	Release of contaminants from bottom sediments (heavy metals, PCBs, PAHs, nutrients) (Sections 5.1.1.1.2, 5.1.2.1.2, 5.1.3.1.2, 5.2.1.1.2, 5.2.2.1.2, 5.2.3.1.2 of the EIA Report). Contamination of water and bottom sediments with petroleum-derived substances from vessels during normal operation (Sections 5.1.1.1.2, 5.1.2.1.2, 5.1.3.1.2, 5.2.1.1.2, 5.2.2.1.2, 5.2.3.1.2 of the EIA Report). Contamination of water and bottom sediments with petroleum-derived substances from vessels in the event of a collision (Sections 2.7, 5.1.1.1.2, 5.1.2.1.2, 5.1.3.1.2, 5.2.1.1.2, 5.2.2.1.2, 5.2.3.1.2, 7 of the EIA Report). Contamination of water and bottom sediments with antifouling agents (Sections 5.1.1.1.2, 5.1.2.1.2, 5.1.3.1.2, 5.2.1.1.2, 5.2.2.1.2, 5.2.3.1.2 of the EIA Report). Contamination of water and bottom sediments with accidentally released municipal waste or household sewage (Sections 5.1.1.1.2, 5.1.2.1.2, 5.1.3.1.2, 5.2.1.1.2, 5.2.2.1.2, 5.2.3.1.2 of the EIA Report). Contamination of water and bottom sediments with accidentally released chemical agents and waste from OWF construction (Sections 5.1.1.1.2, 5.1.2.1.2, 5.1.3.1.2, 5.2.1.1.2, 5.2.2.1.2, 5.2.3.1.2 of the EIA Report).	Transboundary impacts caused by leaks and spills of petroleum-derived substances in emergency situations or as a result of vessel collisions cannot be excluded (Section 5.13). The risk of such events occurring is assessed as minimal. The probability of a vessel collision is estimated to be a very rare event (once every 100 years), and the risk of a vessel directly striking a farm structure within the Baltic West Area is even lower (once every 200 years). The remaining impacts were assessed as negligible or low, and transboundary impact was excluded.

ENVIRONMENTAL ELEMENT (RECEPTOR)	POTENTIAL ENVIRONMENTAL IMPACT	ASSESSMENT IN TERMS OF TRANSBOUNDARY ENVIRONMENTAL IMPACT
	Contamination of water and bottom sediments with compounds originating from corrosion protection agents (Sections 5.1.2.1.2, 5.2.2.1.2 of the EIA Report). Change in the temperature of water and sediments due to heat dissipation from transmission cables (Sections 5.1.2.1.2, 5.2.2.1.2 of the EIA Report).	
Hydrodynamic conditions	Effect on currents, waves and wind (Sections 5.1.1.1.3, 5.2.1.1.3, 5.1.2.1.3, 5.2.2.1.3 of the EIA Report).	The impact of the OWF is limited to local areas around each turbine/OSS, owing to their small size relative to the distances between individual structures. Any transboundary impacts will be negligible.
Climatic conditions	Change in atmospheric thermal conditions (Sections 5.1.1.1.4, 5.1.2.1.4, 5.2.1.1.4, 5.2.2.1.4 of the EIA Report).	These impacts are assessed as negligible or low and will occur only locally. Transboundary impact can be excluded.
Air quality	Exhaust emissions from vessels (Sections 5.1.1.1.4, 5.1.2.1.4, 5.1.3.1.4, 5.2.1.1.4, 5.2.2.1.4, 5.2.3.1.4 of the EIA Report).	These impacts are assessed as negligible and will occur only locally. Transboundary impact can be excluded.
Ambient acoustic background	Impact of underwater and airborne noise on ichthyofauna, seabirds and marine mammals (Sections 3.5, 3.6, 5.1.1, 5.1.2, 5.1.3, 5.2.1, 5.2.2, 5.2.3 of the EIA Report).	Transboundary impact cannot be excluded. This impact is discussed in the sections concerning ichthyofauna, seabirds and marine mammals (Sections 8.3.1, 8.3.3 and 8.3.5, as well as in Section 8.2.2 on the ambient acoustic background and 8.4.1 on cumulative underwater and airborne noise impacts).
Electromagnetic field	Electromagnetic field emission (Sections 2.6.3, 3.7, 5.1.1.1.5, 5.1.2.1.5, 5.2.1.1.5, 5.2.2.1.5 of the EIA Report).	These impacts are assessed as not occurring or as negligible and will occur only locally. Transboundary impact can be excluded.
Biotic elements, protected areas and ecological corridors		
Phytobenthos	Colonisation of the underwater components of the turbines by macroalgae – a change in the natural character of the marine area (Sections 5.1.2.3.1, 5.2.2.3.1 of the EIA Report). Elimination of habitats formed during farm decommissioning (Sections 5.1.3.3.1, 5.2.3.3.1 of the EIA Report).	These impacts will occur only locally. Transboundary impact can be excluded.
Macrozoobenthos	Interference with the seabed – disruption of the structure of bottom sediments, an increase in suspended solid concentration in the water column, sedimentation of suspended solids on the seabed, redistribution of contaminants from the sediment to the water column (Sections 5.1.1.3.3, 5.2.1.3.3 of the EIA Report). New structures on the seabed – loss of a fragment of macrozoobenthos habitat, artificial reef effect (Sections 5.1.2.3.3, 5.2.2.3.3 of the EIA Report).	These impacts are assessed as negligible, low or moderate and will occur only locally. Transboundary impact can be excluded, since disruption of the seabed structure will occur only within the OWF area, and the impact of the increase in suspended solid concentration and its deposition will be small enough that it will not have any effect on macrozoobenthos in areas beyond the immediate vicinity of the works being carried out.

ENVIRONMENTAL ELEMENT (RECEPTOR)	POTENTIAL ENVIRONMENTAL IMPACT	ASSESSMENT IN TERMS OF TRANSBOUNDARY ENVIRONMENTAL IMPACT
	Heat and EMF emission from cables (Sections 5.1.2.3.3, 5.2.2.3.3 of the EIA Report). Elimination of the artificial reef during OWF decommissioning (Sections 5.1.3.3.3, 5.2.3.3.3 of the EIA Report). Suspended solids in the context of sediment deposition (Sections 5.1.1.3.3, 5.1.3.3.3, 5.2.1.3.3, 5.2.3.3.3 of the EIA Report).	
Ichthyofauna	Noise and vibration (Sections 5.1.1.3.4, 5.1.2.3.4, 5.1.3.3.4, 5.2.1.3.4, 5.2.2.3.4, 5.2.3.3.4 of the EIA Report). Increase in the concentration of suspended solids in the water (Sections 5.1.1.3.4, 5.1.3.3.4, 5.2.1.3.4, 5.2.3.3.4 of the EIA Report). Habitat change (Sections 5.1.1.3.4, 5.1.2.3.4, 5.1.3.3.4, 5.2.1.3.4, 5.2.2.3.4, 5.2.3.3.4 of the EIA Report). Emission of pollutants (Sections 5.1.1.3.4, 5.1.2.3.4, 5.1.3.3.4, 5.2.1.3.4, 5.2.2.3.4, 5.2.3.3.4 of the EIA Report). Physical barrier (Sections 5.1.1.3.4, 5.1.2.3.4, 5.1.3.3.4, 5.2.1.3.4, 5.2.2.3.4, 5.2.3.3.4 of the EIA Report).	Transboundary impacts caused by noise during the construction phase cannot be excluded (Section 8.3.1). The remaining impacts were assessed as negligible or low, and transboundary impact was excluded.
Marine mammals	Increase in noise level (Sections 3.5, 3.12.1, 5.1.1.3.6, 5.1.2.3.6, 5.1.3.3.6, 5.2.1.3.6, 5.2.2.3.6, 5.2.3.3.6 of the EIA Report). Change in habitat and food base (Sections 5.1.1.3.6, 5.1.2.3.6, 5.1.3.3.6, 5.2.1.3.6, 5.2.2.3.6, 5.2.3.3.6 of the EIA Report).	It is anticipated that impacts caused by noise during the construction phase should be reduced through minimisation measures, and therefore transboundary impact is not anticipated to occur, or will be low. However, owing to the sensitivity of this environmental element, it is presented in this report (Section 8.3.5). The remaining impacts were assessed as negligible or low, and transboundary impact was excluded.
Migratory birds	Barrier effect (Sections 5.1.1.3.5, 5.1.2.3.5, 5.1.3.3.5, 5.2.1.3.5, 5.2.2.3.5, 5.2.3.3.5 of the EIA Report). Collision with construction vessels (Sections 5.1.1.3.5, 5.1.3.3.5, 5.2.1.3.5, 5.2.3.3.5 of the EIA Report). Risk of collision with turbines (Sections 5.1.2.3.5, 5.2.2.3.5 of the EIA Report).	Transboundary impacts are assessed as possibly occurring, of a negligible or low nature. These will be associated with the barrier effect and collision risk, and their significance will range from negligible to moderate (Section 8.3.2).
Seabirds	Habitat loss (Sections 5.1.1.3.5, 5.1.2.3.5, 5.1.3.3.5, 5.2.1.3.5, 5.2.2.3.5, 5.2.3.3.5 of the EIA Report). Barrier effect and collision risk (Sections 5.1.1.3.5, 5.1.2.3.5, 5.1.3.3.5, 5.2.1.3.5, 5.2.2.3.5, 5.2.3.3.5 of the EIA Report).	Transboundary impacts on benthivorous and piscivorous species cannot be excluded. These impacts are assessed as moderate or important (Section 8.3.3). Impacts on gulls are assessed as low or negligible, with a local range.

ENVIRONMENTAL ELEMENT (RECEPTOR)	POTENTIAL ENVIRONMENTAL IMPACT	ASSESSMENT IN TERMS OF TRANSBOUNDARY ENVIRONMENTAL IMPACT
	Artificial light emission (Sections 5.1.1.3.5, 5.1.2.3.5, 5.2.1.3.5, 5.2.2.3.5 of the EIA Report). Noise and vibration emission (Sections 5.1.1.3.5, 5.1.2.3.5, 5.1.3.3.5, 5.2.1.3.5, 5.2.2.3.5, 5.2.3.3.5 of the EIA Report).	
Bats	Airborne noise (Sections 5.1.1.3.7, 5.1.2.3.7, 5.1.3.3.7, 5.2.1.3.7, 5.2.2.3.7, 5.2.3.3.7 of the EIA Report). Barrier along the flight route (Sections 5.1.2.3.7, 5.2.2.3.7 of the EIA Report). Mortality resulting from collision and barotrauma (Sections 5.1.2.3.7, 5.2.2.3.7 of the EIA Report).	Transboundary impacts caused by mortality resulting from collision and barotrauma during the operational phase cannot be excluded (Section 8.3.4). The remaining impacts were assessed as low or negligible, with a local range.
Protected areas and their conservation objectives	Underwater and airborne noise (Sections 3.12.2, 5.1.1.3.8, 5.1.2.3.8, 5.1.3.3.8, 5.2.1.3.8, 5.2.2.3.8, 5.2.3.3.8, 5.3.3, 5.3.4, 5.3.5, 5.3.6 of the EIA Report). Dispersion of suspended solids (Sections 3.12.2, 5.1.1.3.8, 5.1.3.3.8, 5.2.1.3.8, 5.2.3.3.8, 5.3.3, 5.3.5 of the EIA Report).	Transboundary impacts cannot be excluded in the context of noise emission on the harbour porpoise and avifauna, as well as on the connectivity between protected areas (Section 8.3.6). In the case of the increase in suspended solid concentration and its sedimentation, the possibility of transboundary impacts on protected areas has been excluded.
Ecological corridors	Barrier effect (underwater structures) (Sections 3.12.3, 5.1.1.3.9, 5.1.2.3.9, 5.1.3.3.9, 5.2.1.3.9, 5.2.2.3.9, 5.2.3.3.9 of the EIA Report).	The underwater structures will not restrict the ability of marine organisms to move within the water column and on the seabed – individual foundations will be spaced approximately 1 km apart, and the internal cable lines will be buried in the seabed generally to a depth of up to 3 m (locally, owing to the specific seabed structure, up to 5 m).
Socio-economic conditions		
Cultural heritage	There are no cultural heritage sites within the OWF area or within its range of impact that could be affected by the impacts of the Projects (Sections 3.8, 5.1.1.2.2, 5.1.2.2.2, 5.1.3.2.2, 5.2.1.2.2, 5.2.2.2.2, 5.2.3.2.2 of the EIA Report).	Transboundary impact can be excluded, owing to the distance from the nearest cultural assets.
Fisheries	Extension of the route to fishing grounds (Sections 3.9.2, 5.1.1.2, 5.1.2.2, 5.1.3.2, 5.2.1.2, 5.2.2.2, 5.2.3.2 of the EIA Report).	These impacts are assessed as negligible and will occur only locally. Transboundary impact can be excluded, owing to the low level of fishing fleet activity in the OWF area, and the negligible scale, relative to the whole sea area, of any potential extension of routes to fishing grounds.
Shipping	Restrictions on shipping within the farm area (Sections 3.9.1, 5.1.1.2, 5.1.2.2, 5.1.3.2, 5.2.1.2, 5.2.2.2, 5.2.3.2 of the EIA Report).	These impacts are assessed as negligible, since the farm's location may only necessitate a low adjustment of shipping routes, the significance

ENVIRONMENTAL ELEMENT (RECEPTOR)	POTENTIAL ENVIRONMENTAL IMPACT	ASSESSMENT IN TERMS OF TRANSBOUNDARY ENVIRONMENTAL IMPACT
	Possible need to adjust and extend vessel routes (Sections 3.9.1, 5.1.1.2, 5.1.2.2, 5.1.3.2, 5.2.1.2, 5.2.2.2, 5.2.3.2, 8.2 of the EIA Report).	of which, on the scale of the whole sea area, is negligible. Significant transboundary impact can be excluded.
Landscape, including cultural landscape	Movement of vessels supporting construction/the OWF (Sections 3.10, 5.1.1.1.6, 5.1.2.1.6, 5.1.3.1.6, 5.2.1.1.6, 5.2.2.1.6, 5.2.3.1.6, 8.5 of the EIA Report). Erection/presence of wind turbines and substations (Sections 3.10, 5.1.1.1.6, 5.1.2.1.6, 5.1.3.1.6, 5.2.1.1.6, 5.2.2.1.6, 5.2.3.1.6, 8.5 of the EIA Report).	These impacts are assessed as negligible and low, owing to the low landscape value within the OWF's visibility range, the considerable distance from land, and the absence of culturally significant sites within the project's area of impact. Significant transboundary impact can be excluded.
Population, human health and living conditions	Restrictions on the use of the sea area – described in the sections on fisheries and shipping (Sections 3.9, 3.11, 5.1.1.2, 5.1.2.2, 5.1.3.2, 5.2.1.2, 5.2.2.2, 5.2.3.2 of the EIA Report).	These impacts are assessed as negligible. Potential impacts on people can only be related to shipping and fisheries, and significant transboundary impact has been excluded for these elements.

8.2 Abiotic elements

This chapter describes the baseline status of the potentially exposed environmental elements (receptors) and presents an assessment of the potential transboundary impact on the physico-chemical environment.

8.2.1 Quality of marine waters and bottom sediments

8.2.1.1 Current status

The surveys carried out indicate that the physicochemical parameters of the waters across the entire Baltic West area reach values typical of the waters of the southern Baltic (the central-western part of the Bornholm Basin). These waters are generally characterised by a very good (Class I) or good (Class II) quality status.

- Oxygen and physical conditions

The waters of the surveyed sea area are well oxygenated. In the near-bottom layer during the summer period, which is the most susceptible to deficits, no oxygen deficiencies were found – oxygen concentrations exceeded the threshold value of 6.0 mg/dm^3, indicating a very good status (Class I) or good status (Class II for area 14.E.4). Indicators such as five-day biochemical oxygen demand (BOD5) and total organic carbon (TOC) took very low values (BOD5 consistently <2.0 mg/dm^3), falling within Class I quality standards. Total suspended solids content was low and showed natural seasonal variability determined by biological and physical factors.

- Acidity (pH) and alkalinity

The waters are characterised by a slightly alkaline pH (averaging around pH 8.0–8.1), showing little variation in the vertical profile. Average alkalinity across all areas was approximately 1.7 mmol/dm^3.

- Nutrient conditions

The concentrations of nitrogen and phosphorus compounds showed strong seasonal variability linked to the phytoplankton growth cycle (a decrease in summer, regeneration in winter). Taking into account the annual average and summer values, the concentrations of total nitrogen and mineral nitrogen place the waters in Class I quality. The total phosphorus content in summer indicates Class II quality (good status). Phosphate phosphorus, assessed during the winter season, is a problematic parameter, with its concentrations exceeding the Class II limits, meaning that, in this respect, the water status is classified as below good (inadequate/subGES).

- Hazardous substances and contaminants

The waters within the Baltic West area are characterised by trace and very low concentrations of hazardous substances, such as heavy metals (mercury, cadmium, lead, nickel, arsenic, chromium), polychlorinated biphenyls (PCBs), cyanides, phenols and mineral oils. In most cases, the results do not exceed the environmental quality standards for Class I and II. However, local, incidental exceedances of the standards were recorded for selected polycyclic aromatic hydrocarbons (PAHs), in particular benzo(g,h,i)perylene. This is most likely caused by increased vessel traffic on the adjacent navigational routes and the secondary release of these compounds as a result of sediment resuspension.

- Radionuclides

The activity of artificial isotopes (caesium-137 and strontium-90) was low, confirming the slow downward trend in radioactive contamination in the Baltic Sea since the Chernobyl disaster.

Assessment of marine water status: the assessment of marine water status carried out in accordance with the Marine Strategy Framework Directive (MSFD – 2008/56/EC) indicates that the status of the marine environment in terms of eutrophication within the survey area forming part of the Baltic West area is poor (subGES). This is a result of the aforementioned elevated winter concentrations of mineral nitrogen and phosphates, and the annual average concentration of total phosphorus in the sea basin. For total nitrogen, the good environmental status (GES) target has been met.

Assessment of the bottom sediment status: with respect to the bottom sediment contamination, the analyses showed the following status:

- Heavy metals

Cadmium and mercury concentrations do not exceed the threshold values in any of the water bodies surveyed, classifying the sediment status as good (GES). Lead concentration, on the other hand, shows spatial variation – locally (in areas 14.E.1, 14.E.3 and 14.E.4) it exceeds the threshold values, classifying this parameter as inadequate (subGES), while in area 14.E.2 it remains within the standard (GES status).

- Persistent organic pollutants (POPs)

The concentrations of fluoranthene, benzo(g,h,i)perylene and indeno(1,2,3-cd)pyrene in the sediments did not exceed the threshold values, classifying the status of the surveyed sediments as good (GES) with respect to these parameters.

- Nutrients (nitrogen and phosphorus)

The nutrient content in the surveyed sediments does not exceed the values typical of southern Baltic sediments. The accumulation of total nitrogen and phosphorus in this sea area is naturally limited by the sandy character of the sediments, including the very small proportion of fine fractions and the low organic matter content. Consequently, these sediments do not present a risk of eutrophication.

- Radioactive contamination

The sediments surveyed are characterised by low activity of the radioactive isotope caesium-137, typical of the natural sandy sediments of the southern Baltic.

The baseline survey results obtained for the Baltic West area are fully consistent with regional data from the monitoring of marine water from the Baltic Sea (SEM/HELCOM) from the years preceding the surveys carried out.

8.2.1.2 Environmental impact assessment and transboundary environmental impact

The Baltic Sea is a sensitive ecosystem in which the waters and bottom sediments interact closely, and interference with the seabed carries the risk of releasing contaminants deposited within it.

During the construction phase, the greatest hazards are posed by sediment resuspension and the risk of emergency spills from vessels. During the operational phase, impacts result mainly from the presence of infrastructure and the movement of service vessels. These include secondary disturbance of the seabed, the risk of accidental and operational contamination, leaching of protective coatings (anti-corrosion and antifouling), and local temperature changes and the release of oxidants (TRO, CBP) associated with the operation of the internal cables and open cooling systems at the OfSS.

Owing to their potential transboundary range, two key phenomena are analysed in detail below: the processes by which contaminants are released into the water, and the risk of large-scale contamination by petroleum-derived substances in the event of a failure.

8.2.1.2.1 Release of contaminants and nutrients from sediments into the water

Disturbance of the seabed (e.g. during the installation of foundations, the laying of cables, or the anchoring of vessels) causes the resuspension of sediments and the release of labile forms of metals, persistent organic pollutants (PAHs, PCBs) and nutrients into the water column. The intensity of this phenomenon depends closely on the type of sediment, with the largest amounts of harmful substances being released from muddy and clayey sediments.

Owing to the fact that clean sandy sediments with very low baseline concentrations of toxic substances predominate within the Baltic West area, this process will be significantly limited. The assessment for the individual phases is as follows:

- Implementation phase: The impact is direct and adverse, but short-term. Its significance is assessed as low for marine waters and negligible for sediments. No measurable adverse effects on water quality or ecosystems within the Danish economic zone are anticipated during the construction stage. The impact will be limited to the project area.
- Operational phase: Maintenance and servicing works (e.g. vessel anchoring, servicing of foundations and cables) will cause only temporary, reversible and local seabed disturbance of low intensity. This impact will be of low significance for marine waters and negligible for sediments.

The projected quantities of contaminants released during OWF construction are negligible compared with the loads naturally introduced into the Baltic by rivers and precipitation. Owing to the direct proximity of the Danish EEZ (0 km), the phenomenon of contaminant release in the northern part of the Baltic West area may itself have a physical transboundary range; however, its ultimate, measurable effect on water quality is assessed as negligible.

8.2.1.2.2 Contamination of water and bottom sediments with petroleum-derived substances during an accident or vessel collision

The presence of construction and service vessels during all OWF phases (construction, operation, decommissioning) creates a risk of petroleum-derived substances entering the water column and bottom sediments. This impact is considered under two main scenarios:

- Leaks of petroleum-derived substances associated with the routine operation of vessels (operational leaks): Accidental leaks associated with the routine operation of vessels (e.g. system leaks) are usually very small (up to 2 m^3, a maximum of up to 20 m^3). These contaminants evaporate quickly and disperse naturally in the environment. This impact is direct, short-term and local. Owing to the direct proximity to the EEZ boundaries of neighbouring states, the range can be considered transboundary; however, the significance of this impact for water and sediment quality is assessed as negligible.
- Emergency situations (vessel collisions or construction-related disasters): Serious failures could result in a considerably larger spill (up to a maximum of approximately 200 m^3 of diesel oil). The drift range of such a slick is estimated at 5 to 20 km. Owing to the direct contact of the project area with the Danish EEZ (0 km) and the proximity of the German EEZ,

such an event would acquire a transboundary range. The resulting oil film could locally restrict gas exchange and light penetration. It is worth emphasising, however, that the heavier oil fractions settling on the seabed will not cause a noticeable and lasting deterioration in sediment quality within transboundary areas. This is because sandy sediments with a low organic matter content and a small proportion of fine fractions predominate there, effectively limiting the permanent binding of contaminants within the benthic environment.

Owing to the very low (rare) probability of such serious failures occurring, and the implementation of rigorous hazard and pollution response plans, the overall significance of this impact is assessed as moderate.

8.2.1.2.3 Conclusions regarding transboundary environmental impact

Contaminants and nutrients may be released from sediments and pass into marine waters during any works involving disturbance of the seabed. 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 quantities of contaminants deposited in bottom sediments, and the type of rock material forming the seabed.

This report focuses on the anticipated quantity of contaminants that could be released during the construction of the offshore wind farms within the Baltic West area, at the boundary of the Danish EEZ. The results show that these quantities are negligible compared with the quantities introduced into the Baltic by rivers flowing into it and by precipitation, and their impact on water quality is assessed as negligible. However, taking into account the distances to the EEZ boundaries of other states – the Baltic West area directly borders the Danish EEZ (0 km) and is located just over 14 km from the German EEZ – the phenomenon of contaminant release in the northern part of the Baltic West area may have a transboundary range.

Vessels used during both the implementation and operation of the OWF may, during normal operation, cause only minor leaks of petroleum-derived substances, resulting in contamination of water and sediments of a local and partially transboundary range, but of negligible significance. In the event of a serious failure or collision, the volume of the petroleum-derived substance spill will be larger – it is estimated that this could amount to a maximum of up to 200 m^3, and the drift range of such a slick could reach 5 to 20 km. The probability of such an event occurring is very low (classified as rare); however, owing to the direct contact with the borders of other states, any resulting spill

would acquire a transboundary range, and the significance of such an impact is assessed as moderate.

8.2.2 Ambient acoustic background

8.2.2.1 Current status

The ambient acoustic background of the Baltic Sea is shaped by overlapping natural sources (wind, waves, fauna) and anthropogenic sources (shipping, hydrotechnical works, hydroacoustic equipment). Owing to the specific nature of the Baltic (a shallow, semi-enclosed sea area with seasonal stratification and complex bathymetry), sound propagation conditions here are highly variable and differ from those in oceanic waters.

The key factors influencing the sea area's soundscape are:

- Shipping: This constitutes the main source of anthropogenic noise, dominant at low frequencies. Its effect is most noticeable near shipping routes and ports.
- Hydrodynamic processes: Strong wind and breaking waves generate natural noise with a broad frequency spectrum.
- Impulsive and quasi-impulsive sources: Periodically occurring, high-energy sounds associated with human activity, such as sonars, geophysical surveys or piling.

The Baltic's acoustic climate shows clear seasonal and diurnal dynamics. During storms, noise levels can increase by more than ten decibels, while, in calm sea conditions with no vessels present, the background reaches relatively low values. Spatially, noise generated by surface processes predominates in open areas, whereas persistent noise from vessels plays the main role around shipping lanes.

The current status of the ambient acoustic background for the Baltic West area shows characteristics typical of the shallow, southern Baltic environment. It is shaped simultaneously by natural phenomena and intensive human activity, mainly shipping.

The overall picture of the ambient acoustic background of the entire surveyed area can be characterised in the following respects:

- Moderately high noise levels and high variability

The ambient acoustic background in all the surveyed areas is characterised by moderately high broadband sound pressure level (SPL) values. Taking into account the entire analysed sea area (OWFs 14.E.1, 14.E.2, 14.E.3 and 14.E.4), average background noise values ranged from approximately 103 to 114 dB re 1 µPa (seasonal average values at individual stations ranged from

104.6 dB to 113.8 dB). A common feature across the entire surveyed area is significant short-term variability – episodic, short-lived spikes in elevated noise levels frequently occur.

- Marked seasonal variability

Very clear differences between seasons were observed across the entire Baltic West area:

Summer season: The ambient acoustic background reaches its lowest values, and the environment becomes quieter. This is probably related to weaker winds and the development of the summer thermocline, which hinders the propagation of sound (acoustic energy) from surface sources.

Autumn–winter season: An increase in average daily values and greater variability of the signal is recorded. This is largely due to the intensification of autumn and winter wind and wave processes (storms).

Differences in sound pressure levels between the extreme seasons locally reach as much as 8–10 dB.

- Effect of frequency bands (noise sources)

The nature of the dominant noise source changes depending on the sound frequency analysed:

Low frequencies (including 63 Hz and 125 Hz): These are dominated by anthropogenic noise, primarily distant and nearby vessel traffic. The strongest episodic noise increases (so-called high-value tails in statistical distributions) are visible in these bands. This is also where the greatest differences between individual locations within a given area are noticeable. For example, in area 14.E.3, the station closer to shipping routes recorded a consistently higher noise level below 200 Hz.

Higher frequencies (e.g. 2000 Hz): These are more stable, uniform between stations, and dominated by broadband natural sources, such as wind or breaking surface waves. In calm sea conditions, these values decrease considerably.

- Significance of local conditions (depth and propagation)

In addition to distance from shipping routes, local bathymetric differences have a significant effect on the acoustic status of individual areas. The shallow sea causes sound to behave in a specific way – the phenomenon of so-called acoustic channelling is superimposed on the background. The best example of this is area 14.E.4, where the station located further from the shipping route periodically recorded higher noise than the station closer to vessels, precisely owing to specific local conditions facilitating the propagation of underwater sound waves.

Acoustic climate

According to the survey results, the acoustic climate shows strong variation depending on location. At sea, the key factor shaping the natural ambient acoustic background is wind speed, which generates hydrodynamic wave noise – for this reason, higher sound levels were observed in the open sea area at night, which correlated closely with an increase in wind strength. On land (along the coastline), on the other hand, a typical anthropogenic cycle was recorded, with daytime (44–52 dB) consistently louder than night-time (37–45 dB).

On the basis of the results of turbine noise modelling for the operational phase, which, applying the precautionary principle, was based on the most stringent scenario, i.e. the simultaneous operation of all neighbouring OWFs within the Baltic West area, the calculated levels of noise reaching from the sea (approximately 25.3 dB) are considerably below the natural ambient acoustic background recorded in coastal tourist localities (from 37 to 52 dB, depending on the time of day). These values also meet the strictest Polish standards for areas protected against noise (the limit is 50 dB during the day and 40 dB at night). This confirms that a distance of approximately 26 to 37 km from the proposed wind farms constitutes a natural and highly effective attenuating barrier for acoustic waves propagating through the air.

8.2.2.2 Environmental impact assessment and transboundary environmental impact

8.2.2.2.1 Noise sources

The construction of the OWF within the Baltic West area will involve noise emissions into the atmosphere and the water column during every phase of the project.

Owing to the type and scope of the activities, the highest noise levels will be generated during the implementation phase, with its main sources being: the installation of foundations in the seabed, most significantly their piling (underwater noise), and the presence and movement of construction vessels and units supporting the construction works (underwater noise and noise emitted into the atmosphere).

During the operational stage, the main sources of underwater noise will be the operating wind turbines, where sound generated by the moving mechanical parts of the nacelle (the generator and gearbox) is transmitted into the water column via the turbine foundations. An additional noise source will be the vessels and units moving around during regular inspections, servicing and possible repairs to the OWF.

During the decommissioning phase, the main source of sound will be the works involved in removing OWF structures from the seabed (including sediment removal, drilling into the seabed, and pile cutting) and the increased traffic of vessels supporting the dismantling process.

When driving large-diameter piles, underwater noise can reach instantaneous sound pressure level (SPL) values of over 230 dB re 1 µPa at a distance of 1 m from the source. Carrying out piling without the application of noise reduction measures would cause an adverse effect on the marine environment, including a risk of hearing damage in marine mammals and fish. Consequently, the appropriate Noise Reduction Systems (NRS) will be applied – including, among other things, the soft-start procedure and advanced physical systems, such as a close-range system (CRS) combined with a double big bubble curtain (DBBC) – which will effectively minimise its intensity and spatial range. The Noise Reduction Systems are described in detail in Section 2.4.2.2.2.1 of the EIA Reports and in Chapter 4.12 of this document.

The intensity and frequency of underwater noise generated by vessels depends on many factors, including the type and size of the vessel, the engine type, hull shape, and sea conditions. Low-frequency sounds are generated primarily by large, slower vessels, while high frequencies are generated mainly by small, fast boats. Noise emitted by vessels affects marine animals – mainly mammals and fish – potentially causing masking (interference with communication and the detection of biologically significant signals) and behavioural changes (e.g. avoidance reactions, cessation of foraging). The noise generated by the presence of vessels will be similar across all phases of the project.

8.2.2.2.2 Modelling of underwater noise propagation

Bearing in mind that the proposed construction of the offshore wind farms (OWF) within the Baltic West area, and in particular the pile-driving process, could constitute a significant source of underwater noise, a decision was made to carry out detailed modelling studies. Their purpose was to determine the ranges of propagation of acoustic waves. The full methodology and results of these analyses are presented in Appendix 3 to the national EIA Reports, which also forms an integral part of this document.

The study analysed in detail the acoustic emissions accompanying the construction of the offshore wind farms within the Baltic West area, located in the Polish Exclusive Economic Zone (EEZ). The analysis for the construction phase was carried out for the entire Baltic West area, covering the four proposed wind farm locations: 14.E.1, 14.E.2, 14.E.3 and 14.E.4.

Within each OWF, a single location of the sound source was selected in order to reflect the variability of sound propagation and to assess the impact of noise on neighbouring Natura 2000 sites [Figure 21].

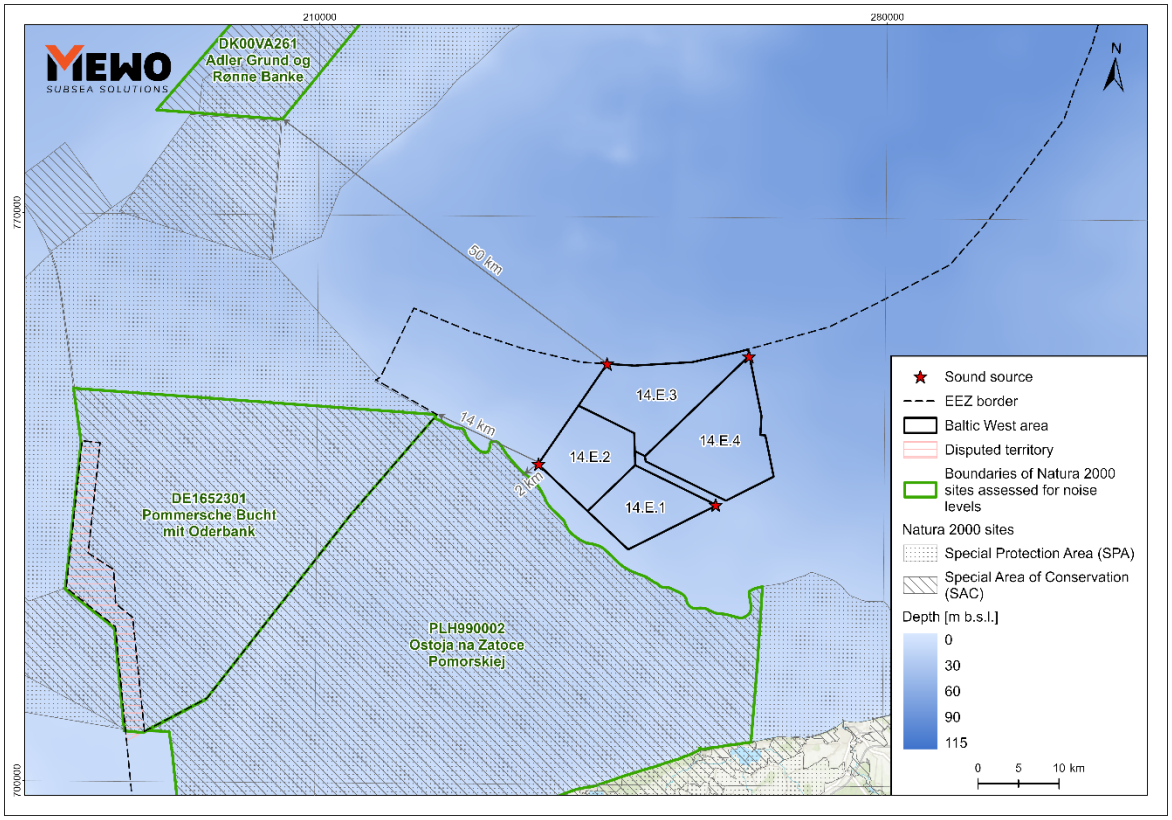


Figure 21 Sound source locations used in the noise modelling within the Baltic West area [source: own study]

Particular attention was paid to the Natura 2000 sites: *Ostoja na Zatoce Pomorskiej* (where the conservation objectives include, among others, the harbour porpoise, the grey seal and the twait shad), *Pommersche Bucht mit Oderbank* (where the harbour porpoise and the twaite shad are protected), and *Adler Grund og Rønne Banke* (where the harbour porpoise is a conservation objective). The analyses were carried out for both the winter and summer seasons, in order to demonstrate seasonal differences in sound propagation.

On the basis of the acoustic modelling, the areas of impact on marine mammals (harbour porpoises and seals) and swim-bladder-bearing fish were determined. The effects studied included behavioural response (a change in behaviour) and reversible hearing damage in the form of a temporary threshold shift (TTS), auditory injury (AINJ), which may (but need not) lead to a permanent threshold shift (PTS) in mammals, and reversible hearing damage in swim-bladder-bearing fish. This study therefore constitutes the technical basis for the environmental impact assessment of the OWFs located within the Baltic West area with respect to marine mammals and fish.

It should be noted that, in connection with the new guidelines of the National Marine Fisheries Service (NMFS, 2024), the terminology relating to marine mammals has been slightly adjusted: the term 'permanent threshold shift' (PTS) has been replaced by the term 'auditory injury' (AINJ). This change has been introduced in the scientific discourse in recent years to reflect the fact that there are effects, such as neuropathy, that constitute hearing damage but do not necessarily lead to PTS. AINJ is therefore used as a broader concept, encompassing PTS but not limited exclusively to it (cf. NMFS, 2024).

For the purposes of the modelling, 72 transects with a maximum length of 165 km each were designated, radiating in all directions. Depth profiles and seabed topography along the transects were obtained from the EMODnet platform. Sound propagation velocity profiles in water were determined on the basis of a publicly available database. The temperature and salinity results obtained, used to determine the sound velocity profiles, were compared with the results of surveys carried out by the Applicant within the sea area. Geoacoustic profiles were obtained on the basis of publicly available data.

The modelling was carried out for two variants – without and with the application of a noise mitigation system.

At the first stage, underwater noise emissions during pile installation were examined for the individual Baltic West areas, i.e. 14.E.1–14.E.4. Calculations were carried out for a monopile structure with a diameter of 13.0 m and a hammer strike energy of 6600 kJ. The calculated source level at the conventional reference distance of 1 m was expressed as the sound exposure level (SEL), i.e. the emitted acoustic energy (in dB re 1 µPa²s), and as peak sound pressure levels (SPL_{peak}) (in dB re 1 µPa). Values were determined for individual pile strikes and for the estimated maximum number of strikes necessary to drive a single foundation into the seabed, i.e. 6000. The calculated sound source level values used in the modelling are presented in the table below [Table 12].

Table 12 Sound source parameters used in the underwater noise modelling

PARAMETER	14.E.1	14.E.2	14.E.3	14.E.4
Max. SEL [dB re 1 µPa2·s]	224.5	222.9	227.7	229.1
Max. SPL_{peak} [dB re 1 µPa]	245.1	243.5	248.3	249.7
Max. SPL_{rms} [dB re 1 µPa]	234.5	232.9	237.7	239.1
SEL_{cum} [dB re 1 µPa2·s]	259.9	258.3	263.1	264.5

Cumulative SEL was calculated taking into account the maximum number of strikes for one complete monopile installation.

The emitted sound levels were also determined with the application of noise reduction measures. For this purpose, a combination of a close-range system and a double air bubble curtain (CRS+DBBC) was used. The resulting reduction was up to 20 dB.

Sound propagation modelling was carried out for the frequency range 20 Hz–4 kHz. Higher frequencies were determined on the basis of the results for 4 kHz, corrected for frequency-dependent transmission losses. The numerical modelling was carried out using the MIKE by DHI Underwater Acoustic Simulator (UAS).

In order to assess the zones of impact on marine mammals, the US regulations (NMFS, 2024) concerning noise criteria for TTS and AINJ were applied. Behavioural criteria were based on a detailed literature review. For swim-bladder-bearing fish, noise criteria were taken from expert guidelines and a review of the available literature. Furthermore, the impact assessment for the construction phase took into account the gradual sound level increase procedure ('soft-start'). For mammals, animal movement was also taken into account, together with effective silence, representing the lower threshold below which no accumulation of acoustic energy occurs in animals. An exception was made for the calculations of noise levels at the boundary of Natura 2000 sites, where no additional parameters beyond the soft-start procedure were taken into account. This makes the noise calculation results at the boundaries of protected areas more conservative, indicating the actual sound levels that could occur within these areas.

The acoustic modelling carried out showed that piling works during the construction of the OWF within the Baltic West area could potentially have an adverse effect on marine mammals and swim-bladder-bearing fish. The ranges of impact calculated for the winter season were, in all cases, higher than for the summer season, owing to seasonal differences in sound propagation conditions within the water column.

Without the application of noise mitigation measures, the ranges of behavioural impact for seals exceeded the boundary of the modelling area (>165 km) in all the farms analysed during the winter season. For the harbour porpoise, the maximum ranges of this impact (without mitigation) were also very large, reaching up to 159 km in the winter season. The highest source sound levels and the greatest ranges of impact were recorded for OWF 14.E.4, located at the greatest depths within the Baltic West area.

The application of the CRS+DBBC noise reduction system significantly limited the ranges of impact at all locations. The ranges of potential hearing damage for marine mammals were reduced to a maximum of 0.1 km, while the ranges of behavioural reactions were significantly reduced for most species and locations.

For swim-bladder-bearing fish, the effectiveness of the mitigation measures applied is lower than for marine mammals. Even after applying the CRS+DBBC system, the maximum cumulative TTS ranges for fish ranged from 2.2 km (OWF 14.E.2) to 21.1 km (OWF 14.E.4) in the winter season, and the ranges of behavioural reactions remained considerably greater. However, the modelling results for fish should be treated with caution, since the current state of knowledge regarding fish responses to anthropogenic noise remains limited, and the response to acoustic exposure varies both between species and between individuals.

The assessment of noise levels at the boundaries of Natura 2000 sites showed that, with mitigation applied, the cumulative TTS thresholds are generally not exceeded. An exception is the boundary of the Natura 2000 site *Ostoja na Zatoce Pomorskiej*, for which exceedances were recorded in some scenarios. The modelling indicated the possibility of an exceedance for swim-bladder-bearing fish (in the winter season) during single piling at OWF 14.E.2, as well as during simultaneous piling at two different locations (e.g. OWF 14.E.3 and OWF 14.E.2). Furthermore, in an extreme scenario, for the location closest to the aforementioned Natura 2000 site, assuming the simultaneous piling of two nearby sources within the OWF 14.E.2 area, the modelling indicated exceedances of the permissible TTS threshold not only for swim-bladder-bearing fish, but also for the harbour porpoise. It should be noted, however, that the Investor has committed to applying such technical and organisational minimisation measures as to prevent exceedances of TTS levels for the harbour porpoise at the boundary of the Natura 2000 site *Zatoka Pomorska* during the implementation phase.

For swim-bladder-bearing fish, exceedances were recorded primarily in the winter season. These related to simultaneous piling scenarios involving the OWF 14.E.2 location, both in combination with the OWF 14.E.1, OWF 14.E.3 and OWF 14.E.4 locations, and in the scenario of two nearby sources within OWF 14.E.2 itself. Additionally, for swim-bladder-bearing fish, an exceedance was also found in the single-location piling scenario at 14.E.2 in the winter season. In the scenario of simultaneous piling at the OWF 14.E.3 and OWF 14.E.2 locations, exceedances for swim-bladder-bearing fish were also recorded in both seasons analysed.

For the harbour porpoise, exceedances of the cumulative TTS thresholds were recorded only for the scenario of two nearby sources within OWF 14.E.2, and this in both seasons analysed.

8.2.2.3 Conclusions regarding transboundary environmental impact

In connection with the construction of the OWF within the Baltic West area, in particular the piling of foundations, transboundary environmental impact may occur. This is associated with the impact of noise on marine organisms. In order to reduce this impact as much as possible, a range of measures is planned to limit the noise propagation within the aquatic environment (primarily the

application of a Noise Reduction System using appropriate mitigation, e.g. CRS+DBBC, as well as appropriate management of the schedule for simultaneous piling).

With respect to marine mammals, the results of the acoustic modelling showed that, with double mitigation applied, the ranges of noise impact in the form of hearing damage (AINJ and TTS) will be negligible and will not cause transboundary impacts in any of the piling scenarios (both for piling at single locations and cumulatively across multiple areas of the Baltic West simultaneously). Behavioural changes in marine mammals, on the other hand, will have a transboundary range, extending beyond Polish Maritime Areas. On top of this, for cumulative piling scenarios, the modelling showed that the noise level causing a temporary threshold shift (TTS) in swim-bladder-bearing fish exceeds the boundary of the Danish exclusive economic zone, creating a transboundary impact on Danish waters in this respect. The impact of underwater noise on marine organisms is described in more detail in the chapters concerning fish and marine mammals.

8.3 Biotic elements and protected areas

This chapter describes the baseline status of the potential impact receptors (exposed environmental elements) and presents an assessment of the potential transboundary impact on the biological environment.

8.3.1 Ichthyofauna

8.3.1.1 Current status

The entire Baltic West OWF area is characterised by an ichthyofauna assemblage typical of the waters of the southern Baltic. Across all campaigns and using various survey tools, up to 23 fish taxa were recorded in total.

Pelagic fish: Two species clearly dominate the water column: herring and sprat.

Demersal (bottom-dwelling) fish: Cod, flounder and shorthorn sculpin dominate in the near-bottom water layers. The permanent demersal fish assemblage, constituting a smaller bycatch, also includes: sand eels, plaice, turbot, lumpfish, and, locally, also eelpout, fourbeard rockling, twaite shad, common dab, whiting, hooknose and European anchovy.

Ichthyoplankton: Among the early developmental stages (eggs and larvae), sprat, flounder and gobies (including the partially protected sand goby) are the most numerously represented, together with sand eels. Sparse larvae of, among others, the striped seasnail (a protected species), longspined bullhead, herring, plaice, cod and rock gunnel are also present here.

The Baltic West area functions primarily as a foraging ground and a migration route, and its use by fish varies depending on the season:

- Cod: Present in large numbers throughout the year, with the peak density occurring in the winter and spring season. The population here is dominated by young, small individuals (below 35 cm in length), whose share exceeds 90% in winter. Cod feeding activity is relatively low (with the highest proportion of empty stomachs in winter, summer and autumn), except in spring, when foraging intensity increases (with crustaceans and small fish dominating the diet).
- Flounder: Mainly adult individuals (24–28 cm) are present in the area. Flounder feed most intensively in spring (recovering losses after spawning), moderately in summer and autumn, while in winter they almost completely cease feeding in preparation for reproduction.
- Herring: This area is an important foraging ground for herring (dominated by the spring-spawning population) during the summer and autumn season. During this time, the fish feed intensively. In winter and spring, foraging activity drops drastically, which is associated with the spawning migration out of the survey area. Owing to its depth, the sea area is not a significant spawning site for this species.
- Sprat: As is the case with herring, the intensive foraging process takes place in summer and early autumn. In winter and spring, most individuals begin spawning (with the highest proportion of fish with mature and spawning gonads), and during this period sprat are largely fasting (e.g. in spring, the proportion of empty stomachs exceeds 90%).
- Ichthyoplankton: In summer, sprat and goby larvae dominate; in autumn, sand eel larvae; while winter and spring are the periods when mainly sprat and flounder larvae are present in the water column.

The Baltic West area constitutes an important ecological corridor connecting shallow coastal waters with deep marine basins.

Active migrations of adult fish:

- Cod: The area lies on the main spawning migration route from coastal zones towards the spawning grounds in the Bornholm Deep. In summer and autumn, a return migration of adult (spent) individuals through this area towards shallow foraging grounds is observed.
- Flounder: Mature individuals migrate in winter and early spring from the survey area to the neighbouring Bornholm Deep, where salinity conditions suitable for their reproduction prevail (>10 PSU).

- Herring: In winter, herring migrate from the project area to shallow coastal spawning grounds (including the Vistula Lagoon, Pomeranian Bay, and Słupsk Bank). After spawning, they return to the Baltic West area to forage.

Passive migrations (ichthyoplankton drift):

The vast majority of fish larvae do not hatch within the Baltic West area, but are carried in by sea currents:

- From the deep sea (Bornholm Deep): Currents transport larvae of sprat (from early spring spawning), flounder, fourbearded rockling, plaice and cod from deeper waters.
- From shallow-water zones: From shallower areas (Pomeranian Bay, the Odra and Orla Banks, the coastal zone), larvae of gobies, sand eels, shorthorn sculpin, herring and striped seasnail drift into the survey area.

The variation in bathymetry and salinity within the Baltic West area directly determines the local structure of the ichthyofauna. In the shallower south-western part (OWF 14.E.1, 14.E.2), lower ichthyoplankton diversity, average herring densities, and an absence of conditions suitable for the reproduction of deep-water species were recorded. In the deeper part (OWF 14.E.3, 14.E.4), on the other hand, biodiversity and herring biomass are higher, and local inflows of saline water create potential conditions for the spawning of, among others, flounder, fourbearded rockling and sprat, although these water bodies do not constitute key spawning grounds for them. Across the entire complex, the presence of significant spawning grounds of the autumn-spawning herring has been excluded.

Of the 24 taxa identified, the species selected for the impact assessment were the economically most important species (sprat, herring, cod, flounder) and the protected species recorded (gobies, striped seasnail, twaite shad), excluding the taxa that occurred only incidentally from the analyses.

8.3.1.2 Environmental impact assessment and transboundary environmental impact

The main impacts on ichthyofauna will be associated with noise and vibration emissions, an increase in suspended solid concentration, the release of contaminants and nutrients from sediment into the water, habitat change, and the creation of a barrier.

8.3.1.2.1 Noise and vibration emission

The ability of fish to detect noise is widespread, but its range depends strongly on their anatomical structure, and in particular on the presence and position of the swim bladder:

- Fish without a swim bladder (e.g. flatfish) or with a swim bladder situated away from the ear (e.g. salmon) detect only the motion of water particles. This results in a narrower range of hearing (usually up to 300–500 Hz) and generally lower acoustic sensitivity.
- Fish with a swim bladder located close to, or connected to, the ear (e.g. herring, cod) additionally detect changes in sound pressure. The swim bladder amplifies the stimulus, which considerably broadens the range of frequencies heard (in Clupeids, even >100 kHz) and increases susceptibility to noise.

Owing to these differences in sound perception mechanisms, the ichthyofauna was divided into four sensitivity groups (plus an additional group for eggs and larvae) for the purposes of the impact analysis, in accordance with the classification of Popper et al. (2014) [Table 13].

Table 13 Classification of ichthyofauna according to the morphology of the hearing organs and the sound detection mechanism [source: Popper et al., 2014]

FISH GROUP	SOUND DETECTION MECHANISM	FREQUENCY RANGE RECORDED	REPRESENTATIVES
Fish without a swim bladder	water particle motion	narrow frequency range	flatfish
Fish with a swim bladder located further from the inner ear, not involved in sound detection	water particle motion	narrow frequency range	salmonids
Fish with a swim bladder close to the inner ear, not connected to the inner ear	water particle motion, pressure changes	broader frequency range, up to approximately 500 Hz	Gadidae, Anguillidae
Fish with a swim bladder connected to the inner ear	primarily pressure change, also particle motion	Broad frequency range, up to several kHz	clupeids, perciforms

Depending on the intensity of the noise and the distance from its source, a whole range of impact effects can occur, ranging from behavioural changes to fish mortality [Table 14].

Table 14 Potential effect of noise on ichthyofauna [source: own study based on Popper et al. (2014)]

IMPACT EFFECT	CHARACTERISTICS OF THE IMPACT
Behavioural changes	Disruption of normal activities, such as: foraging, spawning, shoaling, migration, displacement from preferred areas, avoidance reaction
Masking	Masking of biologically important acoustic signals from the surroundings, including those from other individuals
Temporary threshold shift (TTS)	Damage to hair cells causing a temporary reduction in hearing (TTS)
Tissue damage; physiological disturbances	Examples of damage: internal haemorrhage; damage to gas-filled organs, such as the swim bladder, and the surrounding tissues
Death	Death resulting from damage sustained as a result of exposure to sound

The impact of piling noise on fish comprises three levels: behavioural, physiological and lethal. Behavioural changes and the masking phenomenon result in the temporary abandonment of

habitats (avoidance reaction) and disruption of communication, whereby fish return to the given area within a few hours or days of the emission ceasing. Physiological effects (TTS) constitute a temporary and reversible reduction in hearing, which may temporarily increase exposure to predators. The most serious lethal effects and barotrauma (fatal damage to organs, e.g. the swim bladder), on the other hand, occur only in the immediate vicinity of the works carried out, being limited to a radius of approximately 10–12 m from the noise source. Threshold values for the individual effects were adopted in accordance with the guidelines of Popper et al. (2014) [Table 15].

Table 15 Impact of noise caused by piling on ichthyofauna, taking into account morphology and developmental stage [source: Popper et al. (2014)]

Type of organism*	Mortality and potential lethal injury	Recoverable injury*	Temporary threshold shift*	Masking*	Behavioural disturbance*
Fish without a swim bladder (particle motion 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 a swim bladder not involved in hearing (particle motion detection), e.g. Atlantic salmon	210 dB SEL_{cum} >207 dB_{peak}	203 dB SEL_{cum} >207 dB_{peak}	>186 dB SEL_{cum}	(B) moderate (U) low (D) low	(B) high (U) moderate (D) low
Fish with a swim bladder involved in hearing (sound pressure detection), e.g. Atlantic cod, herring	207 dB SEL_{cum} >207 dB_{peak}	203 dB SEL_{cum} >207 dB_{peak}	186 dB SEL_{cum}	(B) high (U) high (D) moderate	(B) high (U) high (D) moderate
Eggs and larvae	>210 dB SEL_{cum} >207 dB_{peak}	(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 impact effects for which it was not possible to determine a sound level, relative risk (low, moderate, high) is indicated depending on the distance from the sound source: (B) near – tens of metres, (U) moderately far – several hundred metres, (D) far – several thousand metres. Units for peaks: dB re 1 µPa and for the cumulative SEL value: dB re 1 µPa²s)*

The mortality and severe injury thresholds for adult fish, larvae and eggs are consistent with the guidelines of Popper et al. (2014) and the Swedish Environmental Protection Agency [Andersson et al., 2017].

Andersson et al. (2017) do not define universal thresholds for TTS and behaviour (these effects are species-specific). In addition to this, current models based solely on pressure changes may underestimate the impact of noise on flatfish (e.g. flounder), which respond only to water particle motion.

The analysis of the effects of acoustic impact once threshold values are exceeded covers two key phases:

Implementation phase (impulsive noise)

- Mortality and barotrauma: The lethal risk for adult fish is limited to the immediate zone (a few dozen metres); however, thanks to the soft-start procedure, the animals will manage to flee before the loudest sounds occur. Possible local mortality of larvae and eggs, on the other hand, is of negligible significance for the population.
- TTS effect (temporary threshold shift): The range of reversible hearing damage, in the extreme scenario, will reach up to 558 km² in summer and 1116 km² in winter. Owing to its short duration (up to a few days), this phenomenon will not affect population-level fish survival.
- Effect on reproduction and foraging grounds: The farm area does not constitute an important spawning ground for cod, flounder, sprat, autumn-spawning herring, or protected species such as the sand goby or gobies (owing, among other things, to unsuitable depth or salinity). Temporary displacement of fish from foraging grounds will not deplete food resources, thanks to the high mobility of these animals and the vast base of alternative spawning and foraging sites in the southern Baltic. The significance of this impact is assessed as low or negligible.

Operational phase (continuous noise from operating turbines and vessels)

- The ability of fish to perceive operational noise depends on their anatomy, and sounds from the turbines are audible only at a distance of 1 to 5 km. They do not pose a risk of hearing damage to ichthyofauna.
- The persistent flight response of fish is strictly localised (limited to a few metres from the pylon), and moreover fish are able to quickly become accustomed to this sound background (habituation), with any displacement offset by the so-called artificial reef effect.

The long-term operational impact was ultimately assessed as negligible, carrying no risk of population-level or transboundary changes.

8.3.1.2.2 Increase in suspended solid concentration in the water column

Works involving physical interference with the seabed will cause the resuspension of sediments, a temporary increase in water turbidity, and its subsequent sedimentation. The sensitivity of ichthyofauna to this phenomenon depends closely on the developmental stage:

- Adult and juvenile fish (low sensitivity): These show high resistance to turbidity. Owing to their mobility, the main effect will be active and short-term avoidance of contaminated zones (temporary displacement from foraging grounds). The threshold values triggering an avoidance reaction and a lethal effect for these stages are set out in Table 16. Given that the maximum projected suspended solid concentrations at a distance of 150 m from the works (approximately 176 mg/dm³) are many times lower than lethal values, the risk of their direct mortality has been completely excluded.

Table 16 Threshold values of suspended solid concentration triggering an avoidance reaction and a lethal effect in adult fish [source: Rambøll (2014)]

SPECIES	AVOIDANCE RESPONSE	LETHAL EFFECT
Pelagic	10 mg·dm^{-3}	>500 mg·dm^{-3}
Demersal	50 mg·dm^{-3}	>3000 mg·dm^{-3}

- Eggs and larvae (high sensitivity): These respond adversely already at concentrations of the order of milligrams (e.g. owing to gill clogging). Concentrations toxic for these organisms, which lack the ability to flee (>10 mg/dm³), may occur at distances of up to 3.2 km from the works site.

Despite the localised risk for the early stages of commercial species (including sprat, flounder, herring, fourbearded rockling) and protected species (striped seasnail, gobies), the phenomenon of elevated turbidity is very short-lived – concentrations >5 mg/dm³ will persist in the water for a maximum of 26 hours. Moreover, the farm area does not constitute a key spawning ground for these species, and the fish have extensive alternative areas available within the southern Baltic.

Owing to the temporal and spatial limitation of the phenomenon, and the biological resilience and mobility of the ichthyofauna, the ultimate impact of suspended solids on the population's reproductive success is assessed as negligible.

8.3.1.2.3 Release of contaminants and nutrients from sediments

Physical interference with the seabed causes the resuspension of sediments and the release of the contaminants accumulated within them into the water column. An additional risk is posed by potential emergency leaks of petroleum-derived substances from vessels.

In analysing the sensitivity of ichthyofauna to toxic substances, maturing females and early developmental stages, such as eggs and larvae, show the highest susceptibility to damage. In females, exposure to harmful substances – including light petroleum fractions and polycyclic aromatic hydrocarbons (PAHs) – causes direct hormonal disturbances affecting ovulation and the course of spawning, and also results in a reduced heart rate and behavioural anomalies, manifested, among other things, by a decrease in foraging efficiency [Rosenthal et al., 1986]. Importantly, these effects can determine the condition of subsequent generations, causing a reduction in the body size and severe morphological deformities of the spine and jaws in hatching larvae, as documented in common dab, flounder, cod and herring [Dethlefsen et al., 1986]. The earliest ontogenetic stages, in turn, are characterised by the highest sensitivity to environmental pollutants, where even extremely low concentrations of PAHs in the water column exert a strongly adverse effect on proper embryonic development [Collier et al., 2014].

Surveys of sediment samples within the Baltic West area showed low concentrations of harmful substances, which excludes the scenario of toxicants being released in quantities posing a threat to ichthyofauna.

According to NOAA's assessment, the toxic effect of hydrocarbons is largely limited to enclosed coastal water bodies, where fish have no possibility of escape. The risk of accidental spills on the open sea will be minimised to an acceptable level through strict compliance with safety procedures and maritime conventions (MARPOL).

The impact on fish associated with the release of contaminants and nutrients from sediments into the water column is classified as: adverse, direct, momentary and local.

The significance of this impact for all the fish species surveyed is assessed as negligible.

8.3.1.2.4 Habitat change

Another important aspect subjected to analysis is the physical transformation of the seabed and the introduction of new structures within the project area. The potential effect of these phenomena on the habitat and food base of ichthyofauna was assessed separately for the key implementation stages of the projects:

- Construction phase (reduction of the food base): The physical occupation of the seabed for foundations and cable infrastructure will cause permanent destruction of macrobenthos across only approximately 5.7% of the total area of the Baltic West area. For pelagic fish (herring, sprat), this phenomenon is insignificant, since their food (plankton) is widely available within the water column. For benthivorous fish (cod, flounder), this small, localised

loss likewise will not deplete real trophic potential, mainly owing to their high mobility. Owing to its localised nature, this adverse impact was ultimately assessed as negligible from the perspective of local ichthyofauna assemblages.

- Operational phase (artificial reef and refuge effect): The introduction of hard turbine foundations will generate the so-called artificial reef effect, creating a rich food base and attractive shelter for, among others, juvenile cod. In addition, any possible restriction of commercial fishing within the farm boundaries will mean that the project area begins to function as a safe zone excluded from exploitation (a refuge), favouring stock recovery. These transformations will be positive and long-term in nature, and their significance was assessed as low (moderately beneficial) for demersal and protected species, and negligible with respect to the remaining fish species.

8.3.1.2.5 Barrier effect

The effect of the physical presence of the new infrastructure on the free movement and passability of ichthyofauna migration routes was assessed taking into account the individual implementation stages of the Project:

- Construction phase: A potential physical barrier for fish results from the temporary presence of equipment and infrastructure elements within the water column. Under open-sea conditions, however, wind farm arrays cause, at most, a minor barrier effect for mobile species. The results of empirical studies (including for eel, cod and plaice) confirm intensive use of the space between turbines and show no formation of insurmountable obstacles. Only a local hindrance to fish movement around the works sites should therefore be expected. This impact was classified as adverse, direct, local and short-term, and its significance was assessed as negligible for all the surveyed species.
- Operational phase: The presence of turbine and station foundations will not constitute a barrier to the migration of commercially important fish species. These structures are point-like rather than continuous in nature, which entirely excludes the cutting-off of the passability of migration routes. Monitoring of operating offshore wind farms confirms the predominance of local effects (fish aggregation around pylons), with a simultaneous absence of blocking of animal movement on a regional scale. The formation of a physical barrier was classified as an adverse, direct, local, long-term and permanent impact; however, its ultimate significance was assessed as negligible for all species.

8.3.1.2.6 Conclusions regarding transboundary environmental impact

The impact of the Project on ichthyofauna will occur primarily during the implementation stage and will result from noise emissions generated during the installation of foundations using the piling method. This impact may take various forms – depending on the intensity of the noise and the distance from its source, a whole range of effects can occur, ranging from behavioural changes to fish mortality. If piling were carried out without the application of measures to limit noise propagation, the range of impact on fish could be very large. However, the Applicant has already provided, at the planning stage, for the application of such measures (Noise Reduction System – NRS), which will considerably reduce the range of underwater noise impact. These measures will be individually selected depending on the situation, as described in Section 2.4.2.2.2.1.

The impact assessment of noise emissions carried out, taking into account the results of propagation modelling, showed that the area in which immediate increased fish mortality could occur will be very small, reaching a maximum of a few dozen metres (approximately 10–12 m) from the works site. The range of the reversible, temporary hearing impairment effect (TTS), on the other hand, in the most far-reaching cumulative scenario (piling at two nearby locations), will cover an area of 558 km² in the summer period and 1116 km² in the winter period.

The results of the analyses indicate that the Baltic West area lies on the cod spawning migration route; however, its nearest main spawning ground (the Bornholm Deep) is located beyond the direct range of the strongest noise impact, which minimises the effect of piling on its reproductive process.

For herring, the depth of the OWF 14.E.3 and 14.E.4 areas definitively excludes them as sites of intensive autumn spawning. In the shallower water bodies (14.E.1 and 14.E.2), on the other hand, such spawning may occur, but on an insignificant scale. The main, suitable shallow spawning grounds for herring (e.g. Pomeranian Bay, the Vistula Lagoon), like the reproduction zones of protected species (striped seasnail and sand goby), are located in coastal zones and are therefore entirely beyond the range of the TTS effect.

The impact on sprat will likewise be insignificant at the population level. Although early spring spawning may potentially take place in the deepest, northern parts of areas 14.E.3 and 14.E.4 (owing to higher salinity), its very low intensity and the vast area of alternative spawning grounds available in the southern Baltic mean that any disruption to reproductive processes will be of marginal significance. A similar absence of significant impact applies to flounder. This species migrates for reproductive purposes to the neighbouring Bornholm Deep. In addition to this, the specific structure of the flounder's hearing organ and its limited sensitivity to acoustic stimuli mean that piling noise will not trigger a sudden flight response from foraging grounds.

Taking into account the above conditions, the minimal range of impulsive noise impact, and the high mobility of ichthyofauna, the risk of significant adverse effects at the population level, as well as transboundary impacts, can be excluded.

8.3.2 Migratory birds

8.3.2.1 Current status

Surveys of migratory bird passages across the entire Baltic West area (covering sub-areas 14.E.1–14.E.4) were carried out during the spring, autumn and winter periods, spanning 2025 and 2026. Visual observations, vertical and horizontal radar tracking, and acoustic recordings were used for this purpose. Over the entire cycle of surveys, a total of 136 bird species were observed and acoustically recorded within the Baltic West area.

The composition and abundance of species varied significantly depending on the phenological period:

- Spring: The presence of 75 species was confirmed. During this period, the common scoter clearly dominated, followed by the long-tailed duck, greater white-fronted goose, scaup and velvet scoter.
- Autumn: This was the period with the greatest diversity, during which 105 bird species were observed. The most numerous species was the common scoter, followed by the Eurasian wigeon, long-tailed duck and common starling.
- Winter (local movements): 40 species were recorded during the winter period. The long-tailed duck was by far the most numerous, accounting for 50% of all records (most observations took place in December). The velvet scoter, common scoter and auks were observed considerably less frequently during this period.

Summarising the total number of individuals observed during both main migration seasons (autumn and spring), the most numerous groups migrating through the Baltic West area were:

- Geese – accounting for nearly 25% (13822 individuals) of all observations.
- Common scoter – close to 16.8% (9297 individuals).
- Unidentified ducks – 13.3% (7406 individuals).
- Passerines – 12.3% (6812 individuals).
- Long-tailed duck – over 11% (6187 individuals).
- Eurasian wigeon – nearly 5.7% (3149 individuals).

The Baltic West area is used by many species with a sensitive conservation status:

- Of the species observed, as many as 30 are listed in Annex I to the EU Birds Directive.

- The common eider and long-tailed jaeger are considered Endangered (EN) at the European level.
- 13 of the species observed hold Vulnerable (VU) status in Europe (including the black-legged kittiwake, common pochard, common snipe and Eurasian oystercatcher).
- The numerous long-tailed duck and horned grebe also hold Vulnerable (VU) status at the global level.
- According to the HELCOM list, the breeding populations of the common eider and the Baltic subspecies of the dunlin are considered Critically Endangered (CR).

Bird passage over the Baltic West area shows a clear directional seasonality: in spring, migration takes place predominantly towards the east and north-east, and in autumn towards the west and south-west. The surveys confirmed that most birds migrating during the day, including most of the threatened species (with the exception of, among others, the scaup, barnacle goose, European golden plover and common crane), pass at low altitudes, placing them below the impact zone of the future wind turbine rotors.

It should also be noted that the birds recorded within the Baltic West area are highly likely to be using nearby protected areas, which constitute important foraging and resting sites for them, such as *SPA Pommersche Bucht (DE1552401), Adlergrund (DE1251301), Rønne Banke (DK00FC373)*, and *Zatoka Pomorska (PLB990003)*.

Nocturnal migration within the Baltic West area

The inventory data obtained confirmed that the Baltic West area is used by birds migrating at night. Among nocturnal migrants, small passerines (including the European robin, common blackbird, redwing and goldcrest) and waders (including the Eurasian curlew, wood sandpiper and common ringed plover) were identified primarily, together with three duck species: the Eurasian wigeon, common scoter and long-tailed duck. Noticeably higher nocturnal migrant activity was recorded during the autumn season.

On the basis of the results gathered and expert knowledge of migration ecology, however, it is assumed that, owing to the considerable distance from land and the need to cross a vast expanse of open sea with no possibility of resting, this area is used less intensively by small passerines migrating at night than is the case in areas located closer to the coast. For many small terrestrial birds, flying over the open sea entails a greater energy expenditure and reduced possibilities for adjusting the route in the event of worsening weather, and consequently many individuals prefer routes running along the coastline, where it is easier to maintain orientation and where resting sites are available.

Nevertheless, under favourable atmospheric conditions (mainly with a tailwind), some birds cross this sea area directly. The nocturnal migration across the Baltic West area occurs on a so-called broad front, and no clearly defined, narrow migration corridors for nocturnal migrants were identified within the surveyed area.

8.3.2.2 Environmental impact assessment and transboundary environmental impact

In connection with the construction, operation and decommissioning of the OWF within the Baltic West area, impacts on migratory birds associated with the barrier effect and collision risk may occur. This will result, in the first instance, from the presence of construction vessels within the OWF area, and subsequently from the wind turbines being erected in succession. These impacts have been analysed and described in detail in the Annex – Results of the modelling of collision risk and the barrier effect on migratory birds.

8.3.2.2.1 Barrier effect

The presence of construction vessels within the surveyed Baltic region creates a physical barrier, which may affect the way migrating birds move. The scale of the impact will depend on the number of vessels, their size, their operating time, and also the season. Migratory birds sensitive to disturbance generated by vessels may change their flight trajectory vertically or horizontally, which may lengthen the flight and, consequently, also increase the energy costs of migration. However, the change of the route will constitute only a small proportion of the whole migratory journey, and consequently the additional energy expenditure associated with it will be insignificant, as, for example, calculated for the long-tailed duck by the Madsen's team [Madsen and Cook, 2016]. An analysis of the change in migration route length during the operational phase indicates a slight lengthening of the route (approximately 0.02%). Changes of this magnitude have a minimal effect on the length of the entire migratory journey. A forced change of the route to avoid the works area will generate only a negligible increase in energy expenditure, which comfortably falls within the limits of the natural variability of the distances covered by birds from a given population (resulting, among other things, from the choice of different resting sites, the location of nesting sites, or day-to-day route adjustments owing to variable weather conditions). Since this additional effort does not constitute a noticeable burden on the overall energy budget of migratory birds, the significance of this impact during the construction phase was ultimately assessed as negligible or low for all the species and species groups analysed.

The presence of the OWF during the operational stage generates a barrier effect affecting the behaviour (movement) of migratory birds. The scale of the impact will depend on the number of wind turbines, their size, and the distance between them within the Baltic West area. Birds may be

forced to change their flight direction horizontally or vertically, which may slightly lengthen their migratory journey and increase their energy requirements. Studies carried out to date on this subject indicate that avoiding even several OWFs slightly increases both the total length of the migratory route and the energy expenditure associated with the migration [Masden et al., 2010, King et al., 2009, Drewitt et al., 2006]. These results have been taken into account as a point of reference in the impact assessment carried out; however, it should be emphasised that the studies presented in the literature relate to other marine areas. Masden and Cook (2016) present results for the Nysted OWF in the Baltic Sea (165 MW). The report prepared by Jensen et al. (31) presents the situation for the Horns Rev 3 OWF (400 MW, Horns Rev 3, North Sea). In the case of Horns Rev 3, which borders two other OWFs – Horns Rev 1 (160 MW) and Horns Rev 2 (209 MW) – it was found that cumulative impacts would not occur.

As with the implementation and decommissioning phases, this impact is direct in nature; however, owing to the duration of the operational phase, its time frame has been defined as long-term.

The forced route change to avoid the Baltic West area is lengthened, on average, by 23 km, which extends migration routes by an average of 1.71%, and by 0.66% in the case of cranes. The lengthening of the route by 23 km, associated with the barrier effect of the Baltic West area will increase the energy expenditure required to cover the route to a negligible degree [Merkel and Johansen, 2021; Pennycuick, 2001].

The barrier effect, assessed by modelling all four Baltic West sub-areas as a single, connected barrier, resulted in only a slight increase in migration distance and the associated increase in energy expenditure for all species. For most species, the increase in the migration distance was less than 2%, with a similarly small increase in the energy expenditure. The greatest relative effects were observed in auks, in particular the black guillemot, followed by the common guillemot and razorbill, for which the increase in migration distance was approximately 3.7–6.6%, and the increase in energy expenditure approximately 3.0–5.5%. In contrast, for long-distance migratory birds, such as the common swift, the barn swallow and several species of geese and ducks, the changes were negligible and usually amounted to less than 1%. Overall, the results suggest that the increase in the migration distance associated with the barrier in the form of the Baltic West farm area is likely to have a limited impact on the energy expenditure for most species. Consequently, the significance of the impact associated with the barrier effect for all bird groups and species included in the analysis was assessed as low or negligible.

8.3.2.2.2 Risk of collision

Implementation phase

During the construction phase, the night-time lighting of vessels and works carried out in conditions of limited visibility (fog, heavy precipitation) may attract migratory birds, particularly terrestrial passerine species. This phenomenon, documented among others by Blew et al. (2013) and Madsen and Cook (2016), creates a risk of sporadic collisions with vessels. The barrier effect and collisions with vessels constitute direct impacts, of a local range (limited to the works area) and a momentary nature. The barrier effect associated with vessels is fully reversible and ceases once construction is complete, whereas collisions – owing to the complete mortality of the individuals involved – are irreversible in nature. The value of the receptor (species) within the impact zone is estimated as a function of its sensitivity per se, the size and significance of the population within the range of impact, and its conservation status.

The common scoter constitutes a particular case. Despite its low sensitivity to collision, most individuals move at a low altitude (below the range of the rotor blades), which corresponds to a height at which collision with vessels is possible. Owing to the proximity of key wintering grounds (including in Pomeranian Bay) and its high abundance within the surveyed area (6.3% in autumn, and nearly 5% in spring, of the biogeographic population), the significance of this receptor within the range of impact was assessed as high.

Significance of impact on individual bird groups:
Most species and bird groups: low or insignificant sensitivity, low impact intensity, momentary nature. The significance of the impact (the barrier effect and collision risk) was determined as negligible or low.

Common scoter (risk of collision with vessels): low sensitivity (with a high receptor value within the impact zone), moderate impact intensity, momentary nature. The significance of the impact was determined as moderate.

Operational phase

During the operational phase, the main hazard is the risk of bird mortality resulting from the collision with elements of the operating OWF. This depends on the technical parameters of the turbines, the biological characteristics of the individual species, and weather conditions. The latest studies from offshore and onshore wind farms [e.g. Liedtke et al., 2025] indicate that the previously assumed simple relationship, whereby limited visibility (fog, night-time) automatically and unequivocally increases the collision risk by lowering the flight altitude, is in reality considerably more complex. For

example, during the autumn migration in conditions of reduced visibility, birds are able to fly higher, seeking more favourable wind conditions. For this reason, the effect of meteorological conditions on offshore bird behaviour requires a careful assessment.

On the basis of the analyses carried out, the significance of collision impact for most bird species and groups was assessed as negligible or low. An exception is constituted by three species (and, locally, within the OWF 14.E.2 area, geese as a group), for which the significance of impact was consistently determined as moderate:

- Crane: Despite the low projected number of collisions, the species is characterised by a limited biogeographic population (350 000 individuals) and a lower adopted turbine avoidance rate (83%), resulting from the fact that, in this area, the great majority (89% to 100%) of individuals move at altitudes above 20 m above sea level, i.e. within the rotor operating zone.
- Little gull: In addition to its limited population size (130 000 individuals), it was taken into account that, during autumn migration, a significant proportion of its biogeographic population passes through the entire Baltic West area. The highest passage estimates were obtained for the westernmost and southernmost part of the complex, where approximately 2.38% (OWF 14.E.1) and 2.15% (OWF 14.E.2) of the population may pass through, while for the eastern water bodies (OWF 14.E.3 and 14.E.4) these values amount to close to 1.67%.
- Common scoter: Although most individuals move at a safe altitude below the range of the rotor blades, a highly significant proportion of its biogeographic population passes over the Baltic West area – during autumn migration, this ranges from approximately 6.3% in the eastern part (OWF 14.E.3 and 14.E.4) to as much as 12.3–13.4% in the western part (OWF 14.E.1 and 14.E.2). The modelled cumulative annual collision risk was estimated at 130 individuals for the entire Baltic West area. The assessment also took into account the proximity of important wintering grounds for this species (including in Pomeranian Bay).
- Geese (group): These were assessed as posing a moderate collision risk only locally, within the OWF 14.E.2 area, which was justified by the large overall scale of passage through this sea area (approximately 3.6% of the biogeographic population) and the high proportion (66%) of individuals migrating at altitudes above 20 m above sea level. For the remaining OWFs, the impact on this group was assessed as low.

For groups with a higher modelled number of collisions at individual water bodies, such as geese (up to 256 individuals/year for OWF 14.E.3 and 14.E.4) and passerines (up to 156 individuals/year for OWF 14.E.2), the significance of impact was consistently classified as low, owing to the very large

size of their populations (over 3.3 million and approximately 100 million individuals, respectively). For auks and grebes, the collision risk is zero.

A detailed analysis of the impact of the barrier effect and collision risk on migratory birds, based on modelling calculations, is presented in Appendix 4 to the national EIA Reports, which has also been attached to this Espoo Report.

Decommissioning phase

The impact on migratory birds during the decommissioning phase is assumed to be similar to the impact estimated for the construction phase. As the dismantling of the wind farm progresses, the physical barrier will diminish, and the risk of collision with turbines will progressively decrease. The collision hazard will relate mainly to sporadic bird collisions with vessels involved in the dismantling works (just as in the construction phase, this risk increases at night owing to birds being attracted by vessel lighting). This impact is short-term and local in nature, and its significance was assessed as negligible or low for most bird groups, and as moderate for the common scoter.

8.3.2.2.3 Nocturnal migrations

As shown by the pre-investment environmental surveys, the Baltic West area is used by birds migrating at night. This migration takes place on a so-called broad front and relates in particular to small passerines, waders, and also certain duck species (including the Eurasian wigeon, common scoter and long-tailed duck). The impact assessment for this bird group covers two key aspects: the barrier effect and collision risk.

Barrier effect

During the project implementation phase, a temporary physical barrier will be constituted by vessels and the infrastructure elements being progressively erected. During the operational phase, on the other hand, obstacles in the form of operating wind turbines will arise along the passage path.

Both during the day and at night, the presence of the wind farms forces migratory birds to adjust their flight trajectory – avoiding obstacles horizontally (bypassing the farm) or vertically (changing flight altitude). Modelling of the cumulative barrier effect for the Baltic West area showed, however, that the forced change of the route will lengthen the total migration distance to a negligible degree – on average by only approximately 1.71%. Such an increase in distance generates proportionally low energy costs, which comfortably fall within the limits of the natural, day-to-day variability of the distances covered by birds (resulting, among other things, from the search for resting sites or ongoing route adjustments owing to weather conditions). Owing to the negligible effect on birds'

energy budget, the significance of the barrier effect for nocturnal migrants was assessed at levels ranging from negligible to low across all phases of the project.

Risk of collision

For birds migrating at night, the key factor determining a collision risk is disorientation caused by artificial lighting. Migratory birds navigate at night with reference to, among other things, natural light sources (stars, the moon). Attraction by brightly lit construction vessels (during the construction phase) and OWF infrastructure (during the operational phase) increases the risk of collision with these objects. This phenomenon is intensified under unfavourable weather conditions with low visibility (fog, heavy precipitation, cloud cover), when birds may misinterpret artificial light as landmarks.

It should be emphasised, however, that the behaviour of birds at night and in bad weather is highly complex. As the latest empirical studies show [i.a. Liedtke et al., 2025], the previous assumption that limited visibility automatically and unequivocally forces birds to lower their flight directly into the rotor sweep zone is not always confirmed in reality. In many cases, when visibility deteriorates (particularly in autumn), birds are able to increase their flight altitude in order to move above the layer of limited visibility in search of more favourable winds. For this reason, the cumulative risk of collision with wind turbines for most birds was assessed as negligible or low (only for a few groups, including the common scoter and little gull, owing to the high significance of the passing population, was it estimated as moderate). Similar conclusions apply to the risk of collisions with lit vessels during the construction phase, which will be only sporadic in nature.

In order to eliminate the phenomenon of attraction and minimise the collision risk for nocturnal migrants, restrictions on light emission have been introduced for the construction, operation and decommissioning stages of the project. In addition, strong light sources directed vertically upwards and (as far as technically possible) sideways will be eliminated entirely.

Although bird migrations have a territorial range extending beyond national borders, and these impacts cumulate with other offshore farms, thanks to the implementation of mitigation measures their transboundary significance will not exceed a moderate level, meaning that the impact of the Baltic West area on the survival of nocturnal migrant populations will not be significant. In addition to this, during the operational phase, a continuous monitoring system using radar and thermal imaging cameras will be introduced, which will enable the actual impact of the project on birds passing at night to be assessed.

8.3.2.2.4 Conclusions regarding transboundary environmental impact

The entire Baltic West offshore wind farm complex directly borders the Danish exclusive economic zone (EEZ) and is located at a distance of just about more than 14 km from the German EEZ. Owing to this location, and the proximity of foreign Natura 2000 protected sites (including the German *SPA Pommersche Bucht and Adlergrund*, and the Danish *Rønne Banke*), which serve migratory birds as stopover and wintering sites, the occurrence of transboundary impacts on the migration of these animals cannot be excluded – both with respect to birds migrating during the day and at night.

The key transboundary impacts include:

- Barrier effect and habitat displacement: The presence of tall structures at sea has a deterrent effect on birds, forcing them to avoid the farms. For species with a high conservation status (e.g. sea ducks and divers), hardly several percent of individuals choose to fly between the turbines, and the avoidance response begins as early as 1.5–2 km before the farm. Disturbance and habitat displacement will also cumulate transboundarily with nearby existing and proposed German and Danish farms (such as the Baltic Eagle, Wikinger and Arkona OWFs, and facilities at the Bornholm Energy Island). For nocturnal migrants, the barrier effect will lengthen the flight route by an average of only approximately 1.71%, which, given the negligible energy costs, was assessed as a negligible or low impact.
- Collision risk: Given that the vast majority of migratory birds effectively avoid built-up water bodies, the calculated cumulative collision risk in the transboundary context was assessed, for most species, as low or, at most, moderate (as in the case of the common scoter). For nocturnal migrants, the key collision risk results from disorientation caused by artificial light. In transboundary terms, however, this hazard has been minimised through the rigorous restriction of lighting to an absolute minimum and the reduction of the intensity of upward-directed lights.

Owing to the scale and nature of the project, the elimination of transboundary impacts is not possible – it is only possible to strive to minimise their scale and range. Nevertheless, comprehensive analyses show that transboundary impacts on migratory birds (including nocturnal migrants) will not be significant, and their level is classified overall as negligible, low or moderate.

8.3.3 Seabirds

8.3.3.1 Current status

The Baltic Sea area is used by seabirds as a wintering site or as a stopover during migration. Most of the surveyed birds reach their highest abundance in the offshore zone, located more than 1 km from

the shore. An exception is gulls, which accompany fishing cutters on fishing grounds, and their presence on the open sea is strongly determined by human activity.

8.3.3.1.1 Species composition of birds sitting on the water

During the pre-investment monitoring surveys, a total of 9 169 individual birds present on the water were recorded across all water bodies. The species structure of the grouping identified is typical of the open, offshore waters of the Baltic Sea.

The analysis of the results carried out showed a strong dominance of just a few species. The vast majority of the birds observed were sea ducks (primarily the long-tailed duck and velvet scoter, and, to a lesser extent, the common scoter), together with the European herring gull and auks (common guillemot and razorbill). Of the more than twenty taxa identified, only 6 species reached or exceeded the 1% threshold of representation within the grouping, together accounting for over 97% of all birds observed.

Among the birds identified, the presence of species with a special conservation status and a high degree of threat at the international level was recorded:

- National protection (Poland): 21 species subject to strict protection were recorded (including the tufted duck, removed from the list of huntable species in 2025), 3 species subject to partial protection (European herring gull, Caspian gull, cormorant), and 1 huntable species (mallard).
- Birds Directive (Annex I): The presence of 4 species: little gull, horned grebe, red-throated diver and black-throated diver.
- IUCN / HELCOM Red List (global and regional scale):
    - CR (Critically Endangered): black-throated diver and red-throated diver (wintering in the Baltic, according to HELCOM).
    - EN (Endangered): common scoter (according to HELCOM).
    - VU (Vulnerable): long-tailed duck, velvet scoter, white-billed diver, horned grebe, red-necked grebe (IUCN/HELCOM), and red-breasted merganser (HELCOM).
    - NT (Near Threatened): tufted duck, red-breasted merganser (IUCN), and little gull (HELCOM).

The characteristics and share of these key species, which determine the structure of the marine avifauna within the Baltic West area, are set out in the table below [Table 17].

Table 17 Bird species exceeding the average annual threshold within the grouping

ITEM	SPECIES	AVERAGE ANNUAL SHARE	KEY PERIODS AND BEHAVIOUR WITHIN THE OWF AREA
1.	long-tailed duck *Clangula hyemalis*	45%	Clear dominant. Highest share in winter (69%) and spring (49%). Absent in summer.
2.	velvet scoter *Melanitta fusca*	20%	Numerous in autumn (36%) and spring (20%). Absent in summer.
3.	European herring gull *Larus argentatus*	20%	A widely distributed species. Dominant during the summer period (68%) – presence associated with foraging (accompanying fishing cutters).
4.	common guillemot *Uria aalge*	~7%	High share in summer (>22%) and autumn (13%). The area functions as a foraging ground for juvenile individuals from nearby colonies.
5.	common scoter: *Melanitta nigra*	~4%	A significant share during migration and wintering periods.
6.	razorbill *Alca torda*	1%	A consistent, stable share within the grouping.

The high frequency of selected species within the Baltic West area results directly from the proximity of key ecological structures and protected areas in neighbouring states and within the Polish exclusive economic zone (EEZ):

- Denmark (breeding colonies): The relatively high abundance of the common guillemot (particularly juvenile birds under the care of adults) is determined by the proximity of the Danish breeding colony on the Ertholmene archipelago / Græsholm island (Natura 2000 site *DK007X079*), located approximately 80 km to the north.
- Germany and Poland (wintering and migration areas): For auks and the common scoter, the project area constitutes a direct extension of key transboundary wintering areas, which include:
- German Natura 2000 sites: *Pommersche Bucht DE1552401, Adlergrund DE1251301* and *Westliche Pommersche Bucht DE1649401*.
- Polish Natura 2000 sites: *Zatoka Pomorska PLB990003* and *Przybrzeżne wody Bałtyku PLB990002*.

Detailed compilations and the results of quantitative analyses are contained in Appendix 1 to the EIA Reports.

8.3.3.1.2 Species composition of birds sitting on the water within the reference area

During vessel-based observations within the reference area, a total of 21 bird species present on the water were recorded, including 13 species associated with the marine environment and 8 species of

waterbirds rarely encountered at sea far from the coast. In total, 3149 individuals were recorded there during the inventory surveys.

The vast majority (almost half) of the seabird grouping sitting on the water within the reference area was made up of the long-tailed duck. The species with the next highest share within the grouping were: the European herring gull, common guillemot, velvet scoter and razorbill. Given that many of the species recorded occurred only as single individuals, Table 18 sets out only those taxa and groups whose share within the surveyed grouping reached or exceeded the 1% threshold.

Table 18 Abundance and percentage share within the grouping of the individual taxa of birds sitting on the water recorded within the reference area during the period from June 2022 to May 2023

NO.	TAXON	NUMBER OF INDIVIDUALS OBSERVED [individuals]	SHARE WITHIN THE GROUPING [%]
Seabirds			
1.	long-tailed duck *Clangula hyemalis*	1522	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
Waterbirds rarely encountered at sea far from the coast			
7.	cormorant *Phalacrocorax carbo*	41	1.3
Birds not identified to species level			
8.	unidentified divers *Gavia sp.*	55	1.7
9.	unidentified ducks *Anatidae*	33	1.0

The remaining species, not listed in the table above, were sparse (their share amounted to fractions of a percent). Detailed results of the full seabird inventory carried out within the Baltic West area and the reference area, together with the analysis, are provided in Appendix 1 to the EIA Reports.

8.3.3.1.3 Distribution and densities of waterbirds within the surveyed water bodies

The Baltic West area is not a site of large concentrations of any seabird species, and the densities recorded are considerably lower than for other areas designated for offshore wind energy within the

Polish Baltic zone [Figure 22]. The main, key factor differentiating the distribution of avifauna within the analysed sea area is seabed depth.

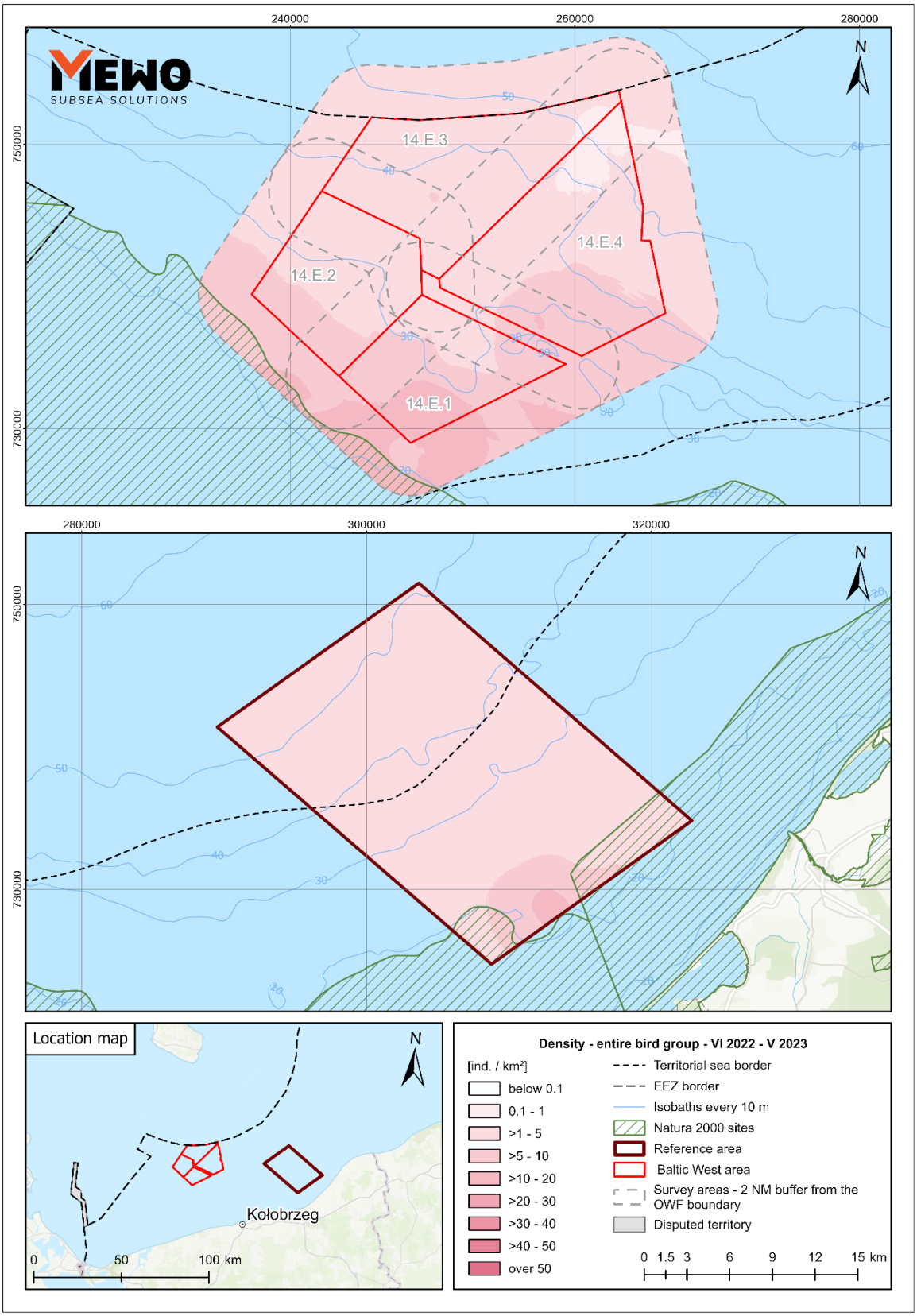


Figure 22 Spatial distribution of average densities of all birds within the Baltic West area and the reference area [source: own study]

A clear density gradient is present here:

- Shallower western and south-western part (OWF 14.E.1 and 14.E.2): In these areas, biodiversity and abundance indices are somewhat higher (H index = 0.56 and 0.72, respectively). In the shallowest sections of these water bodies, particularly during the wintering and spring migration periods, higher concentrations of sea ducks (long-tailed duck, velvet scoter, common scoter) were recorded, with local average densities exceeding 20 to over 100 individuals/km².
- Deeper northern and eastern part (OWF 14.E.3 and 14.E.4): In these water bodies, where depths reach from 25 m to as much as 55 m, species diversity is lowest (H index = 0.53 for E.3 and 0.49 for E.4). At such depths, obtaining food from the seabed becomes energetically unfavourable for diving sea ducks. As a result, the bird distribution here is uniform and highly dispersed, and even the densities of the dominant long-tailed duck did not exceed 100 individuals/km².

As integrated spatial modelling has shown, sensitive sea duck species aggregate en masse (at densities above 1000 individuals/km²) outside the Baltic West area – in shallower protected waters – while, within the considerably deeper project area, their densities remain low. A similar dispersal within the farm area applies to diving piscivorous birds, such as razorbills, common guillemots and divers.

The bird distribution is subject to the strong seasonal dynamics typical of the open sea:

- Winter and spring: Dominance of the long-tailed duck (reaching 69% of the grouping in winter and 49% in spring) [Figure 23, Figure 24].
- Autumn: A clear increase in the significance of the velvet scoter (36%) and a high share (up to 13% in autumn and >22% in summer) of the common guillemot [Figure 25]. The presence of this latter species results from the relatively close distance to the breeding colonies on the Danish Ertholmene archipelago.
- Summer: The area is abandoned by sea ducks. The European herring gull becomes the clear dominant (approximately 68% of the grouping), whose irregular concentrations on the open sea are closely correlated with following fishing vessels and searching for fishing discards [Figure 26].

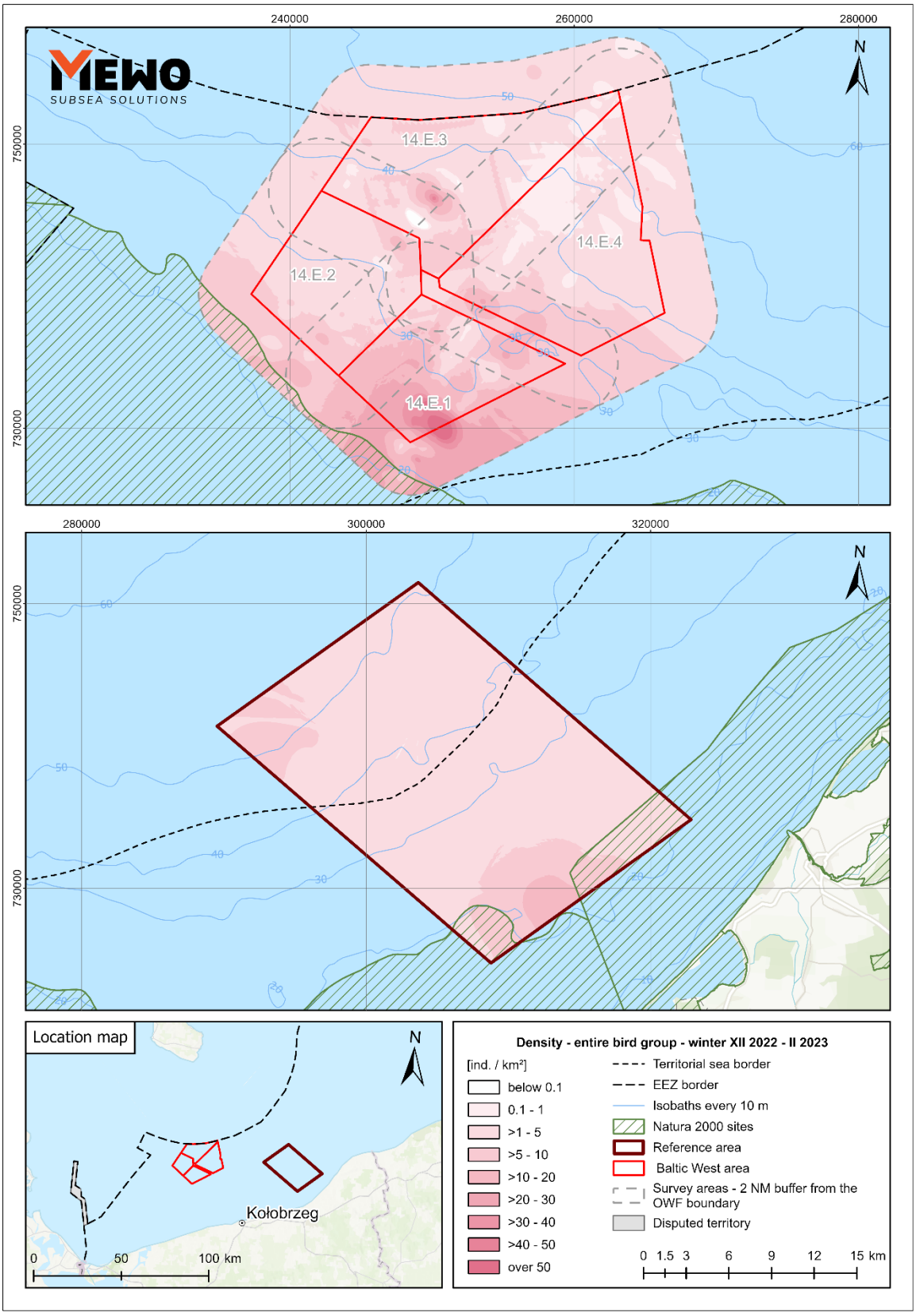


Figure 23 Spatial distribution of average densities of all birds within the Baltic West area and the reference area in the wintering period [source: own study]

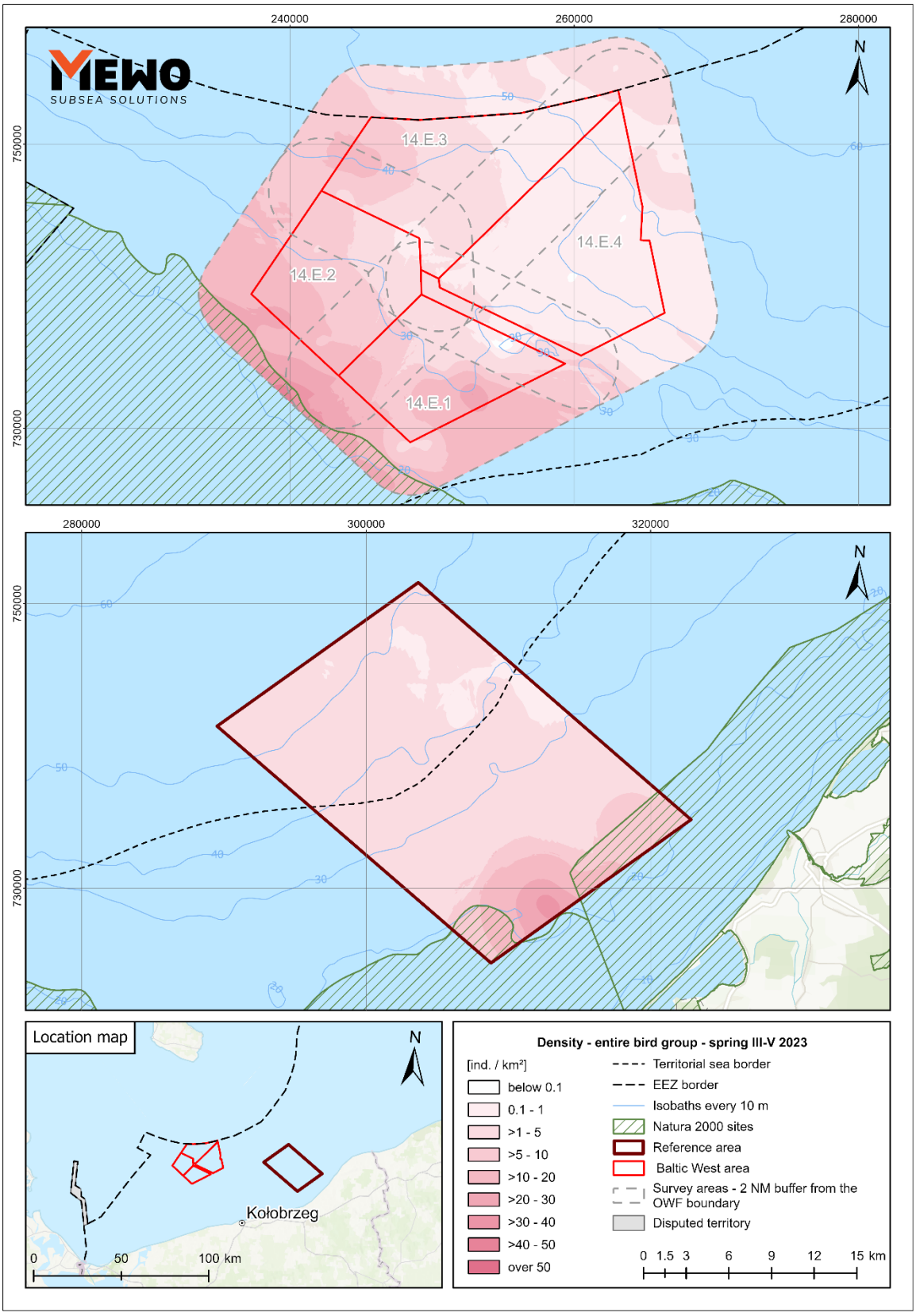


Figure 24 Spatial distribution of average densities of all birds within the Baltic West area and the reference area in the period of spring migration [source: own study]

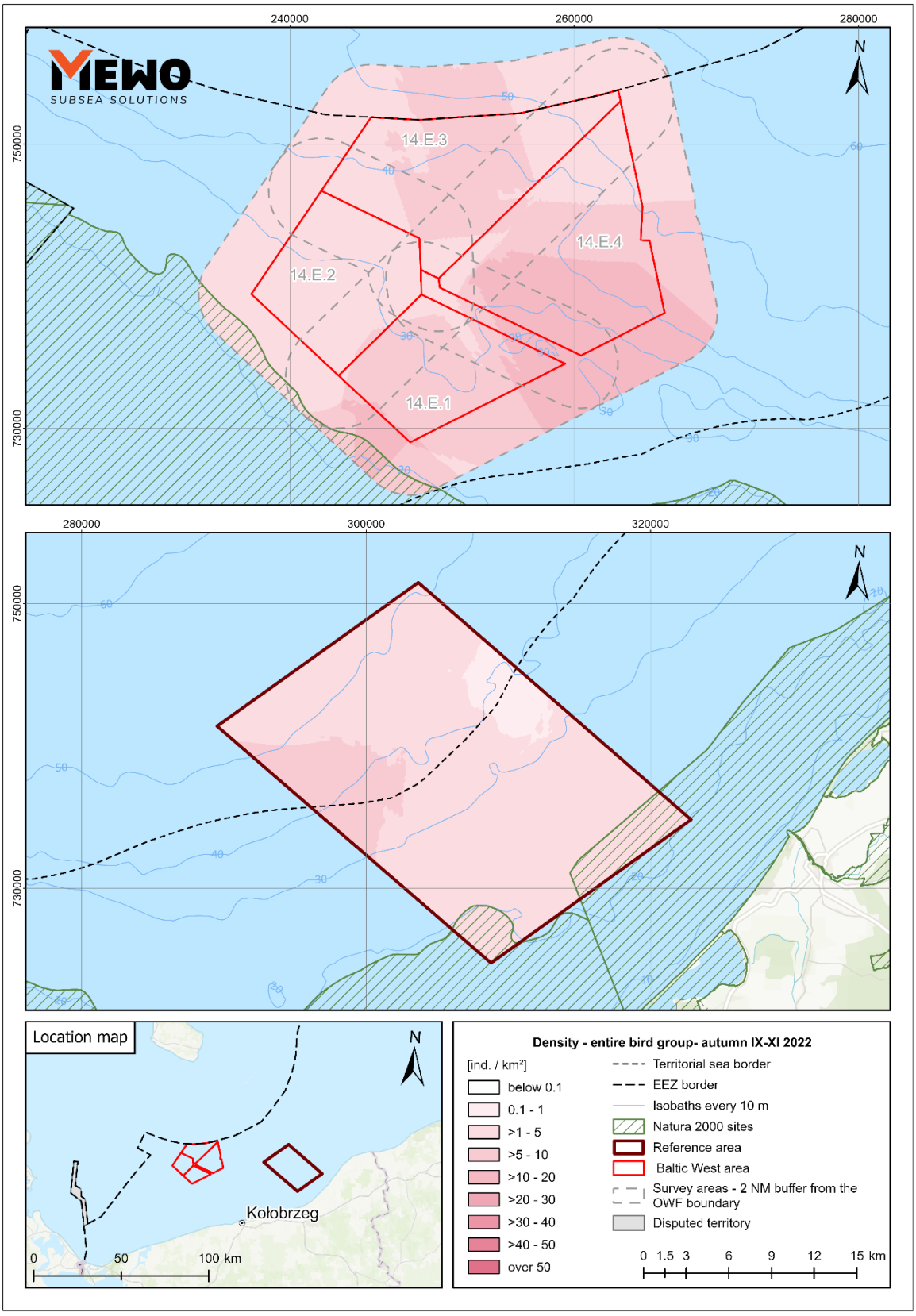


Figure 25 Spatial distribution of average densities of all birds within the Baltic West area and the reference area in the period of autumn migration [source: own study]

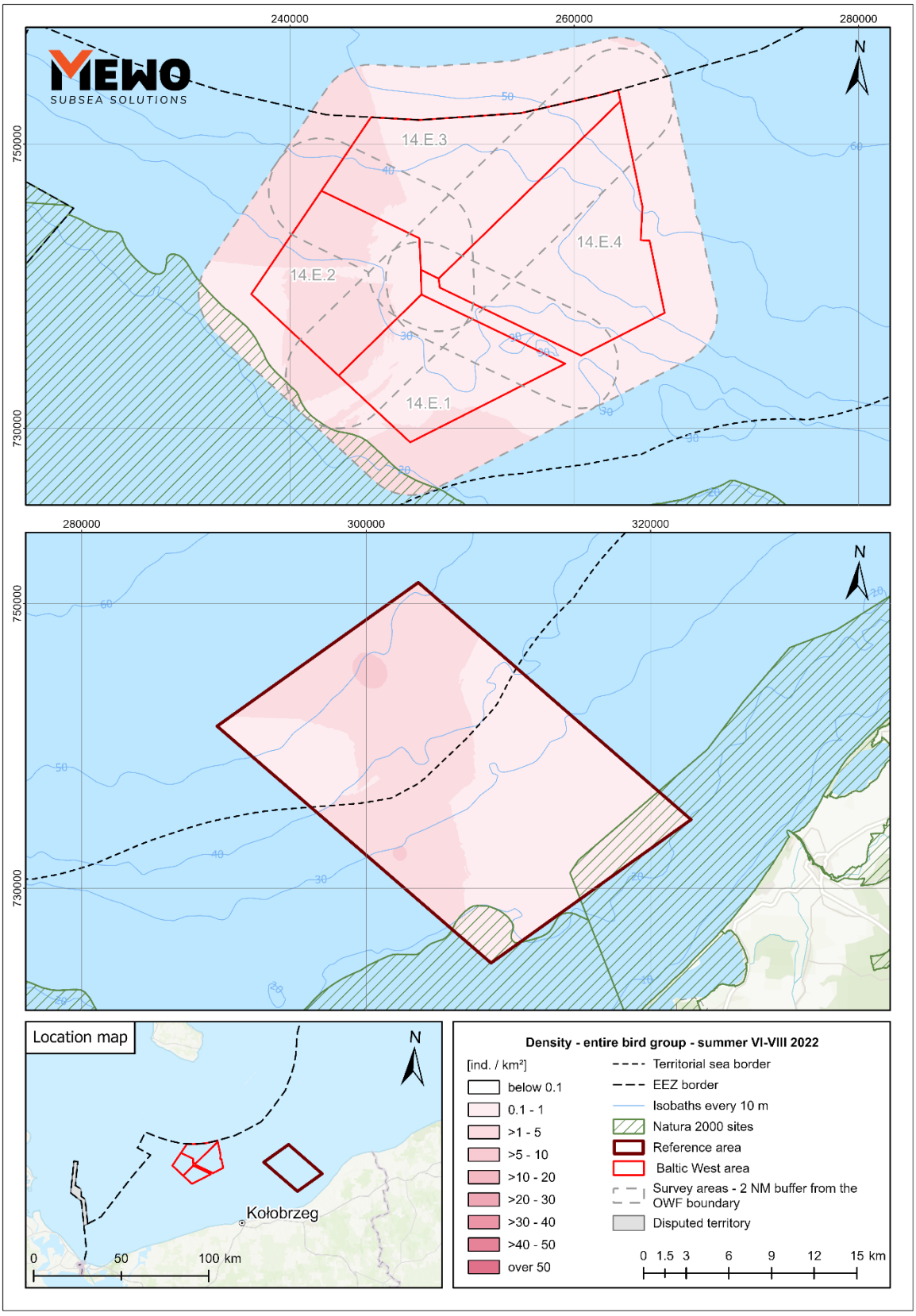


Figure 26 Spatial distribution of average densities of all birds within the Baltic West area and the reference area in the summer period [source: own study]

The Baltic West area does not constitute a critical foraging habitat, and the key, mass concentrations of seabirds, to which birds displaced from the project area could potentially move during the construction or operational phase, are located within neighbouring large-scale protected marine areas. These include, among others, the Polish *Zatoka Pomorska PLB990003),* the Danish *Rønne Banke site DK00FC373* – protecting long-tailed duck wintering grounds – and the German *SPA Pommersche Bucht DE1552401* and *Adlergrund DE1251301* sites. Owing to the lower habitat significance of the Baltic West area itself, the loss of this area will cause birds to move towards these more attractive and shallower foraging grounds.

8.3.3.2 Seabird species included in the impact assessment

Birds present on the water along the survey transects were included in the environmental impact assessment. The species qualification was based on two criteria:

- Quantitative criterion: The most numerous species, whose share within the assemblage structure amounted to at least 1% (rounded from 0.5%) at at least one of the 4 water bodies (14.E.1–14.E.4) during any phenological period. This condition was met by 11 species – the long-tailed duck, velvet scoter, common scoter, razorbill, common guillemot, black-throated diver, horned grebe, and the gulls: European herring gull, lesser black-backed gull, great black-backed gull and little gull.
- Qualitative criterion: Species constituting conservation objectives of the surrounding Natura 2000 sites *(Ławica Słupska PLB990001, Przybrzeżne wody Bałtyku PLB990002, Zatoka Pomorska PLB990003, SPA Pommersche Bucht DE1552401, Westliche Pommersche Bucht DE1649401, Rønne Banke DK00FC373)*.

Species protected under Natura 2000 that were recorded in extremely low numbers – below 20 individuals per year in total across all 4 water bodies – were excluded from the direct impact assessment for the Baltic West OWF area itself. These are: the horned grebe (17 individuals), little gull (11 individuals), black guillemot (4 individuals), red-necked grebe (3 individuals), red-breasted merganser (2 individuals), and great crested grebe (1 individual). These species were analysed solely in the context of their impact on the coherence of the Natura 2000 network.

The species selected for analysis were classified according to similar habitat requirements and similar sensitivity during the construction, operation and decommissioning phases of the farm. They were assigned to 4 ecological groups:

- Sea ducks: long-tailed duck, velvet scoter, common scoter
- Auks: razorbill, common guillemot

- Divers: black-throated diver, red-throated diver
- Gulls: European herring gull, great black-backed gull, common gull, lesser black-backed gull

8.3.3.3 Environmental impact assessment and transboundary environmental impact during the implementation phase

8.3.3.3.1 Vessel traffic

Construction works and the associated traffic of various vessels will disturb seabirds through their physical presence, noise (including potential pile driving) and light emission. While the presence and noise should not modify the flight routes of species solely migrating over this area, strong artificial night-time lighting at the construction site may already exert such an effect. Birds navigate at night with reference to the stars and the sun, and consequently show a tendency to head towards artificial light sources [Wiese et al., 2001]. The scale of this impact depends on the number, size and lighting configuration of the vessels, as well as on the duration of construction and the location of the works within the OWF. The timing of the works is also key – the abundance of most seabirds (particularly ducks) shows strong variation across the individual phenological periods.

The disturbance effect will intensify as development of the sea area progresses. Initially, owing to the local nature of the works, birds will be able to forage at neighbouring OWFs within the Baltic West area, as well as at other neighbouring water bodies (e.g. the Natura 2000 sites *Zatoka Pomorska* PLB990003 and *Przybrzeżne wody Bałtyku* PLB990002). However, in the final construction phase, the range of impact will increase considerably, significantly restricting birds' opportunities to forage and rest across the entire Baltic West area.

Overall, the vessel traffic during the project implementation phase will cause a direct, local and adverse impact on seabirds. Owing to the considerable variation in the response of individual ecological groups to this factor, the final assessment of impact significance is set out and justified in detail below:

- Divers – significance of impact: important (adverse) (Receptor sensitivity: very high | Intensity: high | Nature: short-term)

Divers show very high sensitivity to the presence of vessels and completely avoid water bodies with increased traffic [Garthe et al., 2004; Schwemmer et al., 2011]. Studies confirm the displacement of these birds from the vicinity of operating vessels at distances of up to 10–15 km [Heinänen et al., 2020; Garthe et al., 2023]. In addition to this, they show high route fidelity, indicating a limited capacity to adapt to new barriers at sea [Kleinschmidt et al., 2022].

- Sea ducks – significance of impact: important (adverse) (Receptor sensitivity: high | Intensity: medium | Nature: short-term)

Owing to their high skittishness, these birds will be displaced from the operating area of construction vessels. This may lead to a temporary loss of access to the food base (benthos) within the works area, which constitutes a important burden for this group.

- Auks – significance of impact: moderate (adverse) (Receptor sensitivity: high | Intensity: medium | Nature: short-term)

Although species within this group show high sensitivity to disturbance from the presence of vessels, they are characterised by somewhat greater behavioural plasticity outside the breeding season, which mitigates the effects of habitat displacement relative to divers or sea ducks.

- Gulls – significance of impact: low (Receptor sensitivity: moderate | Intensity: low | Nature: momentary)

This group shows a response opposite to those listed above. Gulls congregate on the open sea, among other things, around vessels, treating them as objects facilitating the search for food and as resting sites. Any adverse aspects of vessel traffic will be only momentary for them and will not adversely affect their overall population status.

8.3.3.3.2 Noise and vibration emission

The presence and movement of construction vessels will be the main cause of seabird disturbance within the Baltic West construction area. This pressure will be considerably greater than other factors associated with the construction phase, such as underwater noise emission.

Construction noise may affect seabirds directly or indirectly – through its effect on fish constituting the food base of diving piscivorous birds. It is worth noting, however, that monitoring during the construction of the Egmond aan Zee OWF in the Netherlands showed no noticeable response to piling among species insensitive to the presence of vessels, mainly gulls and terns [Leopold et al., 2007]. Lacroix et al. (2003), on the other hand, documented a response of long-tailed ducks (*Clangula hyemalis*) to underwater seismic noise, recording an increase in flight frequency and changes in diving behaviour, confirming the sensitivity of sea ducks to underwater noise during the construction phase.

Noise and vibration during the construction phase will constitute a direct, adverse impact on seabirds. Owing to the potential effect on the biogeographic population, the range of this impact for

sea ducks, auks and divers has been determined as regional, while for gulls it has been determined as local. A summary of the detailed assessments for the individual groups is as follows:

Divers: high sensitivity, high impact intensity, short-term nature. The significance of the impact was determined as important.

Sea ducks: high sensitivity, medium intensity, short-term nature. The significance of the impact was determined as important.

Auks: high sensitivity, high intensity, short-term nature. The significance of the impact was determined as moderate.

Gulls: moderate sensitivity, low intensity, momentary nature. The significance of the impact was determined as low.

8.3.3.3.3 Lighting of the project site

During migration, birds navigate with reference to natural light sources (the stars and the sun) and consequently show a tendency to head towards artificially lit offshore structures at night (Wiese et al., 2001). Studies at drilling platforms have shown that artificial lighting causes birds to congregate around these structures outside the migration period as well. This phenomenon relates mainly to nocturnally active tube-nosed seabirds (*Procellariiformes*) but has also been observed in the little auk (*Alle alle*) – a species closely related to the razorbills and guillemots occurring in the area of the proposed project. For most of the remaining typically marine birds (sea ducks, divers), the effect of artificial light on individuals present in the vicinity of its sources remains poorly understood.

Artificial lighting at the construction site will cause a direct and adverse impact on seabirds. Owing to the potential effect on the biogeographic population, the range of this impact for sea ducks, auks and divers has been determined as regional, while for gulls it has been determined as local. The detailed assessment for the individual groups is as follows:

Divers: high sensitivity, medium impact intensity, short-term nature. The significance of the impact was determined as important.

Sea ducks: high sensitivity, medium intensity, short-term nature. The significance of the impact was determined as important.

Auks: high sensitivity, medium intensity, short-term nature. The significance of the impact was determined as moderate.

Gulls: moderate sensitivity, low intensity, momentary nature. The significance of the impact was determined as low.

8.3.3.3.4 Formation of a barrier

The proposed Project within the Baltic West area will involve the creation of an artificial spatial barrier for birds with a total area of 447.82 km². The farm infrastructure will consist of a maximum of 273 wind turbines with a maximum structural height of up to 370 m above sea level.

During the implementation phase, the sea area will be progressively developed with structures protruding above the water. The effect of this process on avifauna is progressive in nature and depends directly on the pace of the OWF assembly works.

Deterrence and displacement effect: Initially, individual turbines will exert only a small impact, but this effect will gradually intensify [Stewart et al., 2005]. Literature data indicate that seabirds avoid the area occupied by wind turbines and show a decline in abundance within a radius of 2–4 km [Christensen et al., 2003; Petersen et al., 2006; Leopold et al., 2011; Krijgsveld et al., 2011]. For divers, the avoidance zone reaches as much as 15 km [Garthe et al., 2023].

Vessel traffic: The presence of a large number of installation and support vessels generates an additional barrier and disturbance effect, disrupting bird movement between breeding grounds (e.g. in Siberia) and wintering grounds. The scale of this impact is determined by the number and size of the vessels, the duration of the construction phase, and the phenological period during which the works are carried out.

While adult individuals show an ability to adapt and become partially accustomed to the presence of structures, individuals undertaking their first migration in life encounter a serious spatial barrier. The lesser experience of juvenile birds is a direct cause of their increased mortality in the first year of life [Clark et al., 2007; Redmond et al., 2012; McKim-Louder et al., 2013]. In addition to this, Kleinschmidt et al. (2022) showed high individual route fidelity in the red-throated diver, which suggests very limited behavioural plasticity of this species in the face of new anthropogenic barriers.

The formation of a barrier will cause a direct and adverse impact on birds. Owing to the potential effect on the biogeographic population of the species, for the selected ecological groups this impact is regional and long-term in nature.

Divers (significance of impact: important): These are characterised by very high sensitivity to external stimuli and the widest avoidance zone around wind farms (up to 15 km). The impact is regional and long-term in nature for them and is also characterised by high intensity.

Sea ducks (significance of impact: important): These show high sensitivity to the new infrastructure. The formation of a spatial barrier will affect them in a long-term and regional manner (with a

possible adverse effect on the biogeographic population), and the intensity of this impact was assessed as high.

Auks (significance of impact: moderate): Despite high species sensitivity, a regional range, and the long-term and intensive nature of the barrier, the overall impact on this group was classified at a moderate level.

Gulls (significance of impact: low): A group with moderate sensitivity, showing the lowest susceptibility to the barrier effect. In this case, the impact has only a local range, a momentary nature, and low intensity.

8.3.3.3.5 Collisions with vessels

Collisions of birds with vessels used for the construction of the wind farms may occur, mainly during night-time hours, when birds are attracted by the light they emit. The scale of the impact will depend on the number of vessels involved in the construction phase, their size, light configuration and intensity, the duration of the construction phase, and the phenological period during which the works are carried out.

The sensitivity to the impact was determined as high for divers, sea ducks and auks, and moderate for gulls.

Collisions with vessels during the construction phase constitute a local, direct and adverse impact on seabirds. For sea ducks, auks and divers, this impact is short-term, while for gulls it is momentary. The intensity of the impact was determined as low for all the seabird ecological groups assessed.

In accordance with the methodology adopted, the significance of the impact was determined as important for sea ducks and divers, moderate for auks, and low for gulls.

8.3.3.3.6 Destruction of benthic habitats

The construction of foundations or support structures and the laying of internal power cables will cause disturbance of benthic communities at the Project implementation site.

Some of the habitats used by seabirds, including as stopover sites during migration, will be lost owing to the placement of foundations or support structures. This process will directly affect the seabed and will influence the water column. Natural benthic environments will be lost, but new ones will most likely develop in their place (the artificial reef effect). The scale of the impact will depend mainly on the number of wind turbine foundations or support structures and their type and size.

The bird species exposed to impacts associated with the loss of benthic habitats owing to space occupation are mainly benthivorous sea ducks. However, these species are highly sensitive to disturbance from the presence of vessels and other human activities at sea, and consequently it is estimated that the impact resulting from disturbance associated with the presence of construction vessels will be the main impact within this area, thereby causing sensitive species to move to other areas. Consequently, these birds will not additionally experience the impact associated with space occupation during the implementation phase.

The sensitivity to the impact was determined as high for sea ducks, divers and auks, and moderate for gulls.

Destruction of benthic habitats constitutes an indirect and adverse impact on seabirds with a local range. For sea ducks, this impact is medium-term, while for the remaining ecological groups it is momentary. The intensity of the impact was determined as medium for sea ducks and low for the remaining seabird groups.

In accordance with the methodology adopted, the significance of the impact was determined as important for sea ducks and divers, moderate for auks, and low for gulls.

8.3.3.3.7 Increase in suspended solid content in the water and deposition of resuspended sediment

During construction works within the Baltic West OWF area, bottom sediments will be disturbed and resuspended, and the suspended solid content will increase, locally and temporarily reducing water clarity. The reduction in visibility could potentially hinder foraging by diving birds that hunt visually (sea ducks, auks, divers). However, as the modelling results show, higher suspended solid concentrations have a strictly local range, not exceeding a distance of approximately 400 m from the site of the underwater works being carried out. Furthermore, the impact of suspended solids on the marine environment, in the least favourable scenario, does not last longer than 23 hours after the works have ended (and a maximum of 26 hours taking into account the cumulation of impacts). Consequently, this phenomenon will largely be superseded by other, more intensive construction-related disturbances (including vessel traffic), which will, independently and well in advance, cause sensitive bird species to leave this area.

With respect to the deposition of resuspended sediment around the foundations, the modelling showed that this phenomenon will not entail adverse consequences for the birds' food base. Even under the least favourable conditions (works involving seabed preparation for large gravity-based (GBS) foundations), the maximum thickness of the newly formed sediment at a distance of 150 m

from the works will not exceed approximately 8 mm, and at a distance of 500 m will locally reach values of only up to 2.3 mm. Such a negligible and short-lived sediment deposition will not adversely affect the gas exchange or the survival of benthic organisms, and will therefore not lead to a reduction in benthos biomass or in piscivorous fish.

Consequently, this impact will not deplete the food base of seabirds. The project will also cause no direct effect whatsoever on species foraging solely at the water surface (gulls).

Significance of impact on individual bird groups:

Divers: high sensitivity, medium impact intensity, short-term nature. The significance of the impact was determined as important.

Sea ducks: moderate sensitivity, medium intensity, short-term nature. The significance of the impact was determined as moderate.

Auks: high sensitivity, medium intensity, short-term nature. The significance of the impact was determined as moderate.

Gulls: low sensitivity, no impact, momentary nature. The significance of the impact was determined as negligible.

8.3.3.4 Environmental impact assessment and transboundary environmental impact during the operational phase

8.3.3.4.1 Vessel traffic

The presence of service vessels and stationary above-water structures will change the spatial distribution of birds. On the one hand, these structures will attract gulls and cormorants, which use them as resting sites. At the same time, any restriction of commercial fishing within the OWF sea area may result in a partial outflow of gulls to other foraging areas. On the other hand, the constant traffic of service vessels and helicopters will cause a direct, adverse disturbance and displacement effect on sensitive species. Satellite telemetry of the red-throated diver [Kleinschmidt et al., 2022] confirms high fidelity to its migration routes and wintering grounds, meaning that even low but regular vessel traffic during the operational phase could lead to the permanent displacement of divers from their traditional foraging grounds [Heinänen et al., 2020]. Although the nature of the impact is analogous to the construction phase, the lower intensity of service vessel traffic will translate into a low intensity of this stimulus for all bird groups.

Significance of impact on individual bird groups:

Divers: high sensitivity, low impact intensity, long-term nature (local range).
The significance of the impact was determined as important.

Sea ducks: high sensitivity, low intensity, long-term nature (local range).
The significance of the impact was determined as important.

Auks: high sensitivity, low intensity, long-term nature (local range). The significance of the impact was determined as moderate.

Gulls: moderate sensitivity, low intensity, momentary nature (local range). The significance of the impact was determined as low.

8.3.3.4.2 Disturbance and habitat displacement

The presence of the operating OWF will cause a direct and adverse disturbance and displacement effect on some seabirds from the farm area and the adjacent belt of waters. This results in loss of access to traditional foraging grounds, with the degree of avoidance of the structures depending on the species. The intensity of this phenomenon is determined by technical parameters: the number and density of turbines, rotor diameter, the clearance between the blades and the water surface (most flights take place up to an altitude of 20 m), and the distance from neighbouring projects, which may intensify the cumulative barrier effect. Strong behavioural avoidance of structures minimises the collision risk (particularly during the day), but permanently excludes the sea area as a food base.

Susceptibility to habitat loss varies ecologically:

Divers: constitute the group most sensitive to wind energy, underwater noise and vessel traffic [Garthe et al., 2004; Furness et al., 2013; Biasotto et al., 2026]. They show an avoidance response within a radius of as many as 15 km from the farm boundaries [Heinänen et al., 2020], which, combined with cumulative anthropogenic impacts, leads to drastic declines in abundance [Garthe et al., 2023; BirdLife International, 2021].

Sea ducks: prefer shallow water bodies, foraging mainly on macrozoobenthos. Telemetry studies of long-tailed ducks show high individual fidelity to specific wintering grounds [Karwinkel et al., 2020, 2025], meaning that the loss of optimal shallow foraging grounds [Kirk et al., 2008; Meissner 2010a, b] carries long-lasting population-level consequences.

Auks: the barrier effect and lengthening of flight routes may limit the breeding success near colonies; however, outside the breeding season, these birds show high mobility and adaptive capacity [Leopold et al., 2011; Garthe et al., 2023]. On top of this, the surveyed sea area is located

more than 80 km from the nearest known colony (the *Ertholmene archipelago*) and does not constitute their preferred foraging ground.

Gulls: show a synanthropic tendency and moderate sensitivity; they will settle on above-water structural elements for resting purposes, and their presence at sea depends mainly on local fishing activity [Garthe, 1997, 2003; Meissner, 2015a, b].

Significance of impact on individual bird groups:

Divers: high sensitivity, low impact intensity, long-term nature (regional range owing to the effect on the biogeographic population).
The significance of the impact was determined as important.

Sea ducks: high sensitivity, low intensity, long-term nature (regional range owing to the effect on the biogeographic population).
The significance of the impact was determined as important.

Auks: high sensitivity, low intensity, long-term nature (regional range owing to the effect on the biogeographic population). The significance of the impact was determined as moderate.

Gulls: moderate sensitivity, low intensity, momentary nature (local range). The significance of the impact was determined as low.

8.3.3.4.3 Formation of a barrier

The OWF structures within the Baltic West area will create a physical spatial barrier, affecting the direction and routes of seabird flights on a local scale (between foraging and resting sites) and on the scale of wider migration.
The choice of technical variant (the number and size of the turbines) does not significantly change the scale of the impact, since birds show clear avoidance of the farms (e.g. the long-tailed duck within a radius of up to 4 km [Christensen et al., 2003; Petersen et al., 2006; Leopold et al., 2007], and divers up to 15 km [Garthe et al., 2023]). An exception is constituted by gulls and cormorants, which settle on above-water elements for resting purposes.

The barrier effect relates mainly to migratory birds heading towards key wintering grounds, breeding grounds and stopover sites within the region (including Natura 2000 sites, such as *Zatoka Pomorska, Przybrzeżne wody Bałtyku* and *Ławica Słupska*). There is a risk of disruption to ecological connectivity between these areas. From a transboundary perspective, the cumulative effect of multiple farms along a single route carries significant population-level consequences [Masden et al., 2009, 2010]. The studies by Kleinschmidt et al. (2022) indicate low migratory connectivity for the red-throated

diver, meaning that individuals from different breeding grounds congregate at the same wintering grounds – as a result, the barrier affects many populations simultaneously. In accordance with EC guidelines C(2026) 2274, species listed in Annex I to the Birds Directive (including divers) require a particularly rigorous cumulative assessment in this context.

Significance of impact on individual bird groups:

Divers: high sensitivity, high impact intensity, long-term nature (regional range owing to the effect on the biogeographic population).
The significance of the impact was determined as important.

Sea ducks: high sensitivity, high intensity, long-term nature (regional range owing to the effect on the biogeographic population).
The significance of the impact was determined as important.

Auks high sensitivity, high intensity, long-term nature (regional range owing to the effect on the biogeographic population).
The significance of the impact was determined as moderate.

Gulls: moderate sensitivity, low intensity, momentary nature (local range). The significance of the impact was determined as low.

8.3.3.4.4 Collisions with wind turbines

The risk of collision with vessels during the operational phase will be lowest across the entire project life cycle, owing to the decline in vessel traffic intensity compared with the construction and decommissioning phases. At the same time, as the turbines are brought into use, the risk of bird collisions with the wind turbine structures will increase, reaching its maximum during the operational phase.

The vast majority of waterbirds show behavioural avoidance of the farms (avoidance of structures documented, among others, by: Christensen et al. (2003); Petersen et al. (2006); Leopold et al. (2007)), which reduces their density within a distance of up to 15 km [Petersen et al., 2005; Garthe et al., 2023] and drastically limits the availability of foraging grounds. This strong deterrent effect, together with the tendency to lower flight altitude and maintain equal distances from obstacles [Desholm et al., 2005; Hüppop et al., 2006], means that overall mortality resulting from collisions at sea remains low. Although the potential collision hazard may increase in areas of high trophic attractiveness or along regular flight routes under conditions of poor visibility (fog, precipitation), the latest studies [e.g. Liedtke et al., 2025] indicate that this relationship is considerably more

complex. The limited visibility does not automatically and unequivocally increase the collision risk by lowering the flight altitude directly into the rotor working zone. In many cases, including during autumn migration, birds are able to fly higher, seeking more favourable wind conditions above the clouds. For this reason, the effect of meteorological conditions on the ultimate collision risk requires careful assessment and does not permit simple generalisations. An important technical parameter is the clearance between the lowest position of the rotor blade and the water surface – the smaller this is, the greater the probability of collision with an operating turbine.

Susceptibility to collisions varies depending on species characteristics:

Divers: migrate predominantly at a safe altitude of up to 20 m above the water, i.e. below the rotor working zone [Noer et al., 2000; BirdLife International, 2021], and their strong avoidance response minimises exposure to the rotating blades [Cook et al., 2012; Furness et al., 2013]. This allowed their sensitivity assessment to be lowered from very high to high. Nevertheless, owing to poor manoeuvrability in flight, divers remain exposed to collisions during short, local movements between foraging grounds. The black-throated diver holds the highest position in the sensitivity index for offshore wind farms [Garthe et al., 2004].

Remaining groups (Sea ducks, Auks, Gulls): In accordance with the results of the collision modelling, the overall intensity of this stimulus was determined as low for all groups. The impact on ducks, auks and divers is direct, adverse, long-term and regional in nature (owing to the potential effect on the biogeographic population). For gulls, the impact has a local range and a momentary nature.

Significance of impact on individual bird groups:

Divers: moderate sensitivity, moderate impact intensity (locally low), long-term nature (regional range). The significance of the impact was determined as moderate.

Sea ducks: moderate sensitivity, moderate intensity (locally low), long-term nature (regional range). The significance of the impact was determined as moderate.

Auks: moderate sensitivity, moderate intensity (locally low), long-term nature (regional range). The significance of the impact was determined as low.

Gulls: low sensitivity, low intensity, momentary nature (local range). The significance of the impact was determined as negligible.

8.3.3.4.5 Formation of an artificial reef

The development of benthic communities on the underwater structural elements of the OWF, and the potential increase in fish abundance, may cause a positive, long-term and local effect on the

food base of seabirds. However, this increased trophic resource will be used to a minimal degree, or not at all, by the avifauna, since this phenomenon will be overshadowed by the stronger, adverse deterrent effect caused by the tall above-water structures. In addition to this, for specialised species, such as the long-tailed duck, which prefer natural sandbanks and shallows, the artificial reef effect will not compensate for the loss of key foraging grounds. Changes in the structure of the benthos and the trophic chain may also lead to shifts in fish availability, which, over a longer time horizon, could affect the condition and reproductive success of piscivorous populations. The impact is direct for sea ducks and indirect for divers, auks and gulls.

Significance of impact on individual bird groups:

Divers: moderate sensitivity, low impact intensity, long-term nature (local range, positive/indirect effect). The significance of the impact was determined as moderate.

Sea ducks: high sensitivity, low intensity, long-term nature (local range, positive/direct effect). The significance of the impact was determined as important.

Auks: moderate sensitivity, low intensity, long-term nature (local range, positive/indirect effect). The significance of the impact was determined as low.

Gulls: low sensitivity, low intensity, long-term nature (local range, positive/indirect effect). The significance of the impact was determined as negligible.

8.3.3.4.6 Formation of a closed sea area

Any complete or partial closure of the OWF sea area to commercial fishing will create favourable living conditions for fish, resulting from the absence of fishing pressure and the development of rich benthic communities. However, the food base created in this way will be used to a minimal degree by the avifauna, since the potential benefits will be overshadowed by the stronger, adverse deterrent effect generated by the above-water turbine structures. This impact is indirect, positive, long-term and local in nature, and its intensity for all bird groups was assessed as low.

Significance of impact on individual bird groups:

Divers: high sensitivity, low impact intensity, long-term nature (local range, positive/indirect effect). The significance of the impact was determined as important (positive).

Sea ducks: moderate sensitivity, low intensity, long-term nature (local range, positive/indirect effect). The significance of the impact was determined as moderate (positive).

Auks: high sensitivity, low intensity, long-term nature (local range, positive/indirect effect). The significance of the impact was determined as moderate.

Gulls: low sensitivity, low intensity, long-term nature (local range, positive/indirect effect). The significance of the impact was determined as negligible (positive).

8.3.3.5 Environmental impact assessment and transboundary environmental impact during the decommissioning phase

The impact of all the projects within the boundaries of the Baltic West area on marine avifauna during the decommissioning phase is assumed to be similar in nature to the construction phase of these projects. The medium-term impact of the project will result mainly from increased vessel traffic, noise emissions and lighting at the dismantling sites, which will cause a disturbance effect and temporary avoidance of this area by seabirds.

A specific impact of this phase, however, will be the progressive removal of the wind turbine structures, which will lead to the gradual disappearance of the physical barrier and a reduction in the deterrent effect. As the infrastructure is removed, birds will regain access to the sea area. It is to be expected that, once the dismantling works have fully ceased, this area will strongly attract sea ducks. This is because, during the several-decades-long operational period of the farms, rich macrozoobenthos communities will have developed on the seabed around the turbines (developing, among other things, thanks to the 'artificial reef' phenomenon), which, owing to birds' earlier avoidance of the farms, will not have been intensively exploited by them, and their biomass will be very high. Opening up access to such a rich food base will constitute a temporary positive effect, until foraging birds naturally lead to a reduction in the accumulated benthos biomass.

Taking into account the above factors – both adverse (disturbance from dismantling works) and beneficial (the subsequent availability of a rich food base) – the ultimate significance of the impact on seabirds during the decommissioning phase was assessed as important for sea ducks and divers, moderate for auks, and low for gulls.

8.3.3.6 Conclusions regarding transboundary environmental impact

Noise and vibration generated as a result of the foundation installation (piling) of offshore wind turbines within the Baltic West area will constitute only a momentary, periodic and fully reversible impact on seabirds. Consequently, no significant transboundary impacts on this ecological group are anticipated.

Direct exposure of diving birds to hazardous underwater noise levels will be excluded thanks to the following mechanisms and mitigation measures:

- Natural disturbance effect: The construction activities themselves, and the presence of vessels (human activity), will trigger an avoidance response in birds, causing them to leave the area of direct noise hazard in advance.

- Soft-start procedure: Beginning each piling operation with low-energy strikes will allow seabirds to move safely away from the construction site before the maximum noise level is reached.
- Dedicated ornithological supervision: During the key migration and wintering period (from the beginning of November to the end of April), the works area will be continuously monitored. If concentrations of sensitive species (sea ducks, auks or divers) are detected within a radius of 1.5 km from the piling site, the commencement of works will be suspended until the birds have left the sea area.

The modelling of suspended solid dispersion in the water, carried out for the purposes of the EIA Report, showed that the extent of bottom sediment dispersal and its deposition layer on benthic organisms will not be significant.

As with noise and vibration, the dispersion of suspended solids in the water will constitute a momentary and fully reversible impact on seabirds, which will in any case be avoiding the sea area in which construction works are being carried out. The elevated concentration of bottom sediments in the water will persist for 12 to 26 hours, regardless of the situation. Consequently, no significant transboundary impacts on the above-mentioned ecological group are anticipated.

Disturbance and habitat displacement will constitute an insignificant transboundary impact on seabirds, which will cumulate with nearby Danish and German OWFs. These areas are: the Baltic Eagle, Windanker, Wikinger and Arkona OWFs, the Arcadia Ost 1 OWF, and the Bornholm Energy Island (the Bornholm I and Bornholm II OWFs). Once the planned Baltic West OWF and the other aforementioned wind facilities have been built, a space with an estimated area of 1347 km² will have been developed.

Operation of the OWF will cause the disturbance and displacement of some seabirds present within the sea area occupied by the turbines and the adjacent belt of waters. The degree and area of bird displacement from this sea area and its surroundings will depend on the species.

The group of birds most sensitive to the impacts of offshore wind farms is divers. Implementation of the Baltic West OWF will most likely result in a reduction in their density, or their complete displacement, within a belt of up to 15 km from structures located within the OWF area [Garthe et al. 2023, BirdLife International, 2021]. For the remaining bird groups, this distance will be smaller – up to approximately 4 km [Christensen et al. 2003; Petersen et al., 2006; Leopold et al., 2007]. This also applies to areas located to the north of the proposed OWF area – within the Danish exclusive economic zone (EEZ). Nevertheless, these areas encompass water bodies with low seabird densities.

This results from the great depth, and thus low foraging attractiveness for seabirds. The low densities are also due to the presence nearby of considerably more valuable and accessible foraging grounds – the Natura 2000 sites *Zatoka Pomorska, Przybrzeżne wody Bałtyku, SPA Pommersche Bucht, Westliche Pommersche Bucht and Rønne Banke*. Displacement from habitats of lesser significance will be associated with birds moving to the more accessible, richer foraging grounds located within the aforementioned Natura 2000 sites.

The effect of the OWF decommissioning process on marine avifauna will be mainly local, transient and fully reversible in nature. Since the nuisances associated with vessel traffic and dismantling noise will be no greater than those identified for the implementation phase, and the physical barrier will be progressively removed (restoring the natural passability and accessibility of the marine space), no significant adverse transboundary impacts on seabirds are anticipated. Any impacts extending beyond the borders of Polish waters will be of negligible or low significance and will not adversely affect the survival of marine biogeographic populations, nor the functioning of foreign protected areas, such as the German and Danish Natura 2000 sites.

8.3.4 Bats

8.3.4.1 Current status

The presence of four identified bat species was confirmed across the entire surveyed sea area: the common noctule (*Nyctalus noctula*), the serotine bat (*Cnephaeus serotinus*), Nathusius' pipistrelle *(Pipistrellus nathusii)*, and the soprano pipistrelle *(Pipistrellus pygmaeus)* (recorded only in areas 14.E.1 and 14.E.2).

Additionally, grouped signals of bats difficult to identify unambiguously, from the genera *Nyctalus, Eptesicus, Eptesicus* and *Vespertilio*, were recorded.

Activity and seasonal dynamics:

- Spring migration period: Bat activity during this time was very low across the entire surveyed area. No signals were recorded on the listening transects. Only single passes were recorded at the stationary points, and the average activity index ranged from 0.8 to 1.1 passes per hour (AU/h). These results indicate that the Baltic West area does not constitute a significant site for chiropterofauna during the spring season.
- Autumn migration period: Activity was considerably higher in autumn, showing variation across the entire complex:
  - Activity was the highest in area 14.E.1 (148 of the 155 total activity units in this area were recorded here, of which 69% were the common noctule and its groups). On 1–4 September

2025, very high activity levels were recorded, reaching indices of up to 26.8 AU/h at transect 14E1_T4 and 20.6 AU/h at the buoy.

- In zones 14.E.3 and 14.E.4, 55 autumn activity units were recorded in each (62 in total for the whole year for each area), in which *Nathusius' pipistrelle* clearly dominated (approximately 68% of all signals). A peak at a high level was recorded there on 1/2 September and 22/23 October (indices of up to 8.7 AU/h at the point stations).
- Zone 14.E.2 showed the lowest autumn activity (33 units, with the annual index dominated 42% by the common noctule). Only one incident of high activity was recorded there (4/5 September, index 6.8 AU/h at the transect), and on the remaining nights it remained at a low to moderate level.

The monitoring results indicate that the proposed offshore wind farm area is used to a limited extent by bats during the spring migration period. Higher activity is recorded only during short periods of autumn migration (early September and the second half of October). Spring migration is usually more spread out over time, and consequently no clear activity peaks are observed. Autumn migrations, on the other hand, coincide with the dispersal of young individuals and autumn bat swarming, and clear activity peaks are observed. The total level of bat activity within the area during spring and autumn, at the transects and the listening point, was low and reached the maximum level of 8.7 passes/hour (i.e. a high level) only on individual nights (median for the whole season = 0.6, mean = 0.6).

The survey results for the 'Baltic Pipe' subsea gas pipeline, located closest to the Project area, indicate a similar species composition and level of bat activity. Three bat species were identified there – Nathusius' pipistrelle, the soprano pipistrelle, and the common noctule. Activity indices throughout the entire survey season remained at a low level, with the highest activity recorded in May (16.4 passes/hour).

All the bat species identified within the survey area are subject to legal protection in Poland. They are subject to strict protection, the provisions of the Bern Convention, the Bonn Convention, and the Agreement on the Conservation of Populations of European Bats (EUROBATS). These species are protected under national and EU law and are listed in Annex IV to the EU Habitats Directive.

The species identified within the surveyed marine area belong to common and non-threatened species. They hold LC (Least Concern) threat status and are classified as abundant or moderately abundant resources across Poland as a whole and in Western Pomerania. For this reason, their local resources identified within the boundaries of the proposed wind farms are considered insignificant.

No rare species, species of outstanding value, or species with the highest conservation status under Annex II to the Habitats Directive were identified within the surveyed sea area.

8.3.4.2 Environmental impact assessment and transboundary environmental impact

During the implementation phase, works carried out below the water surface (cable laying, seabed preparation, foundation installation) will have no effect whatsoever on bats. The potential impact is limited to activities at the sea surface, associated with an increased presence of vessels and helicopter flights. This impact is twofold in nature:

- Adverse (construction noise): Noise emission may potentially disturb animals and cause modification of their flight routes. Since construction works will be carried out progressively and mainly during the daytime, this impact will be direct, but local, short-term and momentary (limited to the vicinity of the vessels and ceasing once the works are completed).
- Beneficial (attraction and shelter effect): Vessels lit during night-time works or while stationary may attract insects, providing migrating bats with a foraging ground and an opportunity to replenish energy. Furthermore, numerous recesses on vessels create potential sites for daytime or brief night-time resting, as confirmed by literature data and observations on anchored vessels.

The monitoring results indicate that the OWF area is used to a limited extent by bats during spring migration, with higher activity recorded only during short periods of autumn migration (early September and the second half of October). Consequently, the intensity of the implementation phase impact on chiropterofauna is low, and the entire construction phase will have no significant effect on this group.

Significance of impact on individual factors:

Noise emission from vessels and helicopters: low sensitivity, low impact intensity, short-term/momentary nature (local range). The significance of the impact was determined as negligible.

Presence of lit vessels (foraging base and shelters): insignificant sensitivity, low impact intensity, short-term/momentary nature (local range, beneficial effect). The significance of the impact was determined as negligible.

During the operational phase, offshore wind turbines, like their onshore counterparts, constitute a potential hazard for migrating bats. This hazard results mainly from the possibility of direct collision, as well as from barotrauma. The sensitivity of the receptor to these factors is assessed as high, and the impact itself will be direct, adverse and permanent during the operational phase.

Operating offshore wind turbines will constitute a physical barrier along bat flight routes. Collision with an operating rotor is the main cause of mortality in these animals [Kunz et al., 2007; Kepel et al., 2011]. Individuals struck by the rotor blades die as a result of fractures, open wounds, multi-organ injuries, or wing amputation [Kepel et al., 2011; Horn et al., 2008]. The considerable height of the towers does not protect against collisions. According to the literature, the activity of the genera *Nyctalus* and *Eptesicus* at a height of 30 m does not differ significantly from ground level [Collins and Jones, 2009], and signals from passing pipistrelles have been recorded at altitudes of up to 150 m, serotine bats up to 90 m (where foraging was also confirmed), and Myotis bats up to 30 m (Sattler and Bontadina, 2005, in: Collins and Jones 2009).

Collision mortality is further intensified by the fact that bats, often flying over the water surface (where, for example, the common noctule has been confirmed to fly at a height of approximately 10 m), sharply increase their flight altitude – even up to 100 m – when approaching an obstacle such as a buoy, vessel or mast. They also frequently use wind turbines as resting sites, as confirmed by findings of individuals on the nacelles of offshore turbines [Ahlén et al. 2007, 2009].

Therefore, newly erected turbines may attract migrating bats, providing a convenient resting place during migration, particularly under unfavourable weather conditions. Additionally, foraging near offshore towers has been confirmed for species that do not migrate across the Baltic, which may generate a collision risk for individuals from populations occurring in Pomerania. Excessively strong and white light used for illumination will attract nocturnal insects, creating attractive foraging sites, which may result in cases of mortality of these mammals even in areas not used by them prior to the implementation of the project [e.g. Cryan and Brown, 2007; Horn et al., 2008; Hüppop et al., 2016].

A further hazard is constituted by the phenomenon of barotrauma – a pressure shock resulting in the rupture of pulmonary alveoli, with dead bats showing no external injuries. The rotating blades of offshore wind turbines cause large pressure differentials. As a result, a decompression phenomenon occurs, causing barotrauma in bats entering the area of reduced air pressure behind the rotor blade [Furmankiewicz et al., 2009; Baerwald et al., 2008].

This risk increases during the autumn migration period. Within the surveyed area of the Baltic West complex, peak bat activity (and thus increased collision risk with the turbines) occurred in the first days of September and, locally, in the second half of October. During these activity peaks, activity reached a maximum of up to 8.7 passes/hour, while the overall level of activity within the surveyed area across the whole spring and autumn season was low (median = 0.6; mean = 0.6 passes/hour). The results of the pre-implementation monitoring indicate negligible use of the area in spring, and fairly intensive but very time-limited use in autumn. This suggests that the impact of the project

during the operational phase will be low in spring but important during the autumn migration period, allowing the overall significance of this impact to be determined as moderate.

Mortality resulting from collision and barotrauma will relate mainly to breeding populations migrating from Scandinavia to wintering grounds on the southern shores of the Baltic. Studies from southern Sweden and Denmark confirm the presence of 11 species there, of which 5 (Nathusius' pipistrelle *Pipistrellus nathusii*, the soprano pipistrelle *Pipistrellus pygmaeus*, the common noctule *Nyctalus noctula*, the parti-coloured bat *Vespertilio murinus*, and Leisler's bat *Nyctalus leisleri*) are long-distance migrants [Ahlén et al., 2009]. Within the surveyed Baltic West area, Nathusius' pipistrelle (68% of recordings) and the common noctule dominated – species highly susceptible to collision [Kepel et al., 2011; Rydell et al., 2010] – together with the serotine bat. The species identified are common and non-threatened in the region; however, owing to their low reproductive rate (typically 1 young per year), the mortality of migrating individuals will affect populations over the long term. For this reason, this impact will have a regional (transboundary) range.

The distance of the project area from land (over 36 km) excludes regular flights by bats from stationary roosts for foraging purposes, since the maximum nightly foraging range of the common noctule is up to 23 km [Mackie and Racey, 2007], and of Nathusius' pipistrelle up to 6 km [Flaquer et al. 2009]. The presence of bats therefore results solely from dispersed broad-front migration [Ahlén, 1997]; studies carried out to date within Polish marine areas have shown no evidence of fixed, clearly defined migration corridors.

In addition to this, bats will be affected by the so-called barrier effect. The rotor movement and air turbulence may force animals to avoid the farm (as shown, among other things, for the serotine bat at the Midlum farm in Germany) [Bach and Rahmel, 2006], which will lengthen flight routes and increase the energy expenditure of migrants. This impact will be direct, adverse, permanent and regional, but of low intensity, and its significance is assessed as low (with moderate receptor sensitivity).

The movement of service vessels during the operational phase, in turn, will generate noise; however, owing to the low sensitivity of bats to this stimulus and the local, short-term and momentary nature of the works, the significance of this impact is considered negligible.

In summary, at the current stage, the monitoring results do not constitute grounds for objecting to the implementation of the project at the proposed site. A true picture of the farm's impact will be provided by post-implementation surveys during the first years of OWF operation, which, in the event of an increase in mortality being recorded, will enable appropriate minimisation measures to be determined.

8.3.4.2.1 Conclusions regarding transboundary environmental impact

The migration recorded relates to animals that have their breeding sites within the territory of the Scandinavian Peninsula and their wintering sites within the territory of Poland or Germany. Thus, the transboundary impact on animal species protected under European and Polish law will occur; however, owing to the low number of passes recorded, this will be low and will relate primarily to the species identified during the surveys, i.e. Nathusius' pipistrelle, the soprano pipistrelle, the common noctule, the serotine bat, and species from the pipistrelle and noctule groups, classified as seasonal migrants.

8.3.5 Marine mammals

8.3.5.1 Current status

Analysis of the data obtained showed the presence, within the boundaries of impact of the Baltic West area, of two marine mammal species – the harbour porpoise and the grey seal.

8.3.5.1.1 Harbour porpoise

During the period from 15 March 2025 to 18 March 2026, the presence of harbour porpoises was confirmed at all 24 measurement stations within the Baltic West survey area (stations FPOD_01–FPOD_24). The overall detection level recorded within the surveyed region was 28.2% DPD (2254 DPD out of 8 003.2 recording days), with DPD levels being similar within the OWF 14.E.1–14.E.4 area (28.9% DPD; 1778 DPD out of 6 152.1 recording days) and within the buffer zone (25.7% DPD; 476 DPD out of 1851.1 recording days) [Table 13]. For DPM, the overall value was twice as high in the buffer zone (0.4% DPM) as within the OWF 14.E.1–14.E.4 area (0.2% DPM). Within the area of the proposed wind farms, detection levels were highest at the OWF 14.E.1 location (42.1% DPD; 0.3% DPM), in the southern part of the Baltic West area, and at the western location of OWF 14.E.2 (37.9% DPD; 0.2% DPM).

Spatial variation was identified with regards to the presence of harbour porpoises within the monitored region, with higher detection levels in the western part of the Baltic West survey area than in the eastern part. The highest detection levels were recorded at station FPOD_23, located in the westernmost part of the buffer zone, where the recorded DPM levels (1.9%) were many times higher than at the other measurement points. The lowest detection levels were found at stations FPOD_17–FPOD_20 of the buffer zone, in the eastern part of the surveyed area, and also at stations FPOD_03–FPOD_04 at the OWF 14.E.3 location and FPOD_05 at the OWF 14.E.4 location, in the north-eastern part of the survey area.

A summary of harbour porpoise detections is presented in the figure below [Figure 28].

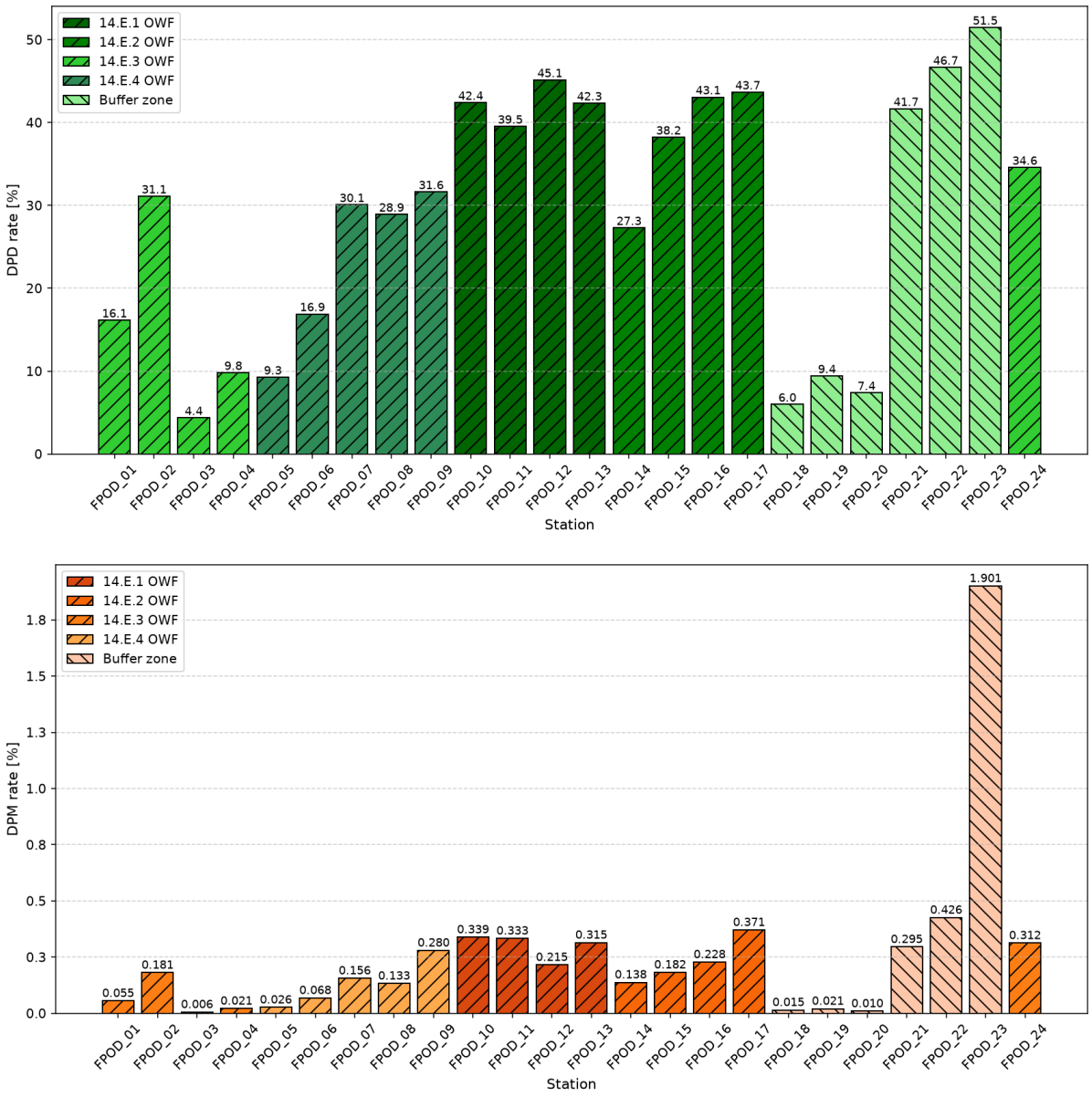


Figure 27 Detection levels recorded at the measurement stations during acoustic monitoring within the Baltic West survey area during the period from 15 March 2025 to 18 March 2026. Data are presented as the percentage of DPD recorded relative to all recording days collected at a given station (top panel) and the percentage of DPM recorded relative to all recording minutes collected at a given station (bottom panel) [source: own study]

An analysis of monthly variation within the Baltic West survey area showed clear seasonality in the harbour porpoise detection. The highest detection levels were recorded in July and August (71.1% DPD; 0.8% DPM, and 63.2% DPD; 0.7% DPM, respectively), while the lowest (taking into account full survey months) were recorded in December (1.7% DPD; 0.004% DPM). In February, a multiple increase in detection levels was recorded compared with the preceding winter months (December–January), with DPD values (52.3%) higher than in June. In March, detection levels fell considerably.

Analysing the results obtained by dividing them into the two survey zones, an analogous pattern of monthly fluctuations was found within the OWF 14.E.1–14.E.4 area and within the buffer zone. In the months with the highest frequency of the harbour porpoise detection (July–August), DPM levels

were considerably higher in the buffer zone than within the OWF 14.E.1–14.E.4 areas (1.5–1.6% DPM versus 0.5–0.6% DPM). The considerable increase in DPD levels in February related to both the wind farm area and the buffer zone.

An analysis of seasonal trends across the entire Baltic West survey area showed the highest detection levels during the summer season (59.6% DPD; 0.6% DPM). In autumn, recording levels were more than twice as low, decreasing further in winter, particularly with respect to DPM levels. The recorded harbour porpoise activity was the lowest during the spring season.

It should additionally be noted that, as part of the aerial observation campaigns carried out since January 2026 using an aircraft equipped with the DAVIS digital aerial recording system, dedicated primarily to seabirds, the presence of marine mammals was recorded on an opportunistic basis. During the winter flights (January–February), no observations of harbour porpoises or seals were recorded.

The aggregate analysis confirms that the project Baltic West project area and the adjacent waters are characterised by a considerably higher frequency of harbour porpoise occurrence than the central and northern part of the Polish Maritime Areas (PMA) [among others Balicka et al., 2024; Lisimienka et al., 2024]. The data confirm the species' seasonality (consistent with SEM and MSIOUG surveys) and an increasing abundance trend compared with the results of the SAMBAH project [SAMBAH, 2016; CIEP, 2023].

The relationships observed explain the spatial and population-level conditions:

- East–west variation: The higher detection levels in the western part of the survey area are fully consistent with the probability models of the SAMBAH project (HELCOM). The lowest recordings at the eastern stations (FPOD_18–FPOD_20) and the maximum at the western station (FPOD_23) reflect a natural spatial gradient [Figure 28, Figure 29].
- Origin of individuals: It is presumed that the gradient observed, and the high activity in the western part of the PMA, result from the migration range (influx) of individuals belonging to the Western Baltic population.

A clear link with protected areas and the food base has also been demonstrated:

- Proximity to Natura 2000: The highest detection within the project boundaries was recorded at the southern OWF 14.E.1 location and the western OWF 14.E.2 location. These areas border (approximately 2–3 km) the *Ostoja na Zatoce Pomorskiej Natura 2000 site* (stations FPOD_21–FPOD_22), where the harbour porpoise is a conservation objective.

- Foraging potential: The high activity in the areas of OWF 14.E.1, OWF 14.E.2 and station FPOD_23 is directly linked to favourable foraging conditions, as confirmed by:
    - the results of ichthyofauna monitoring, which showed an abundance of key components of the harbour porpoise diet: cod, herring and sprat [Andreasen et al., 2017];
    - the overlap of the peak in mammal detection with the maximum in fish biomass occurring in spring and summer (within the Natura 2000 site, the protected twaite shad, a member of the herring family, is also a significant supplementary component of the food base);
    - high, round-the-clock DPM indices during the summer period, indicating intensive echolocation activity associated with foraging.

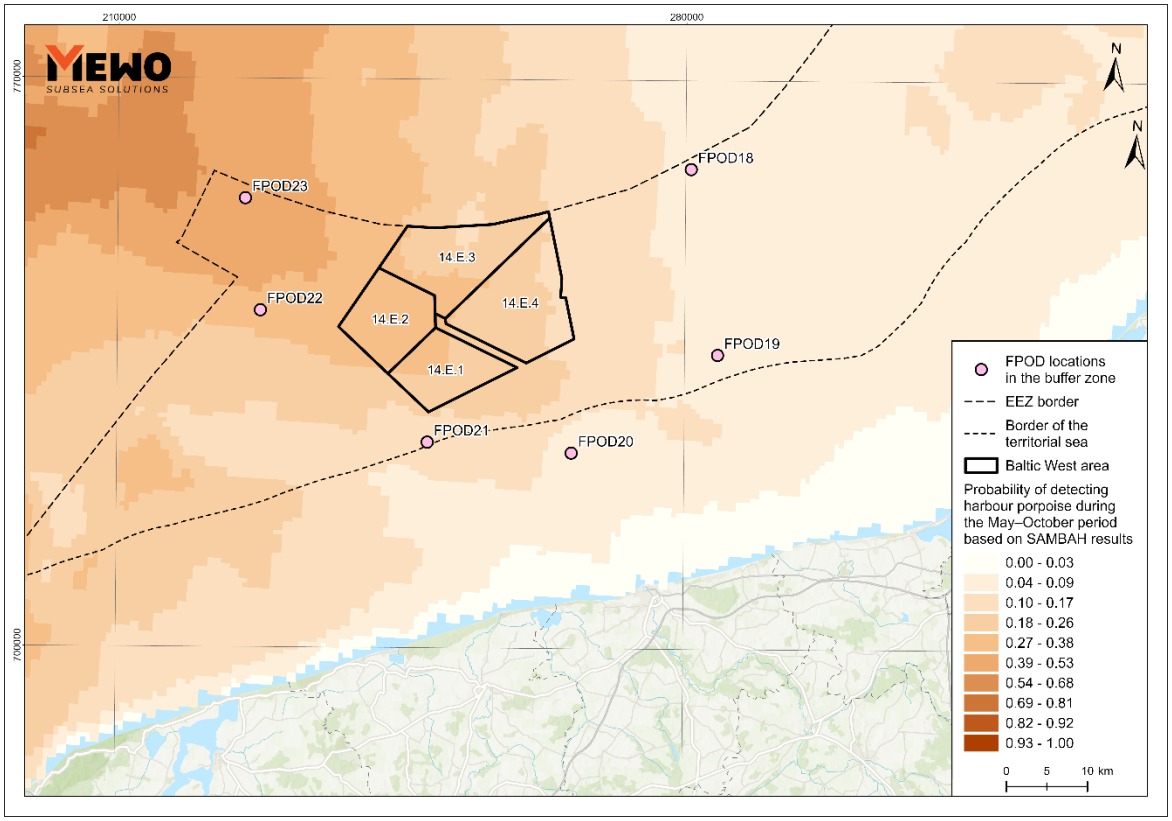


Figure 28 Probability of harbour porpoise detection in the western part of the PMA during the period May–October, based on data from the SAMBAH project (2011–2013). The data are presented against the background of the Baltic West survey area [source: own study]

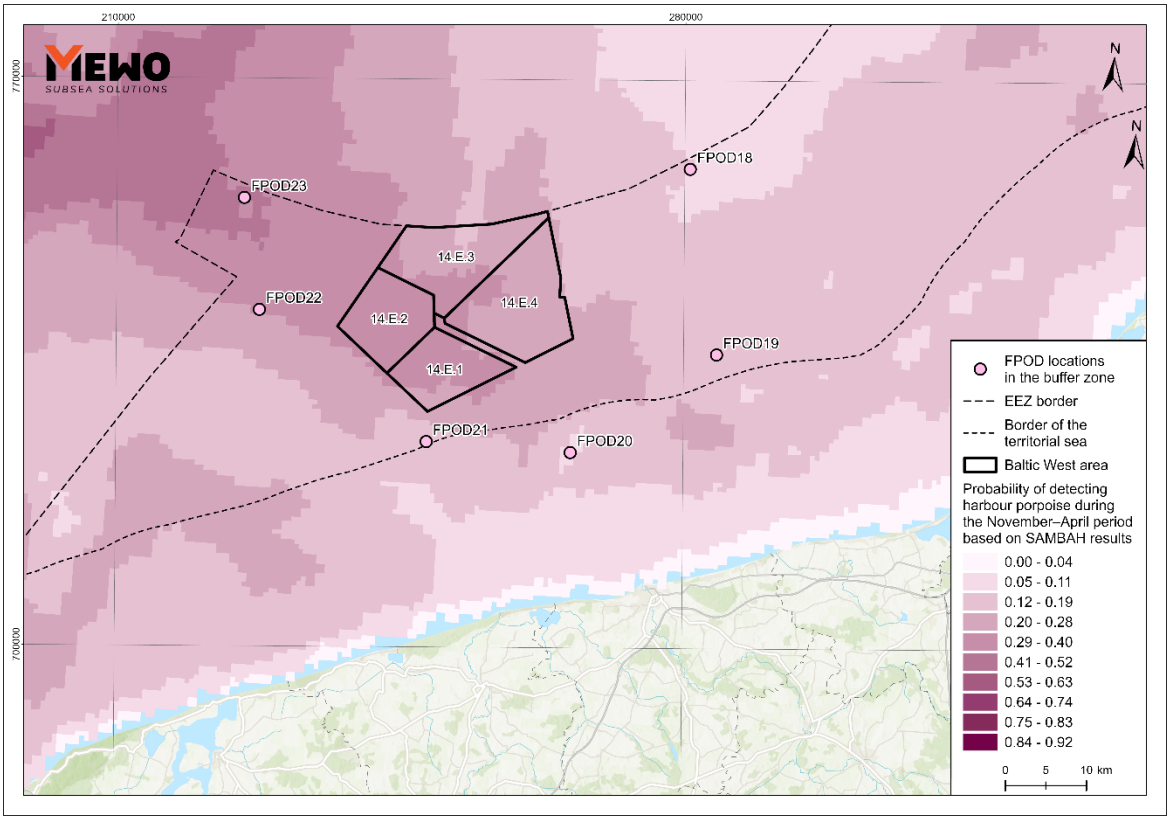


Figure 29 Probability of harbour porpoise detection in the western part of the PMA during the period November–April, based on data from the SAMBAH project (2011–2013). The data are presented against the background of the Baltic West survey area [source: own study]

8.3.5.1.2 Seals

During visual monitoring within the Baltic West survey area, from June 2022 to May 2023, 29 seal observations were made. 25 observations related to the grey seal, and four cases to seals not identified to species level. Seals were recorded at all OWF locations and within the buffer zone, in Polish and Danish waters. 27 observations were recorded within the OWF area, of which 23 related to the grey seal. Most observations were made within the OWF 14.E.3 area [Table 19].

Table 19 Summary of visual seal observations during seabird monitoring within the Baltic West area and the buffer zone during the period from June 2022 to May 2023 (source: own study)

AREA	NUMBER OF OBSERVATIONS	SPECIES, NUMBER OF OBSERVATIONS
OWF 14.E.1	4	Grey seal: 4
OWF 14.E.2	6	Grey seal: 5, unidentified seal: 1
OWF 14.E.3	15	Grey seal: 13, unidentified seal: 2
OWF 14.E.4	2	Grey seal: 1, unidentified seal: 1
PL buffer zone	1	Grey seal: 1
DK buffer zone	1	Grey seal: 1
TOTAL	29	29

Seals were observed in all seasons, in most survey months, with the exception of June, October and March. Most recordings were found during the winter season, in December and January, in most cases at the OWF 14.E.3 location (11 observations).

The results of visual monitoring within the Baltic West area confirmed that, in the western part of the PMA, the most frequently observed seal species is the grey seal, which is consistent with information from the WWF database for 2020–2025 (WWF, 2026). Seals occur within the surveyed region sporadically, in all seasons, similarly to the open waters of the central and northern part of the PMA [Balicka et al., 2024; Brocławik et al., 2022; Gajewski et al., 2021; Lisimienka and Klusek, 2019; Lisimienka et al., 2024; Plichta et al., 2014; 2015; Opioła et al., 2020; Opioła et al., 2024] (Section 3.10.1.6.2.2). During the survey period, the most frequent seal observations were recorded during the winter season, mostly at the OWF 14.E.3 location.

As with the harbour porpoise, large-scale aerial surveys have likewise not yielded any recordings of seals (grey or harbour) to date.

8.3.5.2 Environmental impact assessment and transboundary environmental impact during the construction phase

During the construction phase of the Baltic West area, the following impacts on marine mammals were identified:

- an increase in the level of underwater noise;
- a change in habitat and the food base.

8.3.5.2.1 Increase in the level of underwater noise

During the OWF construction phase, two main sources of underwater noise with a potentially adverse effect on marine mammals are identified: piling and increased vessel traffic. Noise exceeding the ambient acoustic background modifies the behaviour and physiological condition of animals. It is categorised according to four levels of impact [Thomsen et al., 2021; NMFS, 2024]:

1. Detection: Registration of the signal by the organism with no clear behavioural response.
2. Masking: Interference with biologically significant signals (communication, orientation), occurring when the noise frequency overlaps with the species' hearing spectrum.
3. Behavioural responses: Changes in behaviour (fleeing the area, interruption of foraging/resting, changes in swimming and diving dynamics). Prolonged exposure may reduce population condition and alter its range of occurrence.
4. Physiological damage:

- Temporary threshold shift (TTS – reversible),
- Auditory injury (AINJ – not always permanent),
- Permanent threshold shift (PTS – irreversible damage to the hearing apparatus),
- Extreme cases: tissue or organ damage leading to mortality.

The range of the impact zones depends on the parameters of the sound source, hydrological conditions, and the sensitivity of the given species group, determined on the basis of international threshold criteria [e.g. NMFS, 2024].

Species sensitivity within the project area:

- Harbour porpoise (*Phocoena phocoena*): Hearing is its key sense. It is characterised by a broad hearing range (from below 1 kHz to 180 kHz) with the highest sensitivity in the ultrasonic band (50–130 kHz) and echolocation centred around 130 kHz. It shows extremely high sensitivity to anthropogenic noise.
- Seals (grey seal *Halichoerus grypus* and harbour seal *Phoca vitulina*): They hear well both in water and in air. Their underwater vocalisations are concentrated at low frequencies (grey seal: 100 Hz–1.3 kHz; harbour seal: 250 Hz–1.4 kHz). They generally show lower sensitivity to noise than harbour porpoises, together with an ability to habituate to certain sound signals.

8.3.5.2.2 Piling

The propagation of piling noise depends on geomorphological and hydrological conditions, which means that the range of impact on fauna is closely linked to the location of the works. In order to determine the spatial range of the project's acoustic impact on marine mammals, numerical modelling was carried out based on international criteria and harm thresholds for impulsive noise [Table 20].

Table 20 Acoustic thresholds adopted for assessing the impact of impulsive noise on marine mammals (source: own study based on the literature indicated)

SPECIES/ ANIMAL GROUP	EFFECT	ACOUSTIC THRESHOLD SEL [DB RE 1µPA²S] / SPL [DB RE 1 µPA]]	ACOUSTIC THRESHOLD SPL_{PEAK} [DB RE 1 µPA]	SOURCE
Harbour porpoise	AINJ	159 (VHF-weighted SEL_{24h})	202	NMFS, 2024
	TTS	144 (VHF-weighted SEL_{24h})	196	
	Behavioural response	103 (VHF-weighted SPL_{125ms})	-	Tougaard, 2021
Seals	AINJ	183 (PW-weighted SEL_{24h})	223	NMFS, 2024

SPECIES/ ANIMAL GROUP	EFFECT	ACOUSTIC THRESHOLD SEL [DB RE 1µPA²S] / SPL [DB RE 1 µPA]]	ACOUSTIC THRESHOLD SPL_{PEAK} [DB RE 1 µPA]	SOURCE
	TTS	168 (PW-weighted SEL_{24h})	217	
	Behavioural response	137 (unweighted SEL)	-	Aarts et al., 2018; Tougaard, 2021

Noise propagation modelling was carried out for a monopile with a diameter of 13 m. In order to reliably reflect the variability of bathymetric conditions across the entire Baltic West area, calculations were carried out for four separate source locations with varying depths (from 22 m to 55 m, corresponding to the individual farms). Seasonal variability of the marine environment was taken into account, analysing the summer period (July–September) and the winter period (January–March), reflecting the least favourable acoustic conditions. The risk of hearing damage (TTS, AINJ) was assessed under a cumulative scenario (the total time taken to drive a single pile, the soft-start procedure, and animal flight), while behavioural changes were related to a single hammer strike. The results showed that, in the absence of protective measures, safe thresholds are exceeded at a distance of more than 1 km from the source. Consequently, in the final analysis, the application of a Noise Reduction System (NRS) was adopted as a mandatory construction standard. This system must have an attenuation effectiveness at least equivalent to an integrated mitigation system (i.e. a close-range system (CRS) combined with a double big bubble curtain (DBBC)), or be based on other advanced technologies and solutions that will be available on the market at the time of Project implementation and that will guarantee the required reduction in impulsive sound level. **Harbour porpoise**

On the basis of the modelling results obtained for harbour porpoises, it can be presumed that, during piling at a single OWF location, no hearing damage to the species analysed will occur, provided that sound propagation mitigation measures with an effectiveness comparable to CRS+DBBC mitigation are applied. The maximum ranges of impact estimated for TTS and AINJ are of negligible magnitude (0.1 km), in both the summer and winter scenarios. CRS+DBBC mitigation is not sufficient, however, to minimise the impact in the form of a behavioural response. In the summer scenario, changes in harbour porpoise behaviour may occur at a maximum distance of approximately 8 km, while in the winter scenario this is approximately 21 km. Taking into account the results of harbour porpoise monitoring and literature data, the period of greatest species activity within the Baltic West area and the adjacent waters is the summer season (understood, in the analyses of marine mammal occurrence, as the period June–August), particularly July and August. The animals appear within the surveyed region probably for foraging purposes and during migration.

It can be presumed that, as a result of the piling process within the OWF area, harbour porpoises will be deterred from potential foraging grounds. The modelling results indicate that the range of this phenomenon will not encompass a significant part of the western PMA or, during the summer season, the nearby Natura 2000 sites where the harbour porpoise is a conservation objective. The anticipated area of behavioural response may relate to the Baltic West area and the nearby adjacent waters. Taking into account that, during the period of greatest harbour porpoise activity within the surveyed region (i.e. summer), the projected range of possible behavioural changes is limited and does not encompass Natura 2000 sites, no population-level impact is anticipated.

It should be noted that, within the description of the impact of noise on marine mammals, it was not possible to calculate what proportion of the Baltic harbour porpoise population would be affected by the impact, as was done for selected EIA procedures for Polish wind farms planned in the central and northern part of the PMA. This is due to the lack of adequate data determining harbour porpoise abundance within the surveyed region. The OWF area is located within the western PMA, where the presence of two harbour porpoise subpopulations is possible – the Western Baltic subpopulation and the Baltic Proper subpopulation. This is a different situation from other parts of the PMA, where only the presence of the Baltic Proper subpopulation is assumed. Owing to the possibility of the mixing of the two harbour porpoise subpopulations, no estimated data on species abundance within the Baltic West area are available. Moreover, both the surveys carried out within the Baltic West project and the CIEP and MSIOUG monitoring programmes indicated higher harbour porpoise detection levels within the western PMA than determined under the SAMBAH project, which is the only source of information on the estimated abundance of harbour porpoises in the Baltic [Amundin et al., 2021; CIEP, 2022a,b; CIEP, 2023; Koza and Pawliczka, available online; SAMBAH, 2016].

Seal

With respect to seals, the analyses carried out also showed that, during single-location piling, the application of CRS+DBBC mitigation is sufficient to minimise impact in the form of TTS and AINJ (maximum range: 0.1 km). For the behavioural response, the estimated maximum ranges within which changes in seal behaviour could occur are approximately 42 km under the summer scenario and 139 km under the winter scenario. Taking into account the available information on the occurrence of seals within the western PMA and on the behaviour of these animals when exposed to piling noise, it is presumed that the behavioural response effect will not have a significant impact at the population level in any of the seasons analysed. Data from the seal monitoring within the OWF areas and the adjacent waters showed that these animals appear within the surveyed region sporadically, with the highest number of observations in December and January. The animals are

probably migrating and searching for food. Studies carried out on grey seals and harbour seals during the construction of offshore wind farms have shown that, as a result of exposure to noise, these animals may, among other things, cease foraging or leave the area around the noise source. The responses of the animals observed were temporary and limited to the duration of piling. Once the disturbance ceased, seals returned to the area of the OWFs analysed and resumed their previous behaviour [Russell et al., 2016; Aarts et al., 2018]. On the basis of the above information, it is presumed that, during the winter period, when the presence of seals in the waters around the OWF area is more frequent and the ranges of impact in the form of a behavioural response are greater, the effect on these animals will not be significant.

In summary, the modelling results obtained showed that, during piling at a single OWF location, the application of noise mitigation measures is necessary in order to avoid hearing damage to marine mammals. With double mitigation in the form of CRS+DBBC applied, a behavioural response is expected to occur in harbour porpoises and seals, within ranges extending beyond the OWF boundaries. For harbour porpoises, changes in behaviour may result in local avoidance of potential foraging grounds, which may be of the greatest significance during the summer season. No population-level impact is presumed. For seals, the behavioural response effect may relate to the largest number of animals during the winter period; however, no population-level impact is anticipated.

8.3.5.2.3 Vessel traffic

Construction of the OWF will involve an increased vessel traffic, which may raise the level of the ambient acoustic background naturally occurring within this area.

Underwater noise generated by vessels and boats originates, among other things, from propulsion systems. Its intensity and characteristics depend on many factors, including the type and size of the vessel, engine type, hull shape, and sea conditions. Low-frequency sounds are generated primarily by large, slower vessels, while high frequencies are generated mainly by small, fast boats. The classification of vessels according to the frequency and intensity of the noise generated, in accordance with OSPAR (2009), is presented in the table ([Table 21].

Table 21 Classification of vessels according to the frequency and intensity of the noise generated (source: OSPAR, 2009)

TYPE OF VESSEL	LENGTH [m]	FREQUENCY AND INTENSITY OF THE SOUND GENERATED
Small recreational vessels 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; <1kHz

Sounds generated by vessels have a broad frequency range, which may overlap with frequencies significant for marine organisms. Since the main energy of noise from vessels is generally below 1 kHz [e.g. Richardson, 1995; OSPAR 2009], the organisms most exposed to impacts are those for which low frequencies are most important (e.g. fish). It should be noted, however, that a significant proportion of the noise energy generated by vessels (particularly small vessels) lies within the high-frequency band (tens of kHz), falling within the frequency range used, among others, by harbour porpoises.

Studies of the impact of vessel noise on harbour porpoises have been carried out, among other places, in the Danish Straits – a region with high traffic intensity of various types of vessels. The analyses showed that, under conditions of a sudden increase in the level of high-frequency noise generated by fast-moving vessels, the animals responded with behavioural changes – including diving more frequently and ceasing to forage. In some cases, a reduction in echolocation frequency was also recorded, which could potentially have affected foraging efficiency [Wiśniewska et al., 2018]. The responses of Black Sea harbour porpoises (*Phocoena phocoena relicta*) were also studied in another region with high vessel traffic intensity – the Gulf of Izmit (Turkey). Under conditions of intensive vessel traffic, reduced surface foraging by the animals was recorded [Akkaya-Bas, 2017b]. Harbour porpoises were also observed to avoid the areas of the Gulf with the highest vessel traffic intensity. It was suggested that this type of impact could affect the animals' energy budget, and consequently the physiological condition of individuals [Akkaya-Bas et al., 2017a]. It should be noted, however, that, for the cases analysed, it is not clear whether harbour porpoises were responding to the presence of the vessels themselves or to the noise they generated.

During the construction phase of the offshore wind farms within the Baltic West region, the use of vessels generating acoustic waves mainly within the low-frequency range is assumed. Given that the ambient acoustic background of the Baltic Sea is already characterised by a consistently high level of low-frequency noise caused by commercial cargo shipping [HELCOM, 2018], the local fauna shows a certain degree of adaptation to this factor.

Harbour porpoise – On the basis of analogous analyses from infrastructure projects within this basin (e.g. Nord Stream 2), it is anticipated that the noise emission from construction vessels has parameters similar to standard cargo traffic [Tougaard and Griffiths, 2020]. As a result, harbour porpoises may show only short-term, spatially limited avoidance responses to the immediate vicinity of operating vessels.

Seal – Although low frequencies could potentially mask seal vocalisations [Erbe et al., 2019], within the open waters of the Baltic West area these species do not form permanent breeding or mating aggregations in which acoustic communication plays a key role. The construction vessel traffic will therefore not significantly disrupt their behavioural patterns.

In order to maintain the methodological consistency of the assessment for the Baltic West region, the status of other underwater-noise-generating activities has been defined:

- Seismic surveys: Geophysical measurements are carried out during the pre-implementation phase and, owing to their technological and formal distinctness, are subject to independent approval procedures. For this reason, they do not constitute a subject of assessment for the projects in question.
- Removal of unexploded ordnance (UXO): The use of underwater detonation of explosive materials is not planned under the standard implementation scenario. If hazardous objects are detected during the preparatory works stage, priority will be given to avoiding them. Any UXO neutralisations, as extraordinary measures (dictated by the safety of human life), would be carried out in accordance with separate mitigation procedures.
- Acoustic deterrent devices (ADD): The routine use of ADD-type systems is not planned during the construction works stage, and consequently the risk of continuous emission from this source has been excluded from the impact balance.

8.3.5.2.4 Change in habitat and the food base

The construction of the wind farm may result in a change to the habitat and food base for marine mammals. During the construction works, vessel traffic will increase, and the presence of these vessels may deter marine mammals, primarily harbour porpoises. Construction works may also affect fish stocks as a result of the destruction of benthic habitats during piling or as a result of the underwater noise propagation. As a result, a temporary decline in ichthyofauna abundance may occur, and, consequently, the loss of a potential food source and foraging habitat for marine mammals. Both the change in the food base availability and the presence of vessels may cause temporary avoidance of the wind farm area by marine mammals, in particular harbour porpoises.

8.3.5.3 Environmental impact assessment and transboundary environmental impact during the operational phase

The potential impacts associated with the operational phase of the Baltic West OWF include changes to the ambient acoustic background and changes to habitat and the food base.

8.3.5.3.1 Change in the ambient acoustic background

The main source of continuous underwater noise during the operational phase of the offshore wind farms within the Baltic West basin will be the operating turbines. Low-frequency sounds (with most of the energy below 1 kHz) are transmitted into the water column via vibration of the tower and the foundation structure [Madsen et al., 2006; Thomsen et al., 2006]. The acoustic emission level of a single turbine is low – estimated at 10–20 dB below the noise generated by commercial vessels at the same distance from the sound source [Tougaard et al., 2020]. Although earlier numerical models assumed a linear increase in noise with turbine rated power and geometry [Stöber and Thomsen, 2021], the latest empirical studies for modern installations and large-diameter piles do not confirm the existence of such a relationship [Bellmann et al., 2023; Holme et al., 2023].

Experience to date and long-term post-implementation analyses from European offshore wind farms (including Nysted, Rødsand II, Egmond aan Zee) show no significant adverse effect of operational noise on marine mammal populations:

- Harbour porpoises (*Phocoena phocoena*): Passive acoustic monitoring confirms the stable presence of, and return of, animals to the farm area after the construction phase has ended [Teilmann and Carstensen, 2012]. In some cases, an increase in local harbour porpoise detection has even been recorded, which is explained by the so-called artificial reef effect (an increase in the food base) and the shelter effect (the exclusion of the farm area from intensive commercial shipping and fishing). Furthermore, the low frequencies generated by the turbines lie outside the range of this species' highest hearing sensitivity.
- Seals (grey seal *Halichoerus grypus* and harbour seal *Phoca vitulina*): Telemetry studies have shown that seals regularly move around and forage within operating wind farms, showing no behavioural changes [Russell et al., 2016]. Although seals communicate within the low-frequency spectrum, the open waters of the Baltic West area do not constitute key, identified breeding areas for them. They also show a high capacity for adaptation and habituation to a constant sound background.

In light of current scientific knowledge and monitoring data from existing wind farms, long-term operational noise emission from the turbines carries no risk of causing physiological harm or lasting

behavioural disturbances. Consequently, the possibility of a significant adverse effect of the operational phase at the population level for marine mammals across the entire Baltic West region is excluded.

The operation of the wind farm will also be associated with the movement of service vessels, probably of large and medium size. Vessels of this type generate acoustic noise including frequencies used by marine mammals. It is anticipated, however, that both the number of servicing activities and the number of vessels moving at the same time will be low, and will consequently have only a low effect on marine mammals.

8.3.5.3.1. Change in habitat and the food base

It is presumed that, once the construction works – which cause environmental disturbance and potential loss of foraging sites for marine mammals – have ceased, a gradual recovery process will take place. Habitats of benthic organisms will probably re-form around the wind farm area, attracting fish and thereby restoring food availability for harbour porpoises and seals. In the case of the concrete foundations on which the turbines will be seated, a so-called reef effect may occur. Benthic organisms frequently settle in large numbers on additional underwater structures placed on the seabed. This increases local fish populations and biodiversity, often also attracting marine mammals. This type of environmental transformation has been confirmed in the areas around offshore wind turbines. The effect of attracting organisms to the wind farm area is further reinforced by the fact that these are areas excluded from fishing [Degraer et al., 2020].

8.3.5.3.2 Environmental impact assessment and transboundary environmental impact during the decommissioning phase

During the decommissioning phase of the Baltic West OWF complex, impacts on marine mammals will largely be similar to the implementation stage of the project; however, their scale and duration will be considerably smaller. The key pressures identified include an increase in the level of underwater noise, an increased vessel traffic, and local habitat transformation and temporary restriction of the food base caused by the deterrence of fish (ichthyofauna) from the works area.

The main source of noise during this phase will be processes associated with removing structures from the seabed, in particular the removal of sediment around the foundations, any drilling into the seabed, and pile cutting. These works will locally increase the intensity of the ambient acoustic background, generating mainly low- and medium-frequency sounds. Analyses carried out for similar works indicate that exceedance of the temporary threshold shift (TTS) for harbour porpoises may occur only in the immediate vicinity of the works – from approximately 120 m in the case of pile

cutting to 2.6 km in the case of sediment removal. On the basis of current knowledge, no physiological hearing damage to marine mammals is anticipated at significant distances.

The main consequence of the pressures described for harbour porpoises and seals will be a behavioural response consisting of the temporary avoidance of the vicinity of the works sites. These will, however, be short-term, fully reversible responses, limited solely to the duration of the decommissioning works. Once the disturbing factors have ceased, marine mammals will resume using this sea area. No significant adverse impact at the population level for marine mammals was identified for any of the impacts anticipated during the decommissioning phase.

The effect of the wind farm decommissioning process on the environment, in the context of marine mammals (harbour porpoises and seals), will be solely local, transient and reversible in nature. Thanks to their high mobility, these animals are able to temporarily avoid the area of the dismantling works where nuisances arise.

Given that the range of potential hearing damage is minimal, and the range of the behavioural responses triggered is considerably smaller in scale compared with the pile-driving stage during construction, the occurrence of significant transboundary impacts at the population level is excluded. The works carried out during the decommissioning phase will not lead to a lasting deterioration in the favourable conservation status of harbour porpoises or seals, nor will they threaten the integrity of foreign protected areas (including the Natura 2000 network) that constitute habitats for these species. For this reason, the significance of transboundary impacts during this phase is assessed as negligible or low.

8.3.5.3.3 Conclusions regarding transboundary environmental impact

For marine mammals, the transboundary impact may occur during the project implementation stage, i.e. during the construction process. Owing to the border location of the proposed wind farm, the anticipated ranges of the behavioural response of harbour porpoises and seals resulting from piling noise extend beyond the PMA. Changes in the behaviour of marine mammals may include temporary avoidance of areas of occurrence or cessation of foraging. However, for both harbour porpoises and seals, it is not anticipated that the behavioural response effect will result in a population-level impact. With respect to the hearing damage in the form of TTS and AINJ, the results of the numerical modelling indicate that these effects will not have a transboundary range if appropriate noise mitigation measures are applied. In each of the scenarios analysed, the application of CRS+DBBC is sufficient to minimise impact in the form of hearing damage, on the basis of which no occurrence of TTS or AINJ in harbour porpoises or seals is anticipated. During the

decommissioning stage, on the other hand, owing to the considerably smaller range of noise propagation and the strictly local nature of the dismantling works, no significant transboundary impacts on marine mammals are anticipated.

8.3.6 Protected areas, including Natura 2000 sites

8.3.6.1 Current status

The OWF area is located outside the boundaries of the protected areas indicated in the Act of 16 April 2004 on Nature Conservation, including outside the European Ecological Network Natura 2000.

The location of the OWF against the background of protected areas is presented on the map below [Figure 30].

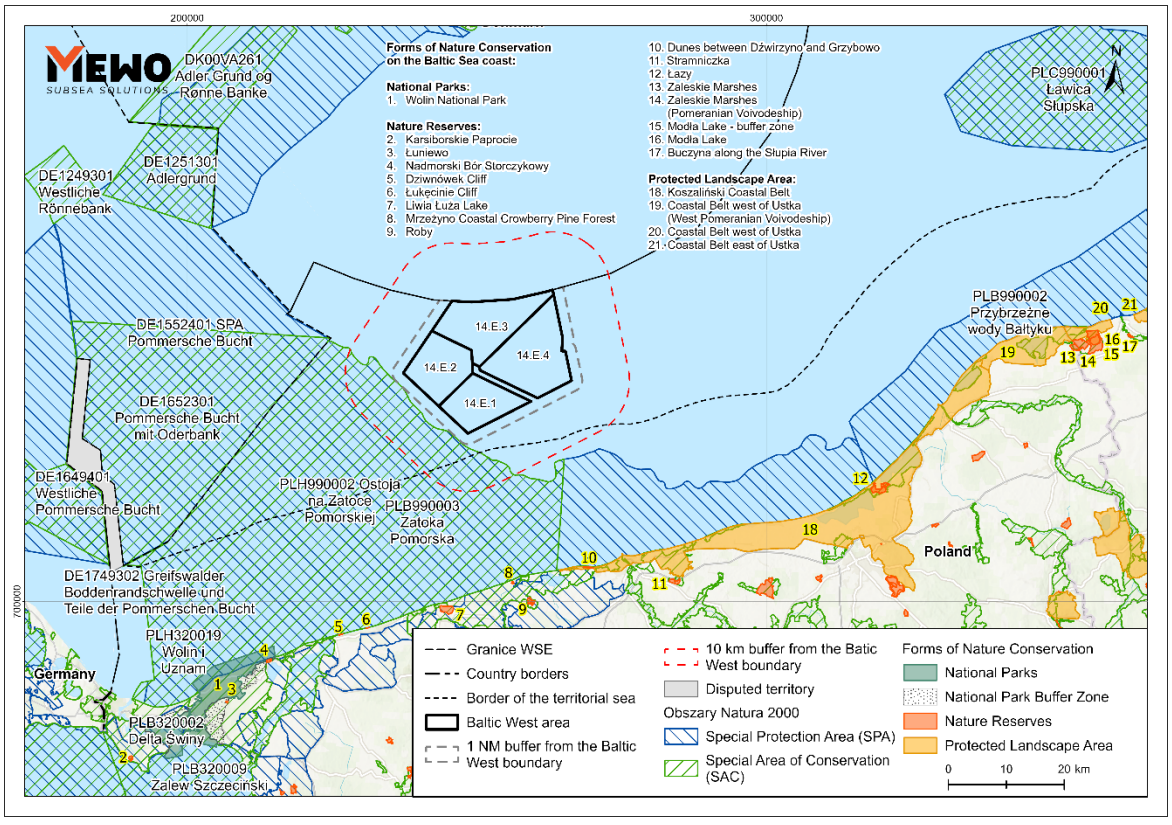


Figure 30 The Baltic West area against the background of protected areas, including the European Ecological Network Natura 2000 [Source: https://www.eea.europa.eu/en/analysis/maps-and-charts/european-protected-areas-1]

The distribution of Natura 2000 sites across the territory of the four states – Poland, Denmark, Germany and Sweden – indicates a high concentration of nature conservation forms within the Baltic Sea region; however, the absence of any such sites within, or in close proximity to, the boundaries of the proposed Project effectively reduces the risk of direct impact on the conservation objectives and subjects of protection of these sites.

Owing to the specific nature of the functioning of the Natura 2000 network, and the possible functional links occurring between these sites, a list of 19 Natura 2000 sites subject to detailed

assessment was selected (their detailed descriptions are provided in Appendix 5 to the EIA Report). The names of the Natura 2000 sites identified and analysed, and their distances from the planned Baltic West area, are set out in the table below [Table 22].

Table 22 Distances of Natura 2000 sites from each of the Projects [source: own study]

NO.	SITE CODE	SITE NAME	SITE TYPE	DISTANCE OF THE NATURA 2000 SITES FROM THE PROJECT [km]			
				14.E.1	14.E.2	14.E.3	14.E.4
1.	PLB990003	Zatoka Pomorska	OSO	1.9	1.9	10.6	11.4
2.	PLH990002	Ostoja na Zatoce Pomorskiej	SOO	1.9	1.9	10.6	11.4
3.	DE1552401	SPA Pommersche Bucht	OSO	22	13.9	17.6	26.2
4.	DE1652301	Pommersche Bucht mit Oderbank	SOO	22	13.9	17.6	26.2
5.	PLH320018	Ujście Odry i Zalew Szczeciński	SOO	41.7	41.7	52.6	52.1
6.	DK00FC373	Rønne Banke	OSO	47.1	47.1	37.9	47
7.	PLH320019	Wolin i Uznam	SOO	48.1	48.1	58.5	58.1
8.	PLB320002	Delta Świny	OSO	49.7	49.7	40.8	59.4
9.	DE1251301	Adlergrund	SOO	49.8	49.8	41.9	52
10.	PLB990002	Przybrzeżne wody Bałtyku	OSO	55	55	55.5	48.4
11.	DE1749302	Greifswalder Boddenrandschwelle und Teile der Pommerschen Bucht	SOO	59.9	59.9	63.2	68.4
12.	DE1649401	SPA Westliche Pommersche Bucht	OSO	59.9	59.9	61.3	68.4
13.	DK00VA261	Adler Grund and Rønne Banke	SOO	60.8	60.8	50	61
14.	PLB320009	Zalew Szczeciński	OSO	64.4	64.4	75.4	47.9
15.	DE1249301	Westliche Rönnebank	SOO	69.5	69.5	62.4	72.5
16.	DE1747402	Greifswalder Bodden und südlicher Strelasund	OSO	74.5	74.5	76.5	82.7
17.	PLC990001	Ławica Słupska	SOO	87.6	87.6	75.5	75.6
18.	PLH220023	Ostoja Słowińska	SOO	115.2	115.2	108.7	107.6
19.	SE0330308	Hoburgs bank och Midsjöbankarna	OSO/SOO	135.4	135.4	118.8	119.2

Natura 2000 sites whose conservation objectives are fish:

Ostoja na Zatoce Pomorskiej PLH990002 and *Wolin i Uznam PLH320019*, where the conservation objectives are the twaite shad and the sea lamprey; *Ujście Odry i Zalew Szczeciński PLH320018*, where the conservation objectives are the twaite shad, asp, ziege, river lamprey and sea lamprey;

and also *Ostoja Słowińska PLH220023*, designated for the protection of: the twaite shad, ziege, spined loach, weatherfish, European bitterling, and the sea, river and brook lampreys.
In addition to this, the analyses took into account nearby German sites: *Pommersche Bucht mit Oderbank DE1652301*, where the conservation objectives include, among others, the twaite shad, and *Greifswalder Boddenrandschwelle und Teile der Pommerschen Bucht DE1749302*, designated for the protection of the reintroduced Atlantic sturgeon.

The inventory surveys carried out across the entire Baltic West area did not confirm the presence of early developmental stages of any of the above-mentioned species protected under EU law; however, they did confirm the incidental (sparse) presence of adult individuals of the twaite shad and the river lamprey.

Natura 2000 sites whose conservation objectives are migratory birds:
The Baltic West area is located approximately 2 km from the Natura 2000 site *Zatoka Pomorska* (PLB990003). The bird species referred to in Article 4 of Directive 2009/147/EC and listed in Annex II to Directive 92/43/EEC, constituting the conservation objectives of the aforementioned site, are: the long-tailed duck, common scoter and velvet scoter, which are diving benthivores, and the black guillemot, razorbill, black-throated diver, red-throated diver, red-breasted merganser, great crested grebe, horned grebe and red-necked grebe, which are piscivores.

The Baltic West area is also located in the direct vicinity of German N2000 sites: the SPA *Pommersche Bucht DE1552401* and *Adlergrund DE1251301* special protection areas, where the most frequently occurring protected species include: the black-throated diver, red-throated diver, long-tailed duck, velvet scoter, black guillemot and little gull. In addition to this, the N2000 site *SPA Pommersche Bucht DE1552401* was designated for the protection of the following bird species: great crested grebe, red-necked grebe, horned grebe, cormorant, common eider, black-headed gull, common gull, lesser black-backed gull, great black-backed gull, European herring gull, common guillemot and razorbill. The nearby Danish N2000 site – *Rønne Banke DK00FC373* – was designated as an important concentration site for the long-tailed duck. Furthermore, the *Przybrzeżne Wody Bałtyku PLB990002* site is also located a short distance away, where the conservation objectives include: the razorbill, black guillemot, long-tailed duck, black-throated diver, red-throated diver, European herring gull, common gull, velvet scoter and common scoter. Given that this survey focuses on migratory birds, it also cannot be excluded that the species observed during migratory bird monitoring may have been using the Natura 2000 sites: *SPA Pommersche Bucht DE1552401, Adlergrund DE1251301, Rønne Banke DK00FC373, Przybrzeżne Wody Bałtyku PLB990002* and *Zatoka Pomorska PLB990003*.

Of the 20 species constituting conservation objectives within the above-mentioned Natura 2000 sites, all of them were observed during the surveys of autumn and spring migration across the entire Baltic West area (the presence of the red-necked grebe was recorded only once, during the autumn season). The most numerously represented were the common scoter (9297 individuals in total) and the long-tailed duck (6187 individuals), with the velvet scoter (1319 individuals) and cormorant (1162 individuals) present in considerably lower numbers.

Natura 2000 sites whose conservation objectives are marine mammals:

The nearest Polish sites are *Wolin i Uznam PLH320019* and *Ostoja na Zatoce Pomorskiej PLH990002*.

The marine mammal species referred to in Annex II to Directive 92/43/EEC, constituting the conservation objectives within the above-mentioned sites, are: the harbour porpoise and the grey seal. The Baltic West area is also located in the vicinity of German and Danish N2000 sites designated for the protection of marine mammals. Among these, a distinction should be made between sites where the sole conservation objective is the harbour porpoise (including: *Pommersche Bucht mit Oderbank DE1652301, SPA Pommersche Bucht DE1552401, Westliche Rönnebank DE1249301, and Adler Grund og Rønne Banke DK00VA261*), and sites where both the harbour porpoise and the grey seal are protected (including: *Adlergrund DE1251301* and *Greifswalder Boddenrandschwelle und Teile der Pommerschen Bucht DE1749302*).

During the inventory within the Baltic West area, the presence of the harbour porpoise and the grey seal was recorded; neither the harbour seal nor the ringed seal was identified.

8.3.6.2 Environmental impact assessment and transboundary environmental impact

An appropriate assessment for each of the OWFs comprising the Baltic West area was carried out with respect to impacts that could potentially cause significant adverse effects on the conservation objectives within the range of these impacts. In particular, an analysis was carried out of whether, and how, the Project could affect the conservation objectives of the individual Natura 2000 sites, their integrity, and the coherence of the entire network.

For the purposes of the appropriate assessment, owing to the nature of the Projects' impact on birds, the construction phase, the operational phase and the decommissioning phase were all analysed.

The appropriate assessment also took into account the impact of underwater noise generated during piling in the construction phase on the harbour porpoise, grey seal and twaite shad, in particular with respect to the permissible levels adopted and the occurrence of behavioural responses. As a consequence of these impacts, the possible effect on the integrity of the Natura

2000 sites in which these species constitute conservation objectives, and on the coherence of the Natura 2000 network, was also analysed.

The identification and detailed assessment of impacts on individual environmental elements during the successive phases of the Project are presented in Section 5.1 of the EIA Report and in Chapter 8 of this document, which analyses the effects of the planned activities within the Baltic West area, as well as cumulative and transboundary impacts.

Impacts that could extend beyond the Baltic West area, and the protected elements of Natura 2000 sites that these impacts could affect, have been identified, with an indication of the Project phase in which they will occur [Table 23].

Table 23 List of potential impacts and the elements of Natura 2000 sites that these impacts may affect [source: own study]

IMPACT	PROJECT PHASE	ELEMENT OF NATURA 2000 SITES
Increase in suspended solid concentration in the water and its sedimentation	Implementation phase; Decommissioning phase	Conservation objectives: fish species and habitats
Underwater noise	Implementation phase; Operational phase; Decommissioning phase	Conservation objectives: marine mammal and fish species
Spatial disturbance	Implementation phase; Operational phase; Decommissioning phase	Conservation objectives: bird and bat species

On the basis of the preliminary impact analysis, it was found that, of the stressors identified, only underwater noise generated during the implementation phase of the Projects (in particular during piling works) could potentially lead to impacts of a significant nature within the meaning of the provisions on the protection of Natura 2000 sites. This results both from the spatial range of sound propagation within the marine environment and from the possibility of behavioural responses occurring in species constituting conservation objectives, as well as potential indirect impacts associated with the functioning of the trophic chain.

With respect to the remaining stressors analysed, including the increase in suspended solid concentration and its sedimentation, it was shown that there are no impacts extending to Natura 2000 sites, or that any effect is insignificant in nature, which allows the possibility of significant adverse impact on the integrity of the sites and their conservation objectives to be excluded at the preliminary screening stage.

Consequently, a detailed assessment of the impact of underwater noise was carried out, covering an analysis of the effect on the conservation objectives and objectives of Natura 2000 sites, in particular

on the harbour porpoise, grey seal and twaite shad, taking into account the application of minimisation measures.

The appropriate assessment of impact on Natura 2000 sites also covered the aspect associated with the probable impact caused by disturbance of the airspace above the OWF development area, in the context of the integrity and coherence of the Natura 2000 network, as well as the effect on the conservation objectives and objects of Natura 2000 sites.

As already indicated in earlier chapters, impacts associated with underwater noise are short-term, reversible and spatially limited in nature, and do not lead to a lasting deterioration in habitat status, an increase in mortality, or disruption of the migratory and foraging functions of species. No risk of the formation of ecological barriers, or of a lasting restriction of the availability of habitats and food resources, was identified either. Implementation of the Projects also has no effect on the possibility of achieving or maintaining the conservation objectives of the Natura 2000 sites. At the same time, no disruption to the coherence of the Natura 2000 network is anticipated – the functional links between the sites will remain preserved.

The proposed Project will affect Natura 2000 sites in a limited, mainly indirect and local manner, associated with behavioural changes in seabirds (avoidance effect, modification of flight routes). These impacts do not, however, lead to the loss or deterioration of habitats constituting conservation objectives, and in particular do not infringe on the required areas of foraging and resting grounds set out in the interim conservation objectives.

Owing to the large scale of the habitats available, the high mobility of the species, and the absence of direct interference within the boundaries of Natura 2000 sites, no significant effect on the status of the protected species populations is anticipated. At the same time, there is no disruption of the functional links between the sites, nor any restriction of migration possibilities.

Consequently, it can be concluded that the Project will not cause significant adverse impacts on Natura 2000 sites.

The table [Table 24] summarises the significance of the individual types of impact analysed on the Natura 2000 sites that were selected under the preliminary screening as potentially exposed to adverse effects of implementation of the Project. The criteria for assigning appropriate values to parameters such as receptor sensitivity, the scale of impact, and the significance of impact are based on the methodological assumptions presented in detail in the EIA Report.

Below is a summary of the impact assessment for each of the Natura 2000 sites that the project could potentially affect:

For the *Zatoka Pomorska PLB990003* site – the significance of the impact owing to spatial disturbance was assessed as low, since, despite the occurrence of impacts of a local nature, mainly involving changes in the way space is used by birds, no significant adverse effect on the conservation objectives or the integrity of this Natura 2000 site is anticipated.

For the *Ostoja na Zatoce Pomorskiej PLH990002* site – the significance of the impact owing to the increase in suspended solids in the water column was assessed as low, since the range of sedimentation of the 1 mm sediment layer will not encompass the habitat constituting the conservation objective, while the increase in suspended solid concentration above 5 mg/l within the site will occur over a small area and will be short-lived, and will therefore not affect the deterioration of the conservation status of the twaite shad and sea lamprey populations.

The projected noise levels within a small, extreme fragment of this Natura 2000 site may reach levels causing TTS in swim-bladder-bearing fish. For marine mammals and swim-bladder-bearing fish, the noise levels may relate to a behavioural response within a small fragment of the site, and consequently the significance of the noise-related impact for the entire site was assessed as moderate.

For the *Ławica Słupska PLC990001* site – the significance of the impact owing to spatial disturbance was assessed as negligible, owing to the considerable distance of the site from the Project location, which significantly limits the scale of potential changes. No significant adverse impact on the conservation objectives or the integrity of the site is anticipated.

For the *Przybrzeżne wody Bałtyku PLB990002* site – the significance of the impact owing to spatial disturbance was assessed as negligible. The distance of this site from the Project (approximately 55 km) significantly limits the scale of potential changes. No significant adverse impact on the conservation objectives or the integrity of this site is anticipated.

For the *Delta Świny PLB320002 site* – the significance of the impact owing to spatial disturbance was assessed as negligible, owing to the considerable distance of the site from the Project location, the local nature of the impacts, and the absence of any effect on the habitats and populations of the species constituting conservation objectives; it is found that the proposed Project will not cause a significant impact.

For the *Zalew Szczeciński PLB320009* site – the significance of the impact owing to spatial disturbance was assessed as negligible, owing to the considerable distance of the site from the Project location, the local nature of the impacts, and the absence of any effect on the habitats and populations of the species constituting conservation objectives.

For the *Wolin i Uznam PLH320019* site – the significance of the impact owing to the increase in suspended solids in the water column and its sedimentation was determined as negligible, owing to the considerable distance of the site relative to the ranges of occurrence of the impact. The site is located beyond the projected range of piling noise impact at the level of a behavioural response in marine mammals and swim-bladder-bearing fish, and consequently the significance of the impact was assessed as negligible.

For the *Ujście Odry i Zalew Szczeciński PLH320018* site – the significance of the impact owing to the increase in suspended solids in the water column and its sedimentation was determined as negligible, owing to the considerable distance of the site relative to the ranges of occurrence of the impact. The site is located beyond the projected range of piling noise impact at the level of a behavioural response in swim-bladder-bearing fish, and consequently the significance of the impact was assessed as negligible.

For the *Ostoja Słowińska PLH220023* site – the significance of the impact owing to the increase in suspended solids in the water column and its sedimentation was determined as negligible, owing to the considerable distance of the site relative to the ranges of occurrence of the impact. The site is located beyond the projected range of piling noise impact at the level of a behavioural response in marine mammals and swim-bladder-bearing fish, and consequently the significance of the impact was assessed as negligible.

For the *Pommersche Bucht mit Oderbank DE1652301* site – the significance of the impact owing to the increase in suspended solids in the water column and its sedimentation was determined as negligible, owing to the considerable distance of the site relative to the ranges of occurrence of the impact. The site is located beyond the range of a behavioural response in marine mammals, but a very small part of it may fall within the range of a behavioural response in swim-bladder-bearing fish, and consequently the significance of the impact was assessed as low.

For the *SPA Pommersche Bucht DE1552401* site – the significance of the impact in terms of spatial disturbance was assessed as low, since, despite the occurrence of impacts of a local nature, mainly involving changes in the way space is used by birds and a local restriction of the availability of foraging grounds, owing to the large area of the sea area and the ability of birds to move freely, the potential impacts will not significantly affect the populations constituting the conservation objectives.

For the *Westliche Pommersche Bucht DE1649401 site* – the significance of the impact in terms of spatial disturbance was assessed as negligible, owing to the considerable distance of the site from the Project (approximately 61 km), the absence of direct impacts on habitats, and the local nature of

the impacts. No significant effect on the populations of the species constituting conservation objectives, nor on the functions of the site, is anticipated.

For the *Adlergrund DE1251301* site – the significance of the impact in terms of suspended solids was determined as negligible, owing to the considerable distance of the site relative to the ranges of occurrence the impact. The site is located beyond the range of a behavioural response in harbour porpoises and swim-bladder-bearing fish, but a very small part of it may fall within the range of a behavioural response in seals, and consequently the significance of the impact was assessed as low.

For the *Greifswalder Bodden und südlicher Strelasund DE1747402* site – the significance of the impact in terms of spatial disturbance was assessed as negligible, owing to the considerable distance of the site from the Project, the absence of direct impacts on habitats, and the local nature of the impacts. No significant effect on the populations of the species constituting conservation objectives, nor on the functions of the site, is anticipated.

For the *Westliche Rönnebank DE1249301* site – the significance of the impact in terms of suspended solids was determined as negligible, owing to the considerable distance of the site relative to the ranges of occurrence of the impact. The site is located beyond the projected range of piling noise impact in terms of a behavioural response in marine mammals and swim-bladder-bearing fish, and consequently the significance of the impact was assessed as negligible.

For the *Greifswalder Boddenrandschwelle und Teile der Pommerschen Bucht DE1749302* site – the significance of the impact in terms of suspended solids was determined as negligible, owing to the considerable distance of the site relative to the ranges of occurrence of the impact. The site is located beyond the projected range of piling noise impact in terms of a behavioural response in marine mammals and swim-bladder-bearing fish, but may fall within the range of a behavioural response in seals (constituting a conservation objective of this site). However, owing to the considerable distance from the Project (approximately 60–68 km) and the temporary and fully reversible nature of these responses, the significance of this impact was assessed as negligible.

For the *Adler Grund og Rønne Banke DK00VA261* site – the significance of the impact in terms of suspended solids was determined as negligible, owing to the considerable distance of the site relative to the ranges of occurrence of the impact. The site is located beyond the projected range of piling noise impact in terms of a behavioural response in marine mammals and swim-bladder-bearing fish, and consequently the significance of the impact was assessed as negligible.

For the *Rønne Banke DK00FC373* site – the significance of the impact in terms of spatial disturbance was assessed as negligible, owing to the considerable distance of the site from the Project, the

absence of direct impacts on habitats, and the local nature of the impacts. No significant effect on the population of the long-tailed duck, constituting a conservation objective, nor on the functions of the site, is anticipated.

For the *Hoburgs Bank och Midsjöbankarna SE0330308* site – the significance of the impact in terms of suspended solids was determined as negligible, owing to the considerable distance of the site relative to the ranges of occurrence of the impact.

The site is located beyond the range of a behavioural response in harbour porpoises, but may fall to a small extent within the range of a behavioural response in swim-bladder-bearing fish, constituting its food source, and consequently the significance of the impact was assessed as negligible. The significance of the impact in terms of spatial disturbance was assessed as negligible, owing to the considerable distance of the site from the Project, the absence of direct impacts on habitats, and the local nature of the impacts.

Table 24 Assessment of the potential significance of OWF impacts on Natura 2000 sites [source: own study]

NO.	NAME AND CODE OF THE NATURA 2000 SITE	TYPE OF IMPACT	SENSITIVITY OF RECEPTOR	SCALE OF IMPACT	SIGNIFICANCE OF IMPACT
1.	Zatoka Pomorska PLB990003	Spatial disturbance	Moderate	Low	Low (N)
2.	Ostoja na Zatoce Pomorskiej PLH990002	Increase in suspended solid concentration in the water and its sedimentation	Moderate	Low	Low (N)
		Underwater noise	High	Moderate	Moderate (N)
3.	Ławica Słupska PLC990001	Spatial disturbance	Low	Low	Negligible (N)
4.	Przybrzeżne wody Bałtyku PLB990002	Spatial disturbance	Low	Low	Negligible (N)
5.	Zalew Szczeciński PLB320009	Spatial disturbance	Low	Low	Negligible (N)
6.	Delta Świny PLB320002	Spatial disturbance	Low	Low	Negligible (N)
7.	Wolin i Uznam PLH320019	Increase in suspended solid concentration in the water and its sedimentation	Low	Low	Negligible (N)
		Underwater noise	Low	Low	Negligible (N)
8.		Increase in suspended solid concentration in	Low	Low	Negligible (N)

NO.	NAME AND CODE OF THE NATURA 2000 SITE	TYPE OF IMPACT	SENSITIVITY OF RECEPTOR	SCALE OF IMPACT	SIGNIFICANCE OF IMPACT
	Ujście Odry i Zalew Szczeciński PLH320018	the water and its sedimentation			
		Underwater noise	Low	Low	Negligible (N)
9.	Ostoja Słowińska PLH220023	Increase in suspended solid concentration in the water and its sedimentation	Low	Low	Negligible (N)
		Underwater noise	Low	Low	Negligible (N)
10.	SPA Pommersche Bucht DE1552401	Spatial disturbance	Moderate	Low	Low (N)
11.	Westliche Pommersche Bucht DE1649401	Spatial disturbance	Low	Low	Negligible (N)
12.	Pommersche Bucht mit Oderbank DE1652301	Increase in suspended solid concentration in the water and its sedimentation	Low	Low	Negligible (N)
		Underwater noise	Moderate	Low	Low (N)
13.	Adlergrund DE1251301	Increase in suspended solid concentration in the water and its sedimentation	Low	Low	Negligible
		Underwater noise	Moderate	Low	Low (N)
14.	Greifswalder Bodden und südlicher Strelasund DE1747402	Spatial disturbance	Low	Low	Negligible (N)
15.	Westliche Rönnebank DE1249301	Increase in suspended solid concentration in the water and its sedimentation	Low	Low	Negligible (N)
		Underwater noise	Low	Low	Negligible (N)
16.	Greifswalder Boddenrandschwelle und Teile der Pommerschen Bucht DE1749302	Increase in suspended solid concentration in the water and its sedimentation	Low	Low	Negligible (N)
		Underwater noise	Low	Low	Negligible (N)
17.		Increase in suspended solid concentration in	Low	Low	Negligible (N)

NO.	NAME AND CODE OF THE NATURA 2000 SITE	TYPE OF IMPACT	SENSITIVITY OF RECEPTOR	SCALE OF IMPACT	SIGNIFICANCE OF IMPACT
	Adler Grund og Rønne Banke DK00VA261	the water and its sedimentation			
		Underwater noise	Low	Low	Negligible (N)
18.	Rønne Banke DK00FC373	Spatial disturbance	Moderate	Low	Low (N)
19.	Hoburgs Bank och Midsjöbankarna SE0330308	Spatial disturbance	Low	Low	Negligible (N)
		Increase in suspended solid concentration in the water and its sedimentation	Low	Low	Negligible (N)
		Underwater noise	Low	Low	Negligible (N)

8.3.6.2.1 Conclusions regarding transboundary environmental impact

The proposed OWFs within the Baltic West area are located outside the boundaries of Natura 2000 sites, which effectively reduces the risk of direct impact on the conservation objectives and subjects of protection of these sites in neighbouring states (Germany, Denmark and Sweden).

The preliminary assessment showed that the only factor that could potentially lead to significant transboundary impacts on protected areas is underwater impulsive noise generated during piling in the construction phase. This may trigger behavioural responses in protected marine mammals (harbour porpoises and seals) and fish. However, these impacts are short-term, reversible and spatially limited in nature, and will therefore not lead to a lasting deterioration in habitat status, an increase in mortality, or disruption of the species' migratory functions.

The project will affect seabirds from Natura 2000 sites in a limited, mainly indirect and local manner, causing behavioural changes in them (an avoidance effect and forced modification of flight routes). These phenomena will not, however, lead to the loss or deterioration of the protected habitats themselves.

Thanks to the high mobility of the animals, the wide availability of alternative habitats, and the absence of physical interference within the sites, implementation of the wind farms will not threaten the coherence of the Natura 2000 network. The functional links (migration corridors) between the protected areas will remain preserved.

The Project will not cause significant adverse impacts on Natura 2000 sites. The impacts on the individual German, Danish and Swedish protected areas (including P*ommersche Bucht mit Oderbank, Adler Grund og Rønne Banke*, and *Hoburgs Bank och Midsjöbankarna*) were ultimately assessed as negligible or, at most, low.

8.3.7 Ecological corridors

An ecological corridor is an area enabling the migration of plants, animals or fungi. In more detailed terms, these are connected and overlapping areas that ensure the free migration of species, in order to preserve their spatial range and the dispersal of their populations. Ecological corridors may constitute a system of areas subject to low anthropogenic pressure and high naturalness, but also of strongly urbanised areas that nevertheless enable species to move. The fundamental criterion of an ecological corridor is, after all, the passability of migration routes.

A separate issue with respect to marine ecological corridors concerns bird migration routes. In this case, the marine area – or, more precisely, the airspace above its surface – constitutes part of the route that birds cover from their breeding grounds to their wintering sites in autumn, and vice versa in spring. As shown by bird passage surveys carried out for offshore wind farms in the Baltic, migrations generally takes place from the north-east to the south-west during the autumn migration period, and in the opposite direction during the spring migration period. Flight routes constitute the shortest possible sections between landmarks on land. According to the general classification of the waterbird migration system in Eurasia, Poland, including its maritime areas, lies within two major migration corridors: the East Atlantic and the Mediterranean/Black Sea corridors. The migration strategy, and the migration corridors of seabirds within the Baltic region, remain very poorly understood. During the summer period, in July and August, the passage of sea ducks (mainly male common scoters) is observed, from the Gulf of Finland towards the moulting areas located in the Danish Straits. They are accompanied by common eiders and velvet scoters, although the abundance of both these species is considerably lower than that of the common scoter. These birds only exceptionally stop over in the waters of the southern Baltic. The autumn migration period for seabirds is very spread out over time. As early as August, a number of waterbird species can be encountered within the PMA. Some of these merely pass through and do not remain for the winter (e.g. terns of the genera *Sterna* and *Chlidonias*), while others are observed throughout the entire migration and wintering period (sea ducks, auks, divers, grebes). In spring, large flocks of sea ducks (long-tailed ducks, velvet scoters, common scoters) are observed, which, while moving towards their breeding grounds, stop over in the Polish Baltic zone [Sikora et al., 2011].

For the remaining animals, no areas can be identified as meeting the criteria for ecological corridors.

Marine mammals found in the southern Baltic, both seals and harbour porpoises, move in search of food, without preferring specific routes.

Owing to the specific nature of this group and the absence of complete surveys within marine areas aimed at determining bat migration corridors across the Baltic, their precise course has not yet been established. Bats usually migrate singly or in small groups, mainly at night, probably moving on a broad front dependent on wind direction and speed. There is a lack of effective survey methods adapted to such small animals, which would provide a complete answer as to the course of these corridors across the Baltic Sea. Survey methods using transmitters automatically relaying the animal's current position could work for surveys of common noctule passage, this species typically reaching a body mass of around 25–30 g. However, Nathusius' pipistrelle weighs around 7–8 g, meaning that the radio telemetry method would need to be used, i.e. tracking by traditional methods, following the tagged animal.

8.4 Cumulative environmental impacts

The cumulative impact assessment for the entire Baltic West area was key, in particular owing to:

- The cascading schedule of works and the long duration of environmental pressures

The precise schedule for the individual projects is not currently defined; however, it is anticipated that all four OWFs will be brought into operation within 7 years of the commencement of the first works. This means that activities during the implementation phase may be carried out in a cascading model. From the point of view of the impact assessment, such a 7-year construction period necessitates an analysis of long-lasting pressure on the marine environment, transferred sequentially. The individual environmental components (including marine mammals, ichthyofauna and avifauna) will be exposed to impacts spread over many years, associated with increased traffic of construction vessels, underwater impulsive noise, and elevated suspended solid concentrations. Only an integrated assessment of the entire area allows the effects of such a long period of disturbance to be reliably captured on a regional scale.

- The envelope approach in the face of unknown logistical strategies

At the current planning stage, the details relating to the contracting of construction and installation vessels for the individual areas are not known. Owing to the globally limited availability of specialist vessels (e.g. WTIVs for turbine installation) and the high cost of chartering them, full and simultaneous construction across all four water bodies is unlikely. Nevertheless, the absence of a final logistical model necessitates the application of the so-called envelope (worst-case scenario) approach. A joint assessment, using unified mathematical models for the entire Baltic West area,

allows the environment to be objectively safeguarded against the most unfavourable contractual variants. This also guards against an artificial underestimation of the assessment of cumulative adverse environmental effects.

- Large-scale changes

Assessment of the area as a whole is also indispensable for the operational phase. Implementation of several neighbouring farms, each comprising several dozen turbines, will result in the transformation of an extensive sea area into a mosaic system of hard-substrate habitats. This large-scale 'artificial reef effect' will cease to be point-like in nature and will, on a regional scale, affect the modification of the structure of ichthyofauna and macrozoobenthos. At the same time, the combined development of the four water bodies will generate a considerable cumulative spatial barrier effect for migrating and foraging birds. Limiting the analysis solely to a single area would make it impossible to properly estimate the actual scale of the spatial impacts generated by all the related projects within this sea area.

As part of the analysis of the cumulative environmental impact of the proposed Projects, available source data on projects of a similar impact nature were also analysed. For this purpose, an identification of existing and proposed OWFs within the designated region of the Baltic Sea was carried out [Figure 31].

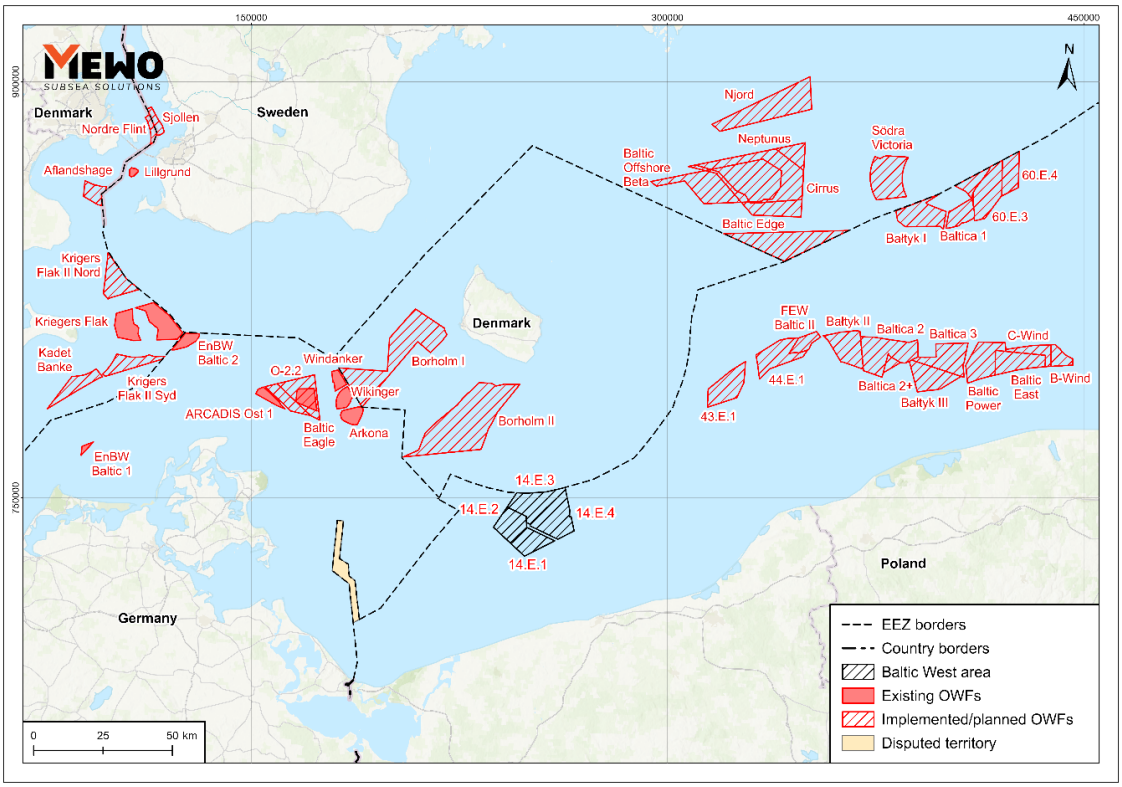


Figure 31 Offshore wind farms within the project region [source: own study]

Within the Polish exclusive economic zone, in particular to the east of the Baltic West OWF, other proposed and implemented offshore wind farms will be located, including: the Sharco Duo OWF (area 44.E.1), Baltica 7 (area 43.E.1), Baltica 9, FEW Baltic II, Bałtyk II, Baltica 2, Bałtyk III, Baltica 3, Baltic Power, Baltic East, C-Wind, B-Wind, Bałtyk I, and Baltica 1.

In addition to this, environmental decisions have already been issued for the connection infrastructure associated with: the FEW Baltic II, Bałtyk I, Bałtyk II and Bałtyk III OWFs, Baltica B-2 and B-3, and Baltica-1.

Owing to the proximity of the boundaries of the exclusive economic zones of Germany, Denmark and Sweden, the cumulative impact analysis also covered the OWFs located within them. A summary of OWF projects in the Baltic Sea within the region of the proposed Project, together with their current status of progress, is set out below [Table 25].

Table 25 Summary of the offshore wind farm (OWF) projects analysed in the Baltic Sea (Polish, German, Danish and Swedish projects), together with their assigned maximum capacity and their current investment status as at 2026

Name	CAPACITY (MW)	Project status
Polish Maritime Areas		
FEW Baltic II	440	**Suspended / Design phase.** Project with an environmental decision already issued, currently undergoing project modification
Bałtyk II	720	**Under construction / Production phase**. Construction works under way (including piling).
Baltica 2 & Baltica 3	2550	**Under construction / Contracting**. Work is under way on onshore connection infrastructure and component production (foundations, turbines); piling for Baltica 2 is also under way. **Pre-construction phase (FID).** The Baltica 3 project is being prepared for the final investment decision, to be implemented following Baltica 2.
Baltyk III	720	**Under construction / Production phase**. Project implemented in parallel with Bałtyk II.
Baltic Power	1140	**Under construction / Installation.** The most advanced Polish project. Intensive offshore installation works (power plants, cables) are under way. The service base in Łeba and the installation terminal in Świnoujście are operational.
BC-Wind	390	**Pre-construction phase.** Following the contracting of the main component suppliers, the project is moving into final preparations for hydrotechnical works
Baltyk I	1560	**Planning phase / Grid connection.** The most advanced project of the second phase, holding a connection agreement.
Baltica 1	900	**Pre-implementation phase.** Intensive wind measurements and seabed geotechnical surveys are under way.
14.E.1 (Energa OWF 1)	812	**Planning phase.** A siting permit has been obtained, preliminary design works are under way. The project is at the stage of obtaining environmental decisions.

Name	CAPACITY (MW)	Project status
14.E.2 (Energa OWF 2)	896	**Planning phase.** A siting permit has been obtained, preliminary design works are under way. The project is at the stage of obtaining environmental decisions.
14.E.3 (Orlen Neptun)	1204	**Planning phase.** A siting permit has been obtained, preliminary design works are under way. The project is at the stage of obtaining environmental decisions.
14.E.4 (Orlen Neptun)	1204	**Planning phase.** A siting permit has been obtained, preliminary design works are under way. The project is at the stage of obtaining environmental decisions.
43.E.1 (Xlokk II, Baltica 7)	1694.2	**Planning phase / Procedures.** The area is covered by administrative procedures following siting decisions.
Sharco Duo (44.E.1)	1325	**Suspended / Design phase.** Project with an environmental decision already issued, currently undergoing project modification
Baltic East (46.E.1)	966	**Planning phase.** Initial project preparation stages. Project with an environmental decision already issued.
60.E.3 (Baltica 1+)	1185	**Planning phase.** Project in PGE's portfolio, conceptual phase.
60.E.4 (Baltica 5)	555	**Planning phase.** Project in PGE's portfolio, conceptual phase.
Baltica 2+	210	**Conceptual phase.** A small project supplementing PGE's portfolio.
Danish Maritime Areas		
Kriegers Flak	604.8	**Operational.** The largest operating Danish farm in the Baltic, fully operational since 2021.
Kriegers Flak 2 – Nord & Syd	500 + 500	**Project phase.** Projects following completed state tenders, in the stage of preparation for construction.
Bornholm I & II	1500 + 1500	**Planning phase.** Key elements of the 'Bornholm Energy Island' project. Schedules have been delayed owing to grid infrastructure costs (Energinet); the projects are in the auction re-planning phase.
Aflandshage	286	**Suspended / Environmental issues.** The project has encountered serious issues with the withdrawal of environmental permits owing to bird and bat protection, and is currently being renegotiated
Nordre Flint	160	**Cancelled / Rejected.** The project was ultimately rejected by the Danish ministry for landscape reasons and owing to protests from local communities.
Kadet Banke	864	**Planning phase.** The project has been suspended in the Open-Door procedure, and is currently being reconsidered under the new government market allocation.
German Maritime Areas		
Arkona	384	**Operational.** The farm has been fully commercially operational since 2019.
Wikinger	350	**Operational.** The farm has been commercially operational since 2017/2018.
Arcadis Ost 1	256.5	**Operational.** An innovative farm (installed using a floating method), brought into full operation at the end of 2023.
Baltic 1	48.3	**Operational.** The first German commercial farm in the Baltic, operating since 2011.
Baltic 2	288	**Operational.** Fully commercially operational since 2015.

Name	CAPACITY (MW)	Project status
Windanker (O-1.3)	300	**Under construction.** Project scheduled to be brought into operation in the coming months.
O 2.2	1000	**Planning phase.** Area reserved for future capacity expansion.
Swedish Maritime Areas		
Baltic Edge	1000	**Conceptual phase.** Project at an early stage of ownership and financial structure planning.
Sjollen	300	**Planning phase / Rejected.** The project has encountered strong administrative opposition and local vetoing; status uncertain or rejected owing to proximity to shipping routes and military zones.
Lillgrund	110.4	**Operational.** The farm has been operating since 2007.

The development of offshore wind energy in the Baltic Sea comprises a number of projects at various stages of progress. Owing to the absence of detailed schedules for projects carried out by independent developers, the precise determination of the simultaneity of works is limited. Nevertheless, in accordance with the precautionary principle, the transboundary analysis has taken into account the risk of cumulative pressures occurring across different phases of the projects' life cycles.

Construction works within the Baltic West area will begin in a few years' time. It is estimated that their commencement will coincide with the start of operation of neighbouring wind farms located further to the west (such as Baltic Power, BC-Wind, and Bałtyk II and III). Cumulative impacts during the construction phase may occur only where works of an identical nature generating pressure overlap in time and space (e.g. simultaneous piling).

Owing to the several-decades-long operational lifetime of wind farms, the operational phases of the individual projects will overlap to a considerable extent. Despite the shift in the commissioning date of Baltic West relative to neighbouring projects, this phase will generate constant, long-term cumulative pressure on a regional scale.

The schedule and precise scale of infrastructure decommissioning are not currently known; however, it is assumed that this process will be spread out over time and carried out in accordance with future environmental standards. The decommissioning of the farms will involve the gradual restoration of the sea area's original state, and the dismantled elements will be transported ashore. Assuming that safety procedures are maintained, even simultaneous removal of structures at several locations should not generate significant cumulative adverse impacts, and their scale will be smaller than during the construction phase.

8.4.1 Assessment of cumulative impacts

Within the framework of the cumulative assessment, only those factors characterised by at least medium term duration, and whose range extends beyond the boundaries of the OWFs comprising Baltic West, were subjected to analysis.

In accordance with the methodology adopted, momentary impacts were excluded from the cumulative analysis – owing to the negligible probability of identical construction works by different investors overlapping simultaneously – as were local impacts, whose range is confined within the boundaries of the individual OWF areas and does not affect the neighbouring water bodies.

Consequently, the key cumulative pressures for the entire Baltic West area (both with respect to the wind farms themselves and the connection infrastructure) identified and assessed were: spatial disturbance (including: exclusion of foraging grounds, formation of a physical barrier, landscape disturbance, disruption to the operation of systems using EMF), hindrances/restrictions to fishing, underwater noise, and an increase in suspended solid concentration and its sedimentation.

Below, a detailed assessment is provided of those cumulative impacts that could be transboundary in nature, or whose aspect was raised during the procedure by the exposed Parties.

8.4.2 Spatial disturbance resulting from the formation of a physical barrier, and collision risk

The possibility of cumulative impacts on avifauna occurring during the construction phase of the offshore wind farms (OWFs) within the Baltic West region depends on the temporal coincidence or proximity of the timing of works generating identical pressures. Owing to the absence of detailed schedules from independent investors, the precise identification of overlapping activities is not currently possible. Nevertheless, given the developers' pursuit of efficiency maximisation and the use of similar technologies, a cumulative barrier effect should be assumed to occur for the projects located closest to one another. The airspace above the Southern Baltic is regularly used by birds, particularly during the spring and autumn migration periods. The formation of permanent above-water structures will force individuals to avoid the built-up water bodies, which will translate into lengthened flight routes and additional energy expenditure.

As the installation works progress and successive turbines are erected, the physical barrier effect will gradually increase, reaching its maximum during the operational phase of the entire area. The current state of scientific knowledge indicates an absence of habituation capacity in the most sensitive groups, such as sea ducks and divers, meaning that the displacement effect will be permanent in nature. These effects may affect many biogeographic populations simultaneously, owing to the low migratory connectivity of certain species concentrating at shared wintering

grounds. Despite the retention of extensive, undeveloped marine corridors (from 4 to 25 km between farms) and the required buffer zones from Natura 2000 sites, the significance of the cumulative barrier effect was assessed as important for sea ducks and divers, moderate for auks, and low for gulls. For ichthyofauna, the significance of the structural barrier will be negligible, owing to the ability of fish to actively avoid physical obstacles.

Calculations of the cumulative risk of bird collisions with turbines for the Baltic West area, and for the maximum scenario covering 49 offshore wind farms (OWFs) in the Baltic Sea, were carried out using the mathematical modelling. Data from existing environmental documentation (including for the BC-Wind, Baltic Power, and Baltica 2 and 3 projects) were used, together with extrapolation of the results in proportion to the installed or planned capacity of the remaining facilities. A conservative avoidance rate of 99% was adopted in the modelling for most species (83% for the crane), which reflects the documented ability of migratory birds to adjust their flight routes well in advance on the open sea. Owing to the considerable spatial spread of the projects, simultaneous impact of all 49 projects on the same bird streams is unlikely, and the actual cumulation will be limited to facilities in the immediate vicinity of Baltic West. Consequently, even under the worst-case scenario, the significance of the cumulative impact on seabird population mortality was assessed as low or, at most, moderate.

With respect to the construction phase, the risk of direct bird collisions with construction vessels, in view of the direct and irreversible nature of collisions, was classified in accordance with the methodology adopted as important for divers and sea ducks, moderate for auks, and low for gulls. It should be emphasised, however, that the actual frequency of such collisions will only be sporadic. The mere physical presence and movement of these vessels will trigger a strong disturbance effect in seabirds, which for the most sensitive groups (sea ducks and divers) is also classified as important. The risk of birds being attracted by artificial light will be minimised by restricting upward-directed floodlights to the necessary minimum.

During the phase of operation of the farms, the key factor subject to cumulation is the physical barrier effect, which depends on the development of the adjacent water bodies. An analysis of flight directions over the Baltic West area showed clear seasonality (in spring towards the east and north-east, in autumn towards the west and south-west), which made it possible to limit the modelling of the cumulative barrier effect to the 14 neighbouring projects located to the east of the project. The results of treating all four Baltic West sub-areas as a combined obstacle indicate a limited effect on the lengthening of the routes and the energy budget of birds. For most species (including sea ducks, divers, gulls and passerines), the increase in the migration distance and the associated energy

expenditure did not exceed 10% (below 2% for most), which, given the broad migration front and the natural variability of routes, is of negligible or insignificant importance. The clear avoidance of the turbines and the greatest relative increase in distance (17–31%) and energy expenditure (16–29%) were shown for auks (mainly the black guillemot), resulting from their short baseline migration distances. However, in absolute terms these costs remain low, and the presence of extensive, undeveloped waters between the farms allows the structures to be freely avoided; as a result of this the cumulative barrier effect for all the groups analysed was considered, at most, low.

In order to protect migratory birds under night-time conditions or in poor visibility, it is recommended that lighting intensity be reduced during migration periods, within the limits permitted by shipping and aviation safety standards.

8.4.3 Impact on fisheries

In assessing the cumulative impact of the entire Baltic West area on Polish fisheries, it was shown that the surveyed region is of marginal significance for the Polish commercial fleet on the scale of the Baltic Sea. The average annual catch volume within this sea area is approximately 1100 tonnes, with a value of approximately PLN 1.7 million, representing only around 1% of the total volume and value of Polish Baltic catches. Catches here are strongly dominated by three species: herring, sprat and flounder.

In analysing the impact, it was taken into account that excluding the entire farm area from use will create a physical barrier extending over a length of approximately 30 kilometres. This will force some domestic cutters to take a longer route to fishing grounds located further to the north. Such a lengthening of the routes will be associated with additional local economic consequences for vessel owners (including increased fuel consumption and longer crew working hours). However, on a nationwide scale, the exclusion of this area from fishing will be of negligible or, at most, low significance.

In order to reliably assess transboundary impacts, an analysis was carried out with regards to the use of the Baltic West sea area by foreign fishing vessels, based on satellite data from the Vessel Monitoring System (VMS) for the years 2020–2025. This analysis showed a negligible presence of foreign fishing vessels within the proposed project area. Over the six-year period analysed, the activity of foreign fleets amounted to only 29, 22, 16, 12, 7 and 3 calendar days per year, respectively. This effort was generated by a very small group of vessels (from 2 to 8 vessels per year), sailing predominantly under German, Danish and Lithuanian flags. Swedish vessels practically do not exploit this region.

Bearing in mind the marginal significance of this sea area for fishing, and the negligible involvement of foreign fishing vessels within the Baltic West area, the complete exclusion of this area will not adversely affect the fishing markets of neighbouring states, including the Swedish, German and Danish markets. Consequently, the possibility of transboundary impacts of the Projects on fisheries has been entirely excluded.

8.4.4 Underwater noise

In order to estimate the cumulative impact of underwater noise on individual sensitive components of the marine environment (in particular marine mammals and ichthyofauna), detailed numerical modelling of the ranges of impact resulting from pile driving was carried out.

The modelling assumed a piling process with mandatory CRS+DBBC mitigation applied, and took into account the variability of sound propagation conditions across two seasons – summer and winter. The calculations took into account cumulative variants, assuming:

- simultaneous piling at two closely situated locations within a single OWF (approximately 1 km apart),
- simultaneous piling at two different locations within the Baltic West area (e.g. combining works within the OWF 14.E.1 area with OWF 14.E.4),
- a maximum scenario in which the pile-driving process takes place at four different locations within the Baltic West area (14.E.1–14.E.4) simultaneously.

The superposition method was used to determine the impact areas for the above scenarios, in accordance with the methodology described in the noise modelling report (Appendix 3 to the EIA Report).

The results obtained in this way, defining the spatial range of the zones of potential hearing damage and behavioural responses, form the basis for the following detailed analysis of the cumulative impact on the individual elements of the ecosystem.

8.4.5 Impact on ichthyofauna

The cumulative impact of noise and vibration, resulting from simultaneous piling at two Baltic West areas, will be adverse, direct and short-term for adult fish, and its range will extend beyond the wind farm areas themselves. Nevertheless, the ultimate significance of this impact was assessed as low or negligible for the individual species.

Detailed conclusions for the individual stages of the fish life cycle are as follows:

- Mortality

The range of noise with a lethal intensity for larval and adult fish stages is sufficiently limited so that, even if the area of this zone were doubled owing to parallel works, this would not significantly affect the ichthyofauna mortality.

- Impact on spawning grounds

The areas covered by the cumulative impact constitute only a small part of the available spawning grounds, which considerably limits the adverse assessment of this phenomenon.

Herring (autumn spawning): The cumulative nuisance effect (e.g. from areas 14.E.1 and 14.E.2) will cover an area of only 34 km². Since these are not areas of intensive spawning for this species, the impact of noise will not be significant for the whole population.

Sprat: Noise may adversely affect the summer shallow-water spawning phase of sprat, which may take place across the entire Baltic West area. The modelling results indicate that the greatest cumulation of impact will result from simultaneous piling at the OWF 14.E.1 and OWF 14.E.4 areas, and its total area will be many times larger than in the case of works being carried out only at the first of the areas mentioned. Nevertheless, this will still be a sufficiently small proportion of the available spawning grounds in the southern Baltic and therefore the population's reproductive processes will not be jeopardised.

- Impact on foraging grounds

Under the worst-case scenario of simultaneous works (OWF 14.E.1 and 14.E.4), the area covered by the TTS effect could increase by as much as 16-fold during the winter period.

Pelagic fish: The exclusion of such a small fragment of the vast pelagic zone of the southern Baltic from foraging will not cause a significant depletion of food resources for fish in this group.

Demersal (bottom-dwelling) fish: Although the noise will cover a significant part of the benthic foraging grounds, the behaviour of the individual species will minimise the adverse effects:

Flounder: The specific, limited sensitivity of its hearing apparatus to acoustic stimuli will, to a large extent, inhibit the flight response from valuable foraging grounds (abounding in, among other things, bivalves).

Cod: Noise does not need to mean abandonment of foraging grounds, since the strong motivation to obtain food (benthic crustaceans) keeps cod in favourable locations. They are a highly mobile species, and a significant part of the cumulative area consists of deeper water bodies, where naturally lower food biomass occurs.

8.4.6 Impact on marine mammals

As part of the analysis of the impact of noise generated during piling on marine mammals, a situation was considered in which the pile-driving process would take place at several Baltic West locations simultaneously. The impact on the harbour porpoise and seals was analysed in the form of hearing damage (TTS and AINJ) and behavioural changes, in accordance with the acoustic threshold criteria set out by NMFS (2024) and Tougaard et al. (2021).

The modelling and mathematical analyses carried out showed that construction works involving simultaneous pile driving at several Baltic West locations carry a minimal risk of direct hearing damage to marine mammals. In the case of both groups analysed, harbour porpoises and seals, the zone in which permanent or temporary threshold shifts (TTS and AINJ) could occur is limited to the immediate vicinity of the sound source and amounts to less than 200 metres.

It should be borne in mind that the results presented assume that double mitigation in the form of CRS+DBBC will be used in the pile-driving process.

2. Behavioural impact on the harbour porpoise population

Although the application of CRS+DBBC systems protects the animals' hearing organs, this technology is not sufficient to minimise the range of behavioural disturbance. High-intensity noise will propagate over considerable distances, resulting in flight responses and changes in natural behaviour in harbour porpoises. The scale of this phenomenon shows strong seasonality:

Summer season (July–September):

The results of acoustic monitoring within the Baltic West region and long-term literature data (CIEP, MSIOUG) clearly indicate that the western waters of the Polish exclusive economic zone are of key significance for harbour porpoises during the period from June to October. High detection indices (DPM) were recorded here compared with the central and northern parts of the Baltic Sea. This area probably serves the animals primarily as a rich food base and a region of free movements (without preference for specific routes), as indicated by increased echolocation activity in July and August.

Under the summer scenario, simultaneous piling at two locations (OWF 14.E.3 and 14.E.4) will generate a flight zone with an area of up to 286 km², while, with works concentrated at four points at the same time, this area will increase to 413 km². The consequence will be temporary deterrence of harbour porpoises from their potential foraging grounds. This impact is regional in nature. Although it will not cover the prevailing part of the western Baltic or Danish waters, the noise may extend into the protected Natura 2000 site (*Ostoja na Zatoce Pomorskiej* PLH990002) under all the

summer scenarios analysed (even with single-location piling), if the works are carried out in the southernmost and south-western parts of the OWF 14.E.1 and OWF 14.E.2 areas.

Additionally, the spreading out of the works over time – resulting from the cascading construction schedule for the entire Baltic West area, estimated at approximately 7 years – creates a risk of cumulative, long-term stress (sequentially transferred pressure) for the local subpopulation.

Winter season (January–March):

For hydrological reasons, the largest areas of behavioural disturbance are projected during the winter season. The discomfort zone (behavioural response) for single-point piling will reach a maximum of 522 km² (for OWF 14.E.4), increasing to 922 km² for simultaneous piling at two locations (in the least favourable OWF 14.E.3 and 14.E.4 configuration), and reaching as much as 1330 km² in the extreme scenario of four simultaneous piling operations within the Baltic West area. Despite such large geographical ranges, monitoring showed that, in winter, harbour porpoise activity within the Baltic West region is drastically lower than in summer. Consequently, it is assumed that the winter avoidance response will not translate into adverse effects at the population level, since it will affect only a small number of individuals.

For seals (grey and harbour), the area of potential behavioural changes under the influence of simultaneous piling will extend over very large distances, well beyond the boundaries of the proposed offshore wind farms. This range will cover a significant part of the western PMA, and, towards the north and north-east, will extend beyond the boundaries of the Polish Maritime Areas, reaching foreign waters (including the exclusive economic zones of Denmark and Sweden), which constitutes a transboundary impact. In accordance with the scientific studies cited [Russell et al., 2016; Aarts et al., 2018], the behavioural responses of seals to impulsive noise have a specific character: they are short-lived and generally limited solely to the time frame during which pile driving is actually being carried out. During noise emission, seals may temporarily cease foraging or change their swimming route. Although contemporary science does not provide an unambiguous answer as to how long-term exposure to noise across the entire sea area affects the overall health condition of these mammals, the literature indicates a high adaptive capacity in seals and their tendency for habituation to an increased acoustic background.

Taking into account the stable, high abundance of the seal population in the southern Baltic, their dispersed pattern of occurrence within this sea area, and the aforementioned short duration of the response, it is projected that the wide range of acoustic impact will not lead to the disruption of the seal population stability on a regional and transboundary scale.

Simultaneous installation works within the Baltic West area, with the application of a double bubble curtain and CRS systems, eliminates the risk of anatomical injury to marine mammals. The main environmental challenge remains the large-scale behavioural impact. This is temporary and reversible in nature; however, during the summer season it may disrupt key life functions (foraging) of harbour porpoises on a regional scale. With respect to seals, despite the very large territorial range of the noise, the species' high resilience and plasticity minimise the risk of occurrence of lasting population-level effects.

8.4.7 Impact on birds

The presence and movement of transport and construction vessels will constitute the main cause of the seabird disturbance within the sea area covered by the construction of the Baltic West OWF. This impact will be considerably greater than other pressures associated with the construction phase, such as underwater noise emission. Noise associated with OWF construction may affect seabirds directly, and fish – constituting the food base of certain diving piscivorous species – indirectly.

Noise and vibration associated with the OWF construction will be able to cumulate only in the event of simultaneous construction of the OWFs across areas 14.E.1 to 4 and/or neighbouring German and Danish wind energy projects. Owing to the globally limited number of WTIVs (Wind Turbine Installation Vessels) and the high cost of engaging them, the simultaneous performance of piling works at more than four locations is highly unlikely. Nevertheless, the cumulative underwater noise impact analysis is limited to the maximum scenario, assuming simultaneous piling at a maximum of four locations, which was directly taken into account in the numerical modelling carried out. Lacroix et al. (2003) documented the response of long-tailed ducks to underwater noise from seismic surveys, showing an increase in flight frequency and changes in diving behaviour, which may confirm the sensitivity of sea ducks to noise emission during the construction phase.

Sensitivity to the impact was determined as very high for sea ducks and divers, and high for auks and moderate for gulls.

Noise and vibration during the construction phase constitute a direct, adverse cumulative impact on seabirds. For sea ducks, auks and divers, this impact has a regional range, owing to the possible effect on the species' biogeographic population, while for gulls it has a local range. For sea ducks, auks and divers, this impact is short-term, while for gulls it is momentary. The intensity of the impact was determined as high for auks and divers, medium for sea ducks, and low for gulls.

In accordance with the methodology adopted, the significance of the cumulative impact was determined as important for sea ducks and divers, moderate for auks, and low for gulls.

9 LINKS WITH CLIMATE POLICY

9.1 Estimated emissions

In assessing the impact of the offshore wind farm, the entire life cycle was analysed, together with its effect on the amount of electricity generated in comparison with electricity production at power plants fired with other types of fuel.

Under the conservative assumption of a 40% capacity utilisation factor and a 55-year operational lifetime, an offshore wind farm with a maximum capacity of, for example, 1000 MW could generate 192.7 TWh/693.7 PJ of electricity, which would avoid the emission of approximately 70 060 000 Mg of CO2, approximately 944 000 Mg of SO_2, approximately 127 000 Mg of nitrogen oxides, and approximately 2 260 000 Mg of particulate matter in lignite-fired power plants [EEA, 2008].

9.2 The Polish energy market

According to the data provided by the Central Statistical Office[1], the primary electricity generation in Poland remains dependent on fossil fuels. The share of the individual fractions in 2024 was as follows:

- hard coal, 47.4% – representing a decrease of 5.7 percentage points compared with 2020;
- lignite, 15.0%;
- other energy carriers (largely renewable), 27.4% – representing an increase of 5.9 percentage points relative to 2020;
- natural gas, 5.7%;
- crude oil, 1.5%.

The data indicate that the Polish electricity sector remains strongly dependent on fossil fuels, whose combined share exceeds 60%. At the same time, a gradual decline in the significance of hard coal and an increase in the share of renewable energy sources are observed, confirming the ongoing energy transition. The growing share of RES and natural gas is changing the structure of energy generation; however, the pace of these changes remains moderate, and the role of conventional sources remains key to ensuring the security of the operation of the power system.

In addition to this, Poland remains dependent on imports of primary energy (including fuels). In recent years, this level has increased to approximately 45%, showing a significant increase in dependency relative to 2021. At the same time, the cost of importing fossil fuels, after a record high

[1] Fuel and Energy Economy in 2023–2024, Central Statistical Office, Warsaw, Rzeszów, 2025

level in 2022 (PLN 193 billion), has fallen considerably, amounting to approximately PLN 112 billion in 2024. This phenomenon resulted, among other things, from the stabilisation of energy commodity prices following the crisis and changes in import directions, alongside persistently high demand for raw materials from abroad.

In recent years, the Polish electricity sector has remained strongly influenced by geopolitical conditions and changes in energy demand. At the same time, an acceleration of measures aimed at energy transition is observed, in particular, as already indicated above, increasing the share of renewable energy sources and reducing the use of coal, although fossil fuels still dominate the energy generation structure.

The emission intensity of the domestic electricity sector is gradually decreasing but still remains high compared with other EU member states. According to the latest available data, the emission factor for electricity was approximately 540 kg CO_2/MWh in 2024, representing a significant improvement compared with previous years, but still indicating the system's high dependence on coal-based sources (kobize.pl).

Despite the downward trend observed, the pace of reduction of emissions in the electricity sector remains moderate. Decarbonisation of the energy mix, increasing the share of low-emission sources, and improving the energy efficiency remain key challenges, constituting a significant element of Poland's climate and energy policy in the years to come.

During the period under analysis, conventional thermal power plants remain the main source of electricity generation in Poland; however, their share in domestic production is systematically decreasing in favour of renewable and gas-fired sources. Energy production at these units remains at a high level, although a downward trend in their share of total energy generation volume is observed. The efficiency of conventional power plants remains relatively stable, at around 40–43%, resulting from the modernisation of existing units and the gradual decommissioning of the oldest units.

Industrial power plants play a complementary role in the electricity system, accounting for a small share of domestic electricity production. In recent years, their production has remained at a relatively stable level, alongside an improvement in energy efficiency. The efficiency of this group of units remains higher than for conventional power plants, which results, among other things, from the widespread use of high-efficiency cogeneration.

Independent power plants, in particular renewable energy source installations – primarily wind and photovoltaic – are of increasing significance within the domestic energy mix. Their dynamic

development in recent years is contributing to an increase in the share of low-emission sources in electricity production and a gradual reduction in the role of conventional units.

In Poland, in 2025, the installed capacity within the National Power System (NPS)[2] totalled 77331 MW, broken down as follows:

- conventional power plants, totalling 40 225 MW, of which conventional hydroelectric power plants account for 2 431 MW and conventional thermal power plants for 37 794 MW;
- wind and other renewable power plants – 37 106 MW;

The data presented indicate an increase in installed capacity within the NPS in successive years, which has reached a level of 77 331 MW. The structure of generating capacity is undergoing significant changes – a clear increase in the share of renewable energy sources is visible, which now account for almost half of the total installed capacity. At the same time, conventional power plants, in particular thermal ones, still constitute a significant element of the power system, accounting for more than half of capacity.

The significant share of renewable sources, including primarily wind and photovoltaic energy, indicates the ongoing energy transition and the growing role of distributed generation. This, however, results in increased variability of energy production and growing requirements with respect to balancing the system and ensuring its stability.

The breakdown into centrally dispatched generating units (CDUs) and non-centrally dispatched generating units (nCDUs) confirms the growing significance of the latter, which currently account for the majority of installed capacity within the system. This phenomenon results primarily from the dynamic growth of renewable sources, which are mostly classified as nCDUs. Consequently, the significance of mechanisms for managing system operation under conditions of high generation variability is increasing, as is the need to develop grid infrastructure, energy storage infrastructure and flexibility services.

Despite the dynamic development of renewable energy sources, conventional units, in particular, the thermal ones, remain key to ensuring the security of electricity supply, performing a stabilising and regulatory function within the power system.

In connection with the increasing share of renewable energy sources, which are characterised by considerable variability and dependence on weather conditions, a growing effect on the functioning of the power system is observed. This phenomenon particularly affects the operation of

[2] Summary of quantitative data concerning the functioning of the NPS in 2025 - access: Reports for the year 2025 - PSE

conventional units, determining the need to increase their operational flexibility and to implement solutions enabling the effective integration of RES within the National Power System.

At the same time, it remains necessary to take measures aimed at reducing demand for fossil fuels originating from the Russian Federation and other states subject to economic sanctions. These measures constitute a significant element aimed at strengthening the country's energy security and accelerating the transition towards a low-emission system.

Consequently, in the coming years, the following measures[3], among others, will be necessary:

- increasing technological diversification and expanding capacity based on domestic sources;
- further development of renewable energy sources, including energy from offshore wind farms;
- development of the grid and energy storage;
- improvement of energy efficiency;
- implementation of nuclear power.

Within the above elements, RES constitutes a diversification element of the electricity mix. By 2040, Poland will aim to achieve a level of around half of electricity production from renewable sources.

9.3 Links between national energy policy and EU climate and energy policy

The Baltic West Area is a strategic project from the point of view of Poland's energy security, while also constituting the implementation of measures aimed at increasing the share of electricity generated from renewable energy sources. It forms part of the assumptions of Poland's Energy Policy until 2040 (PEP2040), which assumes the construction of offshore wind farms with a total capacity of up to 5.9 GW within the Polish exclusive economic zone (EEZ) by 2030, with potential for approximately 11 GW by 2040. In accordance with PEP2040, electricity production from offshore wind farms will account for the largest share in the structure of generation from RES. Owing to the high efficiency and operating characteristics of this technology, the implementation of offshore wind energy has been designated as a strategic project under PEP2040.

At the global level, the provisions of the United Nations Framework Convention on Climate Change, signed in 1992 in Rio de Janeiro and ratified by Poland in 1994, apply, the objective of which is to stabilise greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous changes to the climate system. In 1997, the Convention's regulatory mechanism, the so-called Kyoto Protocol, was adopted, establishing a time frame for the reduction of greenhouse gas emissions (it

[3]Assumptions for the PEP2040 update: 2022-03-29_ZałożeniadoaktualizacjiPEP2040.pdf

entered into force in 2005, and was ratified by Poland in 2002). The Paris Agreement, in turn, adopted in 2015 (and ratified by Poland in 2016), constitutes the overarching instrument of climate policy, setting the objective of limiting the increase in the global average temperature to well below 2°C in relation to the pre-industrial times.

The proposed Projects within the Baltic West area, involving the generation of electricity from a renewable energy source – wind – in marine areas, are in line with the objectives of the above regulations, as well as with Poland's energy policy, contributing to a reduction in adverse environmental impacts and a reduction in greenhouse gas emissions from the energy sector. They are consistent with the EU's current climate and energy policy for the horizon up to 2030 (revised under the 'Fit for 55' package and the RED III Directive), the primary objectives of which are:

- reducing greenhouse gas emissions by at least 55% relative to 1990 levels;
- ensuring that renewable sources account for at least a 42.5% share of energy consumed in the EU by 2030;
- increasing energy efficiency (reducing the EU-level final energy consumption by 11.7% by 2030 compared with forecasts from 2020).

The proposed projects, through the generation of energy from a renewable source and the simultaneous reduction of CO2 emissions, directly contribute to the achievement of these overarching objectives.

The Baltic West area also corresponds to the objectives of the EU's 'Climate Neutrality by 2050' strategy, which assumes achieving net-zero greenhouse gas emissions by 2050, and is in line with the idea of the European Green Deal. The project also fulfils the assumptions of the EU's latest strategy for project in clean energy of March 2026, which places particular emphasis on accelerating the development of large-scale renewable energy sources, the deep transformation of grid systems, and Europe's energy independence.

In accordance with expert analyses and market forecasts, electricity generated at offshore wind farms is among the sources with the lowest levelized cost of electricity (LCOE) under European conditions. This results from continuous technological progress (including an increase in the capacity of individual turbines), a decline in unit investment and operating costs, and the complete absence of fuel costs. The LCOE indicator for offshore wind energy shows a significant economic advantage compared with conventional sources, including gas- and coal-fired sources – particularly taking into account the drastic fluctuations in energy commodity prices and the rising cost of CO2 emission allowances (the EU ETS system). This makes the development of the Baltic West project a key

element in improving the competitiveness of the economy and stabilising energy prices for end consumers.

10 ENVIRONMENTAL MONITORING

10.1 Implementation and Decommissioning Phase

10.1.1 Monitoring of water and bottom sediments

During the implementation phase, monitoring surveys may be required following any unplanned events in the form of accidents and collisions involving transport vessels, in order to assess potential changes in water quality within the environment exposed to impact at the construction site.

Following an accident or leak, the appropriate course of action will first be determined on the basis of a preliminary inspection of the leak, and the post-accident monitoring measures will be tailored to the scale of the event. It is worth noting that leaks with a volume of up to 2 m^3 will not cause spills or contamination of seawater over an area greater than 2 hectares [Fabisiak, 2008], and will therefore fall below the Polish criteria for major accidents (Regulation of the Minister of the Environment of 30 December 2002 on major accidents subject to the obligation to notify the Chief Inspector of Environmental Protection, Journal of Laws 2021, item 1555). Only minor leaks could potentially occur within the Project area, and the area of impact will most likely be limited to a maximum of 2 hectares. If visual inspection shows that water and bottom sediment samples should be collected from the affected area, sampling should be carried out in accordance with the indications of specialists in this field.

The water samples collected should be tested for the following parameters:

- oxygen conditions (dissolved oxygen, five-day biochemical oxygen demand (BOD5)), TOC, acidification (pH) and alkalinity;
- metals and hydrocarbons: mercury (Hg), nickel (Ni), lead (Pb), cadmium (Cd), arsenic (As), total chromium (Cr total), chromium (VI) (Cr IV), phenols, cyanides, mineral oils, polycyclic aromatic hydrocarbons (16 PAHs).

Monitoring of water and sediments is not planned for the decommissioning phase.

10.1.2 Underwater noise monitoring

Underwater noise monitoring is recommended during the piling of support structures.
Measurements should be carried out in a manner that ensures:

- the recording of the acoustic signal with a sampling frequency of at least 44.1 kHz and a resolution of at least 16 bits;
- the use of calibrated hydrophones and the recording of the calibration signal;

- the acquisition of data of a quality that enables the sound exposure level to be determined for a single pile driver strike (SEL_{ss});
- the selection of measurement stations with hydrophones located approximately 2 m above the seabed, taking into account local bathymetric conditions and sound propagation conditions;
- combining noise measurements with procedures for verifying the exclusion zone: Each start of pile driving must be preceded by at least 30 minutes of visual observation (MMO) and/or real-time acoustic monitoring (PAM), and the work itself must be carried out using a 'soft-start' or 'ramp-up' procedure lasting between 20 and 30 minutes.

The above requirements were developed taking into account available guidelines and regional experience relating to underwater noise monitoring, including, among others, Skjellerup et al. (2015) and the German BSH (2011) guidelines.

As part of underwater noise monitoring, the use of the following measurement stations is proposed, at which monitoring will be carried out on each occasion during piling:

- one mobile station at a distance of 6.7 km from the piling location, in the direction ensuring the most effective sound propagation, at which the noise level set as the threshold for cumulative TTS should not be exceeded – 144 dB re 1 µPa²s SELcum weighted using the VHF function for mammals with high sensitivity to very high frequency sounds, including the harbour porpoise [NMFS, 2024];
- at least one mobile station at the boundary of the Polish Natura 2000 site *Ostoja na Zatoce Pomorskiej* PLH990002, at the point located closest to the piling location, or at least two measurement stations carrying out continuous measurements, located at fixed points along the boundary of the Natura 2000 site, at locations closest to the boundary of the offshore wind farm, at which the noise level set as the threshold of 144 dB re 1 µPa²s SEL_{cum} weighted using the VHF function should not be exceeded, for mammals with high sensitivity to very high frequency sounds, including the harbour porpoise; 168 dB re 1 µPa²s SEL_{cum} weighted using the PW function for seals [NMFS, 2024];
- at least one station at the boundary of the German Natura 2000 *site Pommersche Bucht DE1552401*, at which the noise level set as the threshold of 144 dB re 1 µPa²s SEL_{cum} weighted using the VHF function should not be exceeded, for the harbour porpoise; and 168 dB re 1 µPa²s SEL_{cum} weighted using the PW function for seals (NMFS, 2024).

The determination of the location point for the mobile station, situated at a distance of 6.7 km from the piling site, at which the noise level corresponding to the TTS threshold for cetaceans in the VHF group [NMFS, 2024] should not be exceeded, was based on available knowledge regarding the occurrence of harbour porpoises within the Baltic West area and the adjacent waters, and on the results of acoustic modelling.

The results of numerical modelling obtained for the behavioural response effect of harbour porpoises resulting from piling noise were used to determine the criterion for the range of impact in the form of hearing damage. It was assumed that, up to a certain distance from the piling location, harbour porpoises may avoid the area affected by noise. To calculate this distance, the criterion for a change in behaviour of cetaceans in the VHF group, determined by Tougaard et al. (2021), with a value of 103 dB re 1µPa (VHF-weighted SPL_{125ms}), was adopted. Calculations were carried out for 576 sound propagation transects modelled for the entire Baltic West area. The median range within which harbour porpoise behavioural change could occur was determined from the values obtained. This value was 6.7 km from the sound source. It was assumed that, beyond this distance, harbour porpoises may cease fleeing the sound source, remaining within the sphere where they are exposed to the impact of the noise and its cumulation, which, with longer exposure, could lead to hearing damage. For this reason, the value of 6.7 km from the sound source was adopted as the limit value at which the threshold set for the TTS effect in harbour porpoises – 144 dB re 1 μPa^2s SEL_{cum} weighted using the VHF function [NMFS, 2024] – may not be exceeded.

Where simultaneous foundation piling is planned at more than one site within the Baltic West cluster during the summer, the noise monitoring report and the SRH report submitted to the Regional Directorate for Environmental Protection (RDOŚ) in Szczecin two months prior to the works must unequivocally demonstrate that, at the boundaries of the Natura 2000 sites (in particular the *Ostoja na Zatoce Pomorskie*j PLH990002), the behavioural response threshold for porpoises—set at 103 dB re 1 µPa (VHF-weighted SPL_{125ms})—will not be exceeded.

At the monitoring stations located at the boundary of the Polish Natura 2000 site *Ostoja na Zatoce Pomorskie*j PLH990002 and at the boundary of the German Natura 2000 site *Pommersche Bucht* DE1552401, the levels of underwater noise generated during piling should be verified with respect to cumulative TTS for organisms sensitive to noise, in particular the harbour porpoise and seals. Consequently, underwater noise levels for the cumulative pile driver strike should not exceed: 144 dB re 1 μPa^2s SEL_{cum} weighted using the VHF function, applicable to marine mammals with high sensitivity to very high frequency sounds, including the harbour porpoise; 168 dB re 1 μPa^2s SEL_{cum}

weighted using the PW function for pinnipeds underwater, i.e. the grey seal and harbour seal [NMFS, 2024].

If exceedances of the threshold levels are found, or if the noise mitigation measures applied prove ineffective, the causes should be analysed without delay and corrective measures implemented. Any exceedance of the established underwater noise levels should be reported without delay to the locally competent Regional Director for Environmental Protection. The monitoring results should be reported, once completed, to the locally competent Regional Director for Environmental Protection.

Submission to the competent authority (RDOŚ in Szczecin) of a detailed description of the Noise Reduction System (NRS), together with the monitoring methodology, will constitute an obligation to strictly adhere to rigorous environmental targets (i.e. not exceeding the thresholds of 144 dB re 1 μPa^2s SEL_{skum} for porpoises and 168 dB re 1 μPa^2s SEL_{skum} for seals at the specified monitoring points). The selection of a specific hardware configuration for noise reduction at source (e.g. a double bubble curtain (DBBC), a close-range system (CRS), cofferdams, resonant absorbers or equivalent solutions) will take place during the implementation phase and will be adapted to the intended type of foundation and the prevailing geotechnical and hydrological conditions..

During the decommissioning phase of the MFW, underwater noise monitoring will be carried out using calibrated hydrophones during all dismantling work on the seabed (e.g. drilling, blasting, mechanical or abrasive cutting of foundation piles), in line with the layout and methodology used during the pre-investment phase, with particular emphasis on recording low-frequency noise emissions and vibrations.

10.1.3 Ichthyofauna monitoring

Ichthyofauna monitoring is not proposed during the implementation and decommissioning phases.

10.1.4 Migratory bird monitoring

Monitoring is not planned during the implementation and decommissioning phases.

10.1.5 Seabird monitoring

No additional pre-investment monitoring is planned. As part of an additional year of surveys, the Investor has commissioned an annual seabird survey using aerial photogrammetry, the partial results of which are presented in the inventory report constituting an appendix to this report.

Monitoring is not planned during the decommissioning phase.

10.1.6 Marine mammal monitoring

Before the commencement of construction works within the OWF area, it is recommended that acoustic monitoring of harbour porpoises be initiated using the same methodology as that applied during the monitoring stage within the EIA process (i.e. a minimum of five F-POD devices within the OWF area and six within the buffer zone). Parallel sharing of acoustic monitoring across the entire Baltic West area is permissible, if the construction process at the given locations is planned for a similar period. At each of the Baltic West area locations, the monitoring using F-POD devices should ensure data coverage for the entire duration of the construction works.

During the OWF decommissioning works, it is recommended that acoustic monitoring of harbour porpoises be carried out using the same methodology as that applied during the OWF construction phase.

10.1.7 Benthic organism monitoring

Macrozoobenthos monitoring is not planned during the implementation and decommissioning phases.

10.1.8 Bat monitoring

The monitoring of bats is not planned during the implementation and decommissioning phases.

10.2 Operational phase

10.2.1 Monitoring of water and bottom sediments

If seawater cooling of OSS components is used during operation, continuous monitoring of temperature and TRO before the discharge of OSS installation cooling water is necessary. The permissible TRO concentrations in the discharged cooling water should be adapted accordingly to the technical solutions applied – for chlorine compounds, this is 0.1 mg/l.

If anti-corrosion protection systems based on solutions introducing zinc or aluminium into the environment (cathodic protection) are used, at the locations where benthos monitoring will be carried out, sediment samples should be collected during the first period of benthos monitoring and again 10 years after the first monitoring, for analysis of the content of metals introduced into the sediments. Analyses and sample collection should be carried out in accordance with current reference methods.

10.2.2 Underwater noise monitoring

It is recommended that ambient acoustic background monitoring be carried out for 1 year using measurement stations arranged analogously to the layout used during the pre-investment stage, and in accordance with the methodology adopted for that stage.

10.2.3 Ichthyofauna monitoring

Post-investment ichthyofauna monitoring should be carried out in the first year of OWF operation and in the fifth year of OWF operation. The surveys should be carried out within the OWF area and within the reference area, maintaining comparable seasonality and survey effort relative to the pre-investment surveys. Owing to the presence of support structures, cables and other underwater infrastructure elements, carrying out pelagic trawl catches directly within the farm area may be impossible or impermissible for safety reasons.

For this reason, monitoring of pelagic fish within the OWF should be based primarily on hydroacoustic methods, while pelagic catches should be carried out outside the farm area, within the reference area or at the periphery of the OWF, solely at locations safe for the operation of towed gear.

Monitoring of demersal fish should cover the species composition, abundance, biomass and length structure of demersal assemblages; where it is not possible to safely operate towed gear within the farm area, catches using set nets are permissible. Ichthyoplankton monitoring should cover the taxonomic composition and abundance of fish eggs and larvae, as an auxiliary element in the assessment of any changes in the functioning of the area.

10.2.4 Migratory bird monitoring

Taking into account experience from similar projects in the Baltic and North Seas (including the EIA Report for Bałtyk II, 2015; Bednarska et al. 2017; DOF 2024), the authors of this report propose that migratory bird monitoring be carried out in two cycles per year, corresponding to the two bird migration periods, i.e. from March to May (spring migration) and from July to November (autumn migration), over the course of the first five years of operation:

- 2 survey cycles in the first, second, third, fourth and fifth year following the completion of all works of the implementation phase, i.e. one during the spring migration period and one during the autumn migration period,

The monitoring should be carried out using visual observations, horizontal and vertical radar tracking, and acoustic recording. The scope, methodology and research objective of the works carried out should be analogous to the pre-implementation monitoring, taking into account observations of potential avoidance responses resulting from approach to the OWF area or the recording of any collision-related events. The surveys should be carried out from an anchored vessel or platform. The use of other available methods guaranteeing the achievement of an equivalent research objective is permissible, e.g. detection systems based on cameras and radars. Depending

on operational and technical possibilities, the system should be mounted on a WTG (Wind Turbine Generator) platform, an offshore substation, a nacelle or a buoy. Such a system, installed on the OWF to capture seasonal migrations to and from breeding sites, has a considerably wider range than visual observations carried out from a vessel, and provides high-quality, high-resolution data. Once installed, the system operates continuously or on a set schedule and does not require ongoing operator involvement. The effectiveness of the automatic bird passage detection system must be confirmed through in situ validation. An automated system for monitoring migration and collision risks will be commissioned within three months of the offshore wind farm being handed over for operation. Furthermore, after the first year of operation, the monitoring system will be updated and calibrated using actual measurement data collected during the offshore wind farm's operation, which will enable its functionality to be adapted to local flight patterns.

The purpose of the migratory bird monitoring during the operational phase, once all construction works have been completed, will be to verify the assumptions adopted in this assessment with respect to the impact on these birds. Monitoring of bird mortality at the offshore wind farm will be carried out in parallel with migratory bird monitoring.

Monitoring of bird mortality at the offshore wind farm cannot be carried out using the methods applied at onshore farms, where the basis is the systematic searching of the area beneath the turbines by observers or dogs trained for this purpose. Under marine conditions, dead birds disappear from the water surface within a few hours as a result of currents, waves and predators, which practically precludes direct recording of the victims of collisions. Additionally, none of the direct mortality/collision monitoring methods for offshore wind farms has yet reached TRL 8–9 (i.e. technical readiness for industrial implementations other than those in the form of prototypes). For this reason, the proposed monitoring is based on an indirect approach, combining automatic detection of potentially collision-related events with modelled mortality estimation.

The primary tools include the ornithological radar with trajectory tracking, enabling the round-the-clock recording of passages and identification of trajectories that end abruptly within the rotor zone, and cameras (including thermal imaging cameras) installed on selected WTG or OSS structures, recording events within the rotor zone regardless of time of day or weather conditions. Estimating the actual mortality on the basis of the data obtained in this way requires the application of estimation models taking into account the detection coefficients of the automatic system and extremely unfavourable survival coefficients for carcasses in the marine environment. The estimated mortality results are related to the size of the biogeographic populations of the individual species, applying the criterion of 1% of additional annual population mortality, as the threshold for assessing

the significance of the impact, in accordance with the approach of the ORNIS Committee (the Committee for the Adaptation to Scientific and Technical Progress and Management of the Birds Directive).

The possibility of using a shared monitoring system, or elements thereof, for the entire Baltic West area is envisaged.

10.2.5 Seabird monitoring

Monitoring of seabirds during the operational phase will commence within three months of the offshore wind farm being commissioned. It will involve counting birds present within the offshore wind farm area, together with a 2NM wide buffer zone, and within reference area..

The routes of the survey cruises and the transects for aerial surveys will correspond to the layout used during the pre-investment survey. If ship-based monitoring is selected, bird counts on the water and in flight will be carried out between October and May at a frequency of at least one cruise per month (ideally two cruises per month), whilst two monitoring cruises will be carried out during the summer (in mid-August and mid-September). Where aerial photogrammetry is used, flights will be carried out at a frequency of 8–10 flights per year. The dates of surveys within the MFW area (including the 2 NM buffer zone) and within the reference area must always be synchronised within the same survey session, which will ensure full comparability of the results.

These surveys should be carried out over 2 consecutive years (the first 2 years of the OWF operational phase), where construction is not staged. Otherwise, these surveys should be carried out following the completion of the first implementation phase and following the completion of the construction of the entire OWF. During the first season, birds will gradually become accustomed to the situation in which the area designated for the Project becomes inaccessible to them (so-called habituation), which will entail changes in their distribution. This period can therefore be treated as transitional, and it is only in the second year that the scale of the OWF's impact on the seabirds present within this area will stabilise.

The use of monitoring employing aerial photogrammetry or other equivalent methods is permissible. The use of other methods will require the application of different methodologies – aerial photogrammetry or aerial observations are carried out during 8–10 flights per year.

The detailed methodology for post-project monitoring will be possible to determine once the final shape of the proposed project has been approved and the Applicant has presented the schedule for construction works.

10.2.6 Marine mammal monitoring

During the operational phase of the OWF, passive acoustic monitoring (PAM) of porpoises will be carried out for a minimum of the first two years, in accordance with the methodology applied during the pre-investment and construction phases, using at least 5 F-POD devices (or equivalent) within the boundaries of the OWF and 6 in the buffer zone.

Visual monitoring of seals during the operational phase shall be carried out for at least one year, in accordance with the methodology for seabirds monitoring (from vessels or aircraft).

10.2.7 Benthic organism monitoring

In connection with the occurrence of local changes to the structure of the seabed biocenosis caused by the implementation of the OWF, post-implementation monitoring of benthic organisms should be carried out. During the implementation phase, the disruption of the structure of bottom sediments and physical destruction of benthic fauna will occur primarily, while during the operational phase, loss of a fragment of benthic fauna habitat and the artificial reef effect will occur, the significance of which within the PMA is not currently unambiguous. The purpose of the proposed monitoring is, therefore, to determine the scale, and the spatial and temporal extent, of the above-mentioned factors. An important strategy for the monitoring surveys is the possibility of comparing them with data provided by the inventory surveys. This monitoring methodology takes into account the life cycle of benthic organisms in the southern Baltic. In addition to this, the relevant literature was also used [Coates et al., 2011; Degraer et al., 2012; Standard 2013], as were environmental decisions issued to date with respect to benthic organism monitoring for similar projects within the PMA. The surveys should be carried out in accordance with standard methodologies (HELCOM, CIEP).

Surveys of soft-bottom macrozoobenthos assemblages should be carried out using a Van Veen grab around 5 wind turbine foundations/support structures. In the vicinity of the wind turbine foundation, outside the scour protection zone, 6 stations should be designated, including 3 stations along the transect of the main profile (in the axis of the near-bottom current) at distances of 20, 50 and 100 m from the foundation and its scour protection, and 3 stations along a transect perpendicular to the main profile (the reference profile) at the same distances. Macrozoobenthos surveys should be carried out in accordance with standard methodologies (HELCOM, CIEP), with respect to the taxonomic composition, abundance (with the exception of representatives of *Gymnolaemata* and *Hydrozoa*) and biomass of the organisms.

The first macrozoobenthos surveys should be carried out in April–June, provided that 3 months have elapsed since the completion of construction works at the last of the wind turbines selected for

monitoring. Subsequent surveys should be carried out in years 2 and 4 following the first monitoring surveys.

Surveys of the fouling flora and fauna should be carried out at 5 underwater structural elements of the wind turbines (the same ones around which the soft-bottom macrozoobenthos monitoring surveys will be carried out). At each surveyed structure, video (and/or photographic) documentation should be produced using an underwater vehicle, covering the submerged part of the wind turbine in vertical profile from the surface to the seabed (the depth range of the epiphytic flora may differ from the depth range of the epifauna). In addition, the scour protection layer around the 5 selected wind turbines should also be video-recorded.

The first surveys of fouling organisms should be carried out in May–June, in the year following completion of the installation of all wind turbines. Continuation of the monitoring surveys at the same wind turbines covered by monitoring, during the development of the new epifauna and epithytic flora assemblage, should be carried out in May–June, in years 2 and 4 following the first monitoring surveys.

10.2.8 Bat monitoring

The monitoring programme will be launched within three months of the OWF being commissioned. Following the completion of the construction works and commissioning of the project, three-year monitoring of chiropterofauna should be carried out in accordance with applicable guidelines. The monitoring should be based on automatic, broadband recording of the activity of these mammals on the turbine towers using recording devices, e.g. Pettersson D–500, Batcorder, Song Meter SM2BAT or Anabat SD2. The number of recording devices should be no less than 1 recorder per 5 turbines (rounded up to the nearest whole number). Since it is not possible to carry out direct mortality monitoring as at onshore turbines, the results of passive monitoring will be used to model the potential bat mortality rate based on recorded activity indicators. After the first year of operation, the system will be updated on the basis of in-situ measurement data.

10.3 Justification for the monitoring programme

The need to carry out the monitoring results from national legislation (Article 66 of the EIA Act). The proposed monitoring relates to the individual impacts of the proposed Project during the construction and operational phases. In particular, it takes into account the impact on nature conservation forms referred to in the Polish Nature Conservation Act (including the conservation objectives and subjects of Natura 2000 sites) and on the continuity of the ecological corridors that connect them. The programme also takes into account the available results of other monitoring surveys within the region, which may be of importance to the findings in this respect.

The monitoring programme has been selected on the basis of international experience resulting from the preparation of these types of projects, available scientific literature, recognised industry methodologies (including HELCOM guidelines), and experience from the implementation of offshore wind farms at other locations within the Baltic Sea and North Sea basins.

11 TECHNICAL SHORTCOMINGS AND GAPS IN CURRENT KNOWLEDGE

During the preparation of the environmental impact assessment and the transboundary analyses for the Baltic West offshore wind farm cluster (comprising the projects OWF 14.E.1, OWF 14.E.2, OWF 14.E.3 and OWF 14.E.4), a number of difficulties were encountered, resulting from technological and methodological conditions and gaps in the existing natural science knowledge of the PMA:

Application of the envelope approach: Owing to the long preparation and implementation cycle for offshore wind farms (often exceeding 10 years from the commencement of preparatory works to the commissioning of the installation) and the very dynamic technological progress in the offshore sector, it was not possible, at the report preparation stage, to specify a single, final type of turbine or foundation. Consequently, the envelope approach was applied in the analyses, assessing the maximum, most unfavourable variants of the technical parameters (including a structural height of up to 370 m above sea level, a rotor diameter of up to 350 m, and the maximum number of piles and substations).

Uneven historical baseline knowledge and the absence of formal guidelines for selected biotic groups:

- **Chiropterofauna (bats):** Knowledge of the bat activity over the open sea is historically fragmentary. An additional difficulty was the complete absence, in Poland, of binding legal and methodological regulations setting standards for surveying and assessing the impact of OWFs on bats in the marine environment. Consequently, the surveys were based on an adaptation of the 2011 GDEP guidelines (originally developed for onshore farms) and the EUROBATS guidelines. On top of this, there is no mathematical model in the current science that would enable any reliable prediction of bat mortality at sea based on activity indices recorded prior to the project implementation.
- **European herring gull (*Larus argentatus sensu lato*):** During field observations at sea, the visual identification of three morphologically similar species – the European herring gull (*Larus argentatus s.s.*), the yellow-legged gull (*L. cachinnans*) and Caspian gull (*L. michahellis*) – carries a high risk of error. For this reason, in the analyses, these taxa were treated jointly as *Larus argentatus sensu lato*, which is a conservative approach, taking into account the fact that the European herring gull is the dominant species in the region.

Gaps in the knowledge of the structure of the marine mammal population structure within the area of subpopulation overlap: Unlike offshore wind farms planned within the central and northern part of the PMA, the Baltic West area lies within a transitional zone, where two distinct harbour porpoise subpopulations mix – the Western Baltic subpopulation and the Baltic Proper subpopulation. Owing to the absence of precise data on the proportions and abundance of both subpopulations within this specific region, as well as in light of the fact that the results of dedicated OWF monitoring showed considerably higher detection levels than those determined under the historical SAMBAH project (2011–2013), it was not possible to mathematically calculate the precise percentage of the Baltic harbour porpoise population situated within the noise impact zone.

Technical limitations in the modelling of the collision risk of birds migrating at night: The recording of passage using the ornithological radar enabled the precise determination of the streams and altitude ceilings of nocturnal migration over the Baltic West area; however, under night-time conditions, these devices do not allow for the automatic identification of species of passing birds. The lack of a possibility to assign specific passage magnitudes to individual species made it impossible to define the required input parameters for standard mathematical collision risk models (e.g. the Band model), which precluded the development of a separate simulation-based collision model for nocturnal migrants.

12 CONCLUSIONS

In presenting the conclusions, it should be emphasised that the detailed characterisation of environmental components, based on survey results and available literature, as well as the comprehensive environmental impact assessment, were carried out at the stage of the national environmental impact assessment procedure and are described in the EIA Reports for the individual wind farms comprising the Baltic West Area.

This document, prepared in accordance with the requirements of the Espoo Convention, focuses on the identification and assessment of potential transboundary impacts. At the same time, all issues raised during the course of the procedure have been taken into account and analysed, to the extent relevant to the assessment of possible transboundary effects.

12.1 Transboundary environmental impact: Sweden

The Swedish side presented its position in a letter dated 15 September 2025, forwarding at the same time the positions of domestic entities interested in the course of the transboundary environmental impact assessment.

The table below [Table 26] sets out the issues raised by the Swedish side, together with information on how they have been addressed in the environmental impact assessment process and in the Espoo Report.

Table 26 Issues raised by the Swedish side, together with information on how they have been addressed in the environmental impact assessment process and in the Espoo Report

ISSUES	HOW ADDRESSED IN THE ENVIRONMENTAL IMPACT ASSESSMENT
impact on the conservation subjects of Natura 2000 sites located on the Swedish side, with particular attention to the Hoburgs Bank och Midsjöbankarna SE0330308 Natura 2000 site	This issue has been addressed: • in Chapter 8.3.6 of the ESPOO Report • in Sections 5.3 and 8.10 of the EIA Reports
	The issue of the project's potential impact on the conservation subjects of Swedish Natura 2000 sites, with particular attention to the *Hoburgs Bank och Midsjöbankarna (SE0330308) site*, was subjected to detailed assessment as part of the environmental impact assessment. Owing to the considerable distance of this site from the proposed farms (over 100 km), direct impacts on habitats were excluded, and any effect of the increase in suspended solid concentration and spatial disturbance was assessed as insignificant. Furthermore, this site is located entirely beyond the projected range of the harbour porpoise's behavioural response. It may fall only to a small extent within the zone of behavioural response of swim-bladder-bearing fish (constituting a potential food source), and consequently the impact of underwater noise was also classified as negligible. The implementation of the Project will not adversely affect the conservation subjects or the integrity of this Swedish Natura 2000 site

ISSUES	HOW ADDRESSED IN THE ENVIRONMENTAL IMPACT ASSESSMENT
impact on fish stocks and fisheries during the construction, operation and decommissioning of the wind farm, as well as taking into account cumulative impacts with other proposed and existing wind farms in the Baltic Sea	This issue has been addressed: • in Chapters 8.1, 8.6 and 8.10 of the ESPOO Report • in Sections 3.9, 5.1, 5.2, 8.6 and 8.10 of the EIA Reports
	This issue was assessed in detail, and the occurrence of significant transboundary impacts on Swedish territory was ultimately entirely excluded, both across all project phases and in cumulative terms. With respect to fish stocks, the potential risk of hearing organ damage during the construction phase will be minimised to the greatest extent possible thanks to the implementation of advanced noise mitigation systems, such as, for example, a double bubble curtain. Any behavioural changes (flight responses) in fish will be a solely short-term and reversible phenomenon. During the operational phase, the adverse impact of the farm at the population level will be negligible, and the appearance of new, hard structures on the seabed may even trigger a local, positive 'artificial reef' effect. The impacts during the decommissioning phase, in turn, will be similar to those of the construction stage, however their scale and intensity will be considerably smaller, which will allow for the gradual biological succession and restoration of the natural ecological functions of seabed habitats. With respect to fisheries, in turn, detailed analysis of satellite VMS data for the years 2020–2025 confirmed the negligible presence of foreign fishing vessels within the analysed region. Since this sea area is characterised by marginal significance even for domestic fishing (accounting for only around 1% of the volume and value of Polish Baltic catches), the possibility of transboundary impacts on the fishing markets of neighbouring states, including the Swedish market, has been entirely excluded. At the same time, once the farm's life cycle has ended, the dismantling of the structures during the decommissioning phase will free up the sea area, once again making this region available for unrestricted fishing.
impact on migratory fish species, including the European eel (*Anguilla anguilla*), Atlantic salmon (*Salmo salar*) and sea trout (*Salmo trutta*)	This issue has been addressed: • in Chapters 8.3.1 and 8.4 of the Espoo Report • in Sections 3.12, 3.9, 5.1, 8.4, 8.6 and 8.10 of the EIA Reports
	As part of the environmental impact assessment, comprehensive, year-round ichthyofauna inventories were carried out (4 survey campaigns covering pelagic and demersal catches and hydroacoustic soundings). As a result of these surveys, the European eel and sea trout were not recorded in any of the surveyed water bodies (14.E.1–14.E.4). Atlantic salmon, in turn, was found only in trace amounts – solely during pelagic catches within the 14.E.2 farm area. Owing to the complete absence, or only marginal presence, of the migratory species mentioned, the Baltic West area does not constitute a key habitat for them. Any impacts on these taxa (including the risk of creation of a physical barrier) were classified as negligible or low, which allowed the occurrence of significant transboundary impacts to be entirely excluded.
the effects of the spread of alien invasive species, such as the round goby (*Neogobius melanostomus*), in connection with the implementation of the Project	This issue has been addressed: • in Chapter 8.3.1 of the ESPOO Report • in Sections 5.1.2, 5.2.2 and 8.6 of the EIA Reports
	This issue was analysed in detail as part of the environmental impact assessment, and the risk of colonisation and spread by the invasive round goby was considered unlikely and insignificant. The excessive depth of the sea area entirely precludes reproduction of the species, which spawns exclusively in shallows (0.2–1.5 m). In addition to this, the expansion is blocked by the

ISSUES	HOW ADDRESSED IN THE ENVIRONMENTAL IMPACT ASSESSMENT
	fish's limited mobility, since adult individuals migrate a maximum of 100 metres, and the absence of planktonic larval stages precludes their passive transport by sea currents. Consequently, the effective colonisation of the deep-water OWF structures by individuals from distant coastal areas is impossible. This means that the implementation of the Project will not contribute to the spread of this alien invasive species into the territories of neighbouring states.
impact during construction and decommissioning on abiotic elements of the marine environment in the form of water turbidity, an increased quantity of nutrients, the dispersion of any toxins from bottom material, and intensification of vessel traffic	This issue has been addressed: • in Chapter 8.2.1 of the ESPOO Report • in Sections 5.1.1.1.2, 5.1.3.1.2, 8.3 and 8.10.3 of the EIA Reports
	The impact of the construction and decommissioning phases on water turbidity, the release of nutrients and toxins from bottom sediments, and the intensification of vessel traffic has been assessed in detail. Comprehensive analyses clearly showed that these impacts will be solely local in nature (limited to the immediate area of the works), short-term and reversible. Their significance was classified as negligible or low, which allowed the risk of significant transboundary impacts to be entirely excluded.
presentation of impacts on wind, waves and sea currents during the construction stage (e.g. during drilling of foundation holes or the laying of cables) and during operation	This issue has been addressed: • in Chapter 8.1 of the ESPOO Report • in Sections 5.1.1, 5.1.2, 8.1 and 8.2 of the EIA Reports
	The issue of the impact on hydrodynamic conditions (wind, currents and wave action) was subject to an assessment in the report. The analyses showed that the impact of the OWF, both during the construction stage (interference with the seabed) and the operational stage (presence of above-water and underwater structures), is limited solely to local areas around each individual turbine and substation. This results from the small size of the structures themselves in relation to the relatively large distances between them (approximately 1 km). Any disturbances to sea currents, wave action or wind flow will be strictly point-like in nature, and consequently the risk of transboundary impacts on Swedish territory has been entirely excluded (their significance was classified as negligible).
a description of the effects of the cumulative impact of offshore wind turbines located in the Baltic Sea, including the Gulf of Bothnia, on processes that occur within the marine environment, including the mixing of water layers and the exchange of greenhouse gases and oxygen between the sediment, the water column and the atmosphere	This issue has been addressed: • in Chapters 8.1 and 8.2.1 of the ESPOO Report • in Sections 5.1.1, 5.1.2, 8.1, 8.2, 8.3 and 8.10 of the EIA Reports
	This issue was assessed as part of the analysis of the impact on hydrodynamic conditions and water quality. The results showed that the impact of offshore wind farms on currents and wave action is limited solely to local zones around the individual foundations, resulting from their small size in relation to the large distances between them (approximately 1 km). Consequently, the presence of the infrastructure will not disrupt the macro-scale movement and mixing of water layers within the Baltic Sea, including the Gulf of Bothnia. Phenomena such as gas exchange (including oxygen) between the sediment, the water column and the atmosphere may undergo only point-like and short-term modifications during construction works (e.g. temporarily improved oxygenation of disturbed sediments). However, these changes are strictly local and reversible in nature, and in no way do they threaten the ecological equilibrium. In cumulative terms, the possibility of measurable transboundary impacts on macro-scale physicochemical and hydrodynamic

ISSUES	HOW ADDRESSED IN THE ENVIRONMENTAL IMPACT ASSESSMENT
	processes occurring within the marine environment has been entirely excluded.
a description of the cumulative impact with existing, planned or anticipated activities in the Baltic Sea in the context of compliance with national and EU legislation, including the Habitats Directive and the Marine Strategy Framework Directive	This issue has been addressed: • in Chapters 7 and 8.4 of the ESPOO Report • in Sections 1.5, 5.3 and 8.10 of the EIA Reports
	This issue was analysed in detail. The analysis took into account the overlap of impacts of the entire Baltic West complex with other implemented, ongoing and proposed Projects within this region of the Baltic Sea (including with respect to underwater noise, the barrier effect for avifauna, and collision risk). The entire assessment was carried out in direct connection with the environmental objectives defined at national and EU level. The analyses clearly take into account the requirements and standards arising from, among others, the Marine Strategy Framework Directive, the Water Framework Directive, the Birds Directive and the Habitats Directive. In accordance with the guidelines of the Habitats Directive, an assessment of the potential impact on the conservation subjects of Natura 2000 sites was carried out. This took into account cumulative links with other projects and plans, ultimately excluding significant adverse impact on the coherence and integrity of these sites.
an analysis of the impact on the Baltic population of harbour porpoise, also in cumulative terms, taking into account the following threats: continuous underwater noise caused by commercial and recreational shipping; impulsive underwater noise from seismic surveys, seal scarers, piling and underwater explosions; contamination with hazardous substances and pollutants; bycatch in set nets at fishing grounds; declining availability and quality of prey caused by overfishing, eutrophication and pollution; carried out on the basis of mapping the presence of harbour porpoises within the investment area over a period of at least three years	This issue has been addressed: • in Chapters 8.3 and 8.4 of the ESPOO Report • in Sections 3.12, 5.1.1.3.6, 5.1.2.10.4, 5.3 and 8.10.2 of the EIA Reports
	This issue was comprehensively analysed in the environmental impact assessment (including in model studies for cumulative scenarios), and the anticipated impact on the Baltic harbour porpoise population was assessed as insignificant. The assessment was based on multi-season field surveys, comprising: continuous acoustic monitoring using F-POD detectors carried out in 2025–2026, visual observations from vessels carried out on an opportunistic basis (during seabird survey campaigns) in 2022–2023, and aerial surveys using a digital video recording system (DAVIS), begun in January 2026 and still ongoing, during which the presence of marine mammals is additionally recorded and analysed. These data were cross-checked against the long-term results of the SAMBAH, State Environmental Monitoring (SEM) and MSIOUG projects, obtaining a complete picture of harbour porpoise activity. With respect to the individual threats: Impulsive noise – the application of rigorous piling noise mitigation systems (e.g. CRS+DBBC) will reduce the range of hearing damage to only 100 m, preventing lasting population-level injuries. To further protect harbour

ISSUES	HOW ADDRESSED IN THE ENVIRONMENTAL IMPACT ASSESSMENT
	porpoises, the Investor does not plan to use acoustic deterrent devices (ADD). Any underwater explosions (unexploded ordnance) and seismic surveys are not part of the assessed projects and will be subject to separate pre-investment procedures. Continuous underwater noise – noise from vessels servicing the OWF will have parameters similar to the existing background of commercial cargo shipping in this region. It will cause only short-term and spatially limited avoidance responses in animals, restricted to the immediate vicinity of the operating units. Contamination and pollution – the release of toxins was considered negligible, owing to the cleanliness of the sandy sediments within the project region and the implementation of strict procedures preventing operational leaks. Bycatch and the food base – closing or restricting access to the OWF sea area for commercial fishing (including set nets) will eliminate the risk of harbour porpoise bycatch within this area. Additionally, the development of a so-called 'artificial reef' on the structures will attract fish, creating a safe foraging ground for harbour porpoises, excluded from fishing pressure (a refuge effect).
presentation of the project's impact on birds that use (and can be predicted to continue using) the given area, based on current knowledge of the hazards posed to birds by offshore wind farms and surveys carried out from vessels and aircraft, and telemetry surveys with GPS transmitters providing the best data	This issue has been addressed: • in Chapters 8.3.2, 8.3.3 and 8.4.2 of the ESPOO Report • in Sections 3.12, 5.1.1, 5.1.2, 6.6, 8.8 and 8.10.4 of the EIA Reports
	The impact of the project on birds was assessed in detail on the basis of an extensive data package. The identification was based on a full annual cycle of the Applicant's own visual and radar observations from vessels, supplemented with digital aerial photogrammetry (aircraft-based counts). The assessment of the barrier effect and habitat loss additionally drew on the latest satellite transmitter studies available in the scientific literature for key species (including the long-tailed duck and red-throated diver). This made it possible to precisely determine their fidelity to wintering grounds and the actual ranges of OWF avoidance. The field data collected, supplemented with literature telemetry and behavioural data, were used to carry out advanced modelling of the cumulative collision risk and barrier effect for OWFs in the Baltic. The use of the best available survey methods (vessels, aircraft) combined with current scientific knowledge (telemetry) enabled a reliable and objective assessment, which ultimately showed that transboundary impacts on birds will not be significant, and their level was classified as ranging from negligible to moderate.
an analysis of collision risk, barrier effect and avoidance effect with respect to birds, taking into account other existing and potential wind farms in the region;	This issue has been addressed: • in Chapter 8.4.2 of the ESPOO Report • in Sections 5.1.1, 5.1.2, 6.6, 8.8, 8.10.1 and 8.10.4 of the EIA Reports and in Appendix 4 to the EIA Report
	As part of the environmental impact assessment (including in particular in the chapter devoted to cumulative impacts), a comprehensive analysis of collision risk, the barrier effect and the avoidance effect with respect to birds was carried out. This analysis fully takes into account both the proposed Project and the remaining existing and potential (at various stages of planning or implementation) offshore wind farms in the region. A total of 49

ISSUES	HOW ADDRESSED IN THE ENVIRONMENTAL IMPACT ASSESSMENT
	offshore wind farm projects in the Baltic were included in the mathematical modelling of the cumulative collision risk, while the modelling of the cumulative barrier effect and habitat displacement covered 14 neighbouring wind farms situated along the main migration routes (to the east of the Baltic West area). The results of the analyses showed that the forced route change will lengthen the migration distance for most species by less than 10% (when avoiding solely the Baltic West complex itself, this value is below 2%). The cumulative collision risk for the vast majority of birds was assessed as negligible or low (it was classified as moderate only for the common scoter, little gull and crane). Taken as a whole, the possibility of significant transboundary impacts on avifauna was excluded.
the cumulative impact of the wind farm, together with other farms located in the immediate vicinity and other activities relating to shipping, fisheries and mining, on the status of bird populations occurring within the OWF area	This issue has been addressed: • in Chapter 8.4.2 of the ESPOO Report • in Sections 5.1.1, 5.1.2, 6.6, 8.8, 8.10.1 and 8.10.4 of the EIA Reports and in Appendix 4 to the EIA Reports
	This issue was assessed in detail, and the results of comprehensive analyses (including advanced mathematical modelling) excluded the possibility of significant adverse cumulative impacts on bird populations. The modelling of the cumulative barrier effect (covering 14 neighbouring farms) and cumulative collision risk (for 49 farms in the Baltic) was carried out. Owing to the considerable spatial spread of the projects, the impact of all facilities on the same streams of migrating birds was assessed as unlikely. The cumulative physical barrier effect will lengthen the migration distance for most species by less than 10% (when avoiding solely the Baltic West complex itself, this value is below 2%), without drastically increasing their energy expenditure. The cumulative collision risk was assessed at the population level as negligible or low, and was classified as moderate only for the common scoter, crane and little gull. With respect to shipping and commercial fishing during the operational phase, safety zones will be established around the individual structures, which will, in practice, eliminate regular, large-scale transit shipping from this area. Commercial fishing, in turn, may be conditionally permitted within this region (partially or fully). This will reduce the human pressure and vessel noise in relation to the current state and will allow a safe zone (a so-called refuge effect) rich in food resources to be developed. Although birds may make only limited use of this food base owing to their natural avoidance of tall turbines, the mere restriction of maritime traffic will significantly reduce the stress-inducing nature of the environment, and the movement of small service vessels will be of negligible significance. With respect to the issue of mining, in accordance with the Polish MSP, the primary function of the sea area is the generation of renewable energy, and any mining activity is entirely subordinate to this and significantly restricted. This entirely eliminates the risk of simultaneous, adverse cumulative impacts from the mining sector on the marine environment and the avifauna inhabiting it.
carrying out surveys using radar, in order to capture the scale, diversity and variability of mass bird (and probably bat) migration, taking into account	This issue has been addressed: • in Chapters 8.3, 8.4.2 and 10 of the ESPOO Report • in Sections 3.12, 5.1.1, 5.1.2, 6.6, 8.8, 8.10.4, 11.6 and 11.8 of the EIA Reports and in Appendix 4 to the EIA Reports

ISSUES	HOW ADDRESSED IN THE ENVIRONMENTAL IMPACT ASSESSMENT
weather data, and to provide forecasts of annual collision statistics for migratory birds	This issue was analysed in detail. Bird migration dynamics were determined on the basis of multi-season radar surveys (vertical and horizontal radars). The advanced modelling of the bird collision risk directly took into account local weather data and their effect on flight altitude and avoidance behaviour. The calculated annual collision forecasts in cumulative terms (for 49 farms) showed a negligible/low risk for most species. Bat migration, in turn, was identified using stationary and mobile ultrasonic recorders. The collision risk will further be verified during the operational phase through dedicated monitoring programmes. For migratory birds, automated detection systems based on radars and cameras mounted on the turbines (WTGs), substations, nacelles or buoys will be applied. The monitoring of the bat activity, on the other hand, will take place using broadband ultrasound recording devices installed directly on the turbine towers. Subsequently, as part of the analysis of the results obtained from the recording devices, an assessment of their potential mortality will be carried out.

12.2 Transboundary environmental impact: Denmark

The Danish side presented its position in a letter dated 11 September 2025, forwarding at the same time the positions of domestic entities interested in the course of the transboundary environmental impact assessment.

The table below [Table 27] sets out the issues raised by the Danish side, together with information on how they have been addressed in the environmental impact assessment process and in the Espoo Report.

Table 27 Issues raised by the Danish side, together with information on how they have been addressed in the environmental impact assessment process and in the Espoo Report

ISSUES	HOW ADDRESSED IN THE ENVIRONMENTAL IMPACT ASSESSMENT
presentation of cumulative impacts with respect to migratory birds, seabirds and marine mammals (including, among others, the long-tailed duck, divers, harbour porpoise, grey seal and harbour seal), migratory bats, and maritime safety, which may result from the expansion of offshore wind energy, with particular attention to the existing Kriegers Flak wind farm, the OWF: Kriegers Flak II Nord and Syd, and Energiø Bornholm, the offshore wind farm areas implemented as part of the Bornholm energy island with a capacity of at least 3 GW and the possibility of a capacity increase of 0.8 GW, and wind turbine heights of up to 330 m	This issue has been addressed: • in Chapter 8.4 of the ESPOO Report • in Sections 5.1, 6.6, 8.2, 8.7, 8.8, 8.9, 8.10, 8.10.1, 8.10.2 and 8.10.4 of the EIA Reports and in Annexes 3 and 4 to the EIA Reports
	This issue was analysed in cumulative terms for the Baltic (taking into account Danish projects, including Kriegers Flak and Bornholm). With respect to birds, the cumulative collision risk was assessed as negligible or low, resulting from strong avoidance of the farms and the preference of long-tailed ducks for shallower waters, and, in the case of divers, from their strong avoidance response and the fact that they move mainly at a safe altitude of up to 20 m above the water, i.e. below the rotor working zone. The cumulative barrier effect will lengthen routes for most of the species analysed (including divers) by less than 10%, which will not adversely affect the energy budget of migrants. It should be noted, however, that divers show extreme avoidance of operating OWFs (even within a radius of up to 15 km) and show no capacity for habituation, and consequently the cumulative

ISSUES	HOW ADDRESSED IN THE ENVIRONMENTAL IMPACT ASSESSMENT
	phenomenon of habitat loss (displacement) was considered regionally important for them. Nevertheless, thanks to the high mobility of these birds and the wide availability of extensive, undeveloped Baltic waters, this phenomenon will not lead to a threat to the stability of their biogeographic populations. For marine mammals, mandatory noise mitigation (e.g. CRS+DBBC) eliminates the cumulative risk of hearing damage (range <200 m). Only transient, cumulative behavioural responses (avoidance) will occur, but without any impact on populations. For bats, the cumulative barrier effect and collision risk were assessed as ranging from low to moderate. This results from the negligible intensity of bat migration, which is limited solely to a short autumn peak. Shipping safety was analysed taking into account the fact that clusters of farms will create barriers and force route corrections (e.g. for fisheries). The risk will, however, be minimised by mandatory mitigation measures (including navigational assessments evaluating the impact on vessel safety and VTS systems), which ultimately reduces the significance of the impacts to low.
carrying out surveys through the appropriate placement of detectors and acoustic equipment enabling the identification of bird and bat species	This issue has been addressed: • in Chapters 4.2.2, 8.3.2 and 8.3.4 of the ESPOO Report • in Section 3.12 of the EIA Reports and in Appendix 1 to the EIA Reports
	The methodology applied for migratory bird surveys comprised visual observations from vessels (assisted by a laser rangefinder) and tracking of passage using vertical and horizontal radars, as well as acoustic recording, which was used for the precise identification of species on the basis of their vocalisations emitted during spring and autumn migrations. Broadband ultrasonic recorders (e.g. Wildlife Acoustics) were used to detect bats; they were mounted on stationary buoys and on the survey vessel. In order to guarantee the highest quality of recordings and error-free species identification, the microphones on the vessel were mounted in specially selected locations – free of detection field restrictions, away from water splashes and sources of acoustic and electromagnetic interference. Thanks to the appropriate placement of the detectors, high-quality sound material was obtained, enabling reliable, two-stage bat species identification (automatic analysis and manual verification).
preparing analyses based on EUROCONTROL guidelines in order to determine the potential impact of the offshore wind farm on Danish military radar installations	This issue has been addressed: • in Chapter 8.1 of the ESPOO Report • in Sections 2.7, 3.9, 5.1.1, 5.1.2 and 8 of the EIA Reports
	As part of the environmental impact assessment procedure, due to the statutory requirement to ensure full public participation and the transparency of documentation, it is not possible to disclose or analyse detailed technical and geodetic data relating to military radar systems. These data are subject to a confidentiality clause for reasons of state security and defence. For this reason, a dedicated mechanism operates within the project process for examining and determining the conditions for project implementation with respect to broadly understood defence issues. Analyses in this regard are carried out outside the public EIA procedure, at the stage of dedicated technical expert assessments carried out before the construction permit is

ISSUES	HOW ADDRESSED IN THE ENVIRONMENTAL IMPACT ASSESSMENT
	obtained. Considerations and agreements regarding any potential impact on military radar infrastructure should take place within the appropriate NATO structures or through direct intergovernmental arrangements, conducted solely between the authorised entities responsible for the defence of both States (the Republic of Poland and the Kingdom of Denmark). The Applicant is required to carry out such analyses and to agree them with the competent military authorities. If a risk of interference is identified, the Applicant will implement agreed mitigation or compensatory measures, eliminating the interference at source.

12.3 Transboundary environmental impact: Germany

The German side presented its position in a letter dated 12 September 2025, forwarding at the same time the positions of domestic entities interested in the course of the transboundary environmental impact assessment.

The table below [Table 28] sets out the issues raised by the German side, together with information on how they have been addressed in the environmental impact assessment process and in the Espoo Report.

Table 28 Issues raised by the German side, together with information on how they have been addressed in the environmental impact assessment process and in the Espoo Report

ISSUES	HOW ADDRESSED IN THE ENVIRONMENTAL IMPACT ASSESSMENT
an analysis of the effects of impacts on migratory birds in the context of collision risk, barrier effect and avoidance effect, taking into account other existing and potential offshore wind farms, including within the German EEZ, carried out also on the basis of vertical radar data enabling the recording of migration intensity (daytime and night-time);	This issue has been addressed: • in Chapters 8.3.2 and 8.4.2 of the ESPOO Report • in Sections 3.12, 5.1.1, 5.1.2, 6.6, 8.8, 8.10.1 and 8.10.4 of the EIA Reports and Appendix 4 to the EIA Reports
	In accordance with the request, the survey methodology included tracking of passage using vertical radar. This tool provided key information on flight altitudes and the intensity of daytime and night-time bird migration over the sea area. These data were supplemented with horizontal radar readings, visual observations with a laser rangefinder, and acoustic monitoring. The report analyses in detail the collision risk, the avoidance (barrier) phenomenon, and the direct impact on migratory birds. The analyses showed that most birds migrating during the day fly at low altitudes (below the rotor working zone), thanks to which the significance of impacts during the implementation and operational phases was assessed as ranging from negligible to moderate, depending on the species analysed. The phenomenon of spatial disturbance (barrier effect) and bird collision risk was subjected to extensive analysis in cumulative terms. The assessment takes into account the overlap of impacts of all four farms proposed within this region (14.E.1–14.E.4) with other implemented, existing and proposed offshore wind energy projects within the Baltic Sea region.

ISSUES	HOW ADDRESSED IN THE ENVIRONMENTAL IMPACT ASSESSMENT
presentation of an appropriate model for determining the collision risk of migratory and passage birds, taking into account parameters such as: meteorological data, flight altitude, migration periods (daytime/night-time migration), object visibility and species-specific behaviour (e.g. obstacle avoidance, coping with specific weather conditions), together with the presentation of specific preventive and mitigating measures (e.g. the application of temporary shutdown of the facility in the event of a significant increase in collision risk, including a determination of the threshold for applying this measure);	This issue has been addressed: • in Chapters 8.4.2, 10 and 11 of the ESPOO Report • in Sections 5.1.1, 5.1.2, 6.6, 8.8, 8.10.4, 10.1.4 and 11.6 of the EIA Reports and in Appendix 4 to the EIA Reports)
	This issue was analysed in detail using the advanced mathematical collision risk modelling. An avoidance rate of 99% was used in the calculations for most migratory species, and 83% for the crane. The application of a reduced rate for this species results from the fact that, despite the relatively low overall number of passages over the surveyed sea area, almost all the individuals recorded (from 89% to 100%) moved within the higher parts of the rotor working zone (above 20 m above sea level), which significantly increased their potential exposure to collisions. The analysis directly takes into account weather parameters and visibility (including the behaviour of the species analysed under conditions of limited visibility: at night, in fog and during precipitation). It was noted, however, that birds' response to poor atmospheric conditions is highly complex and, contrary to earlier assumptions, does not always result in a lower flight altitude, but may sometimes lead to an increase in the altitude in search of more favourable wind above the clouds. At the same time, as explained in detail in the chapter on knowledge gaps, the inability to visually identify, by species, birds recorded at night by radar made it impossible to reliably establish the input parameters (passage streams of specific species) and to develop a separate collision risk model for the unidentified group of nocturnal migrants. In order to minimise the collision risk, the implementation of mitigation measures has been proposed. The main measure will be a round-the-clock automated detection system, based, among other things, on ornithological radars and cameras, used to monitor passages. The reactive element of this system (so-called curtailment, involving the temporary slowing of turbines), dedicated to crane protection, is conditional in nature and will be implemented only if the results of post-investment operational monitoring indicate such a need – i.e. confirm the intensive migration of this species at the collision height (defined as a passage stream reaching or exceeding 1% of the crane's annual biogeographic population) or where the modelled collision mortality exceeds the threshold of 1% additional annual mortality (in accordance with the criterion of the ORNIS Committee), with the final necessity and algorithm for shutdowns to be agreed with the RDEP in Szczecin. Additional preventive measures include reducing the project's night-time lighting to the necessary minimum, in particular reducing the intensity of upward-directed lights.
carrying out surveys covering: in the case of migratory birds – surveying at least two consecutive full annual cycles before construction begins, through monthly bird counts from on board vessels and additional digital counting of birds in flight (video/photographs), and in the case of migratory birds – carrying out surveys over at least two consecutive full years before construction begins [cf. BSH, 2013];	This issue has been addressed: • in Chapters 4.2.2, 8.3.2 and 8.3.3 of the ESPOO Report • in Sections 3.12, 5.1.1, 5.1.2, 11.5 and 11.6 of the EIA Reports and in Appendix 1 to the EIA Reports
	In the case of seabirds, a total of two years of pre-investment surveys are being carried out. The first full annual cycle (from June 2022 to May 2023) comprised an inventory carried out from research vessels. During this period, as many as 24 full survey campaigns were carried out, ensuring a frequency of 1–2 cruises per month. In order to strengthen the reliability of the data at the spatial level and to meet the highest survey standards (including the German StUK4 guidelines), the Investor implemented an additional year of inventory (begun in January 2026), carried out from an aircraft using a high-resolution digital aerial photogrammetry system (DAVIS).

ISSUES	HOW ADDRESSED IN THE ENVIRONMENTAL IMPACT ASSESSMENT
	In the case of migratory birds, a dedicated, multi-season programme was carried out at the turn of 2025/2026 (covering the key spring migration, autumn migration and winter dispersal periods). An advanced combination of methods was used: vertical and horizontal radars (tracking the intensity of passages, directions and flight altitude in 3D round the clock), acoustic recording, and visual observations assisted by laser rangefinders. The extensive information package collected in this way – combining varied pre-investment survey techniques (including visual monitoring from vessels, digital aerial photogrammetry, and radar remote sensing) and cross-checked against the latest satellite studies [*Kleinschmidt et al., 2022*] for key barrier-affected species (including the red-throated diver) – fully addressed any potential information gaps. This allowed for the implementation of highly precautionary estimation models, which guarantee the high-quality temporal and spatial resolution, allowing for a reliable assessment of the transboundary and cumulative collision risk.
presentation of a post-investment monitoring methodology for migratory birds that enables the direct detection of collisions (e.g. through the use of vibration sensors) and defining the criteria for effective collision avoidance;	This issue has been addressed: • in Chapter 10.2.4 of the ESPOO Report • in Section 11.6 of the EIA Reports
	In accordance with the request, collision monitoring has been proposed; however, for technological reasons, it has been based on indirect methods. The analysis showed that none of the direct collision monitoring methods for offshore wind farms (e.g. impact sensors) has yet reached a sufficient level of technological readiness (TRL 8–9 required). Furthermore, searching for victims on the water is pointless, since they quickly disappear as a result of currents and predators. An indirect approach has been adopted – radars and cameras. A round-the-clock, automated tracking system will be implemented, based on ornithological radars (recording bird trajectories that break off abruptly within the rotor zone) and synchronised visual and thermal imaging cameras mounted directly on the turbines. The events recorded will be used for an advanced estimation of actual mortality. As a strict criterion for the assessment of the significance of impact (the threshold for effective avoidance), 1% additional annual mortality for the biogeographic population of the individual species has been adopted, which is fully consistent with the methodology of the EU ORNIS Committee.
an analysis of the effects of impacts on seabird populations and resting birds (with particular attention to grebes, divers, sea ducks and auks) in the context of the avoidance effect,	This issue has been addressed: • in Chapter 8.3.2, 8.3.3, 8.4 of the ESPOO Report • in Sections 3.12, 5.1.1, 5.1.2, 5.3, 6.6, 8.8, 8.10.1 and 8.10.4 of the EIA Reports and in Annexes 1 and 4 to the EIA Reports

ISSUES	HOW ADDRESSED IN THE ENVIRONMENTAL IMPACT ASSESSMENT
taking into account other existing and potential wind farms (in particular the four proposed offshore wind farms (OWFs): 14.E.1, 14.E.2, 14.E.3, 14.E.4 and the proposed wind farms within the German EEZ), in particular with respect to the protected areas: NSG Pommersche Bucht – Rönnebank and Pommersche Bucht, carried out on the basis of data obtained from observations from vessels and aircraft;	In accordance with the request, a detailed assessment was carried out for marine avifauna. The assessment was based on comprehensive, year-round inventories carried out from research vessels, which were subsequently supplemented with an additional year of large-scale aerial surveys using high-resolution digital photogrammetry (the DAVIS system). On the basis of these direct observations, it was found, among other things, that grebes occurred in extremely low numbers (a total of fewer than 20 individuals per year across the entire Baltic West area), and thus any deterrence of them was analysed solely in terms of Natura 2000 network coherence, without calculating cumulative losses at the population level. In order to determine the scale of displacement and the range of the barrier effect, on the other hand, specialist scientific literature was drawn upon. Using documented survey results from other already operating offshore wind farms, it was confirmed that divers avoid power plants within a radius of up to 15 km, while sea ducks and auks show an avoidance response at a distance of up to approximately 4 km. In analysing the impact on the *NSG Pommersche Bucht – Rönnebank and SPA Pommersche Bucht* sites, the conservation subjects of these areas were subjected to a detailed assessment. Owing to its considerable depths, the Baltic West area is characterised by low foraging attractiveness. Sea ducks and divers displaced from it will move to neighbouring, shallower water bodies with a richer food base – including precisely the aforementioned German protected areas. Owing to this, the impact of the Projects on the conservation objectives and integrity of these German sites was ultimately classified as low or negligible. The phenomenon of habitat loss (displacement) was analysed under a cumulative scenario, taking into account the combined operation of the 4 farms within the Baltic West area and farms located, among other places, within the German EEZ (such as Baltic Eagle, Windanker, Wikinger, Arkona, and Arcadia Ost 1). Although the cumulative impact resulting from the displacement was considered regionally important for divers and sea ducks, the high mobility of these species and the availability of extensive, undeveloped Baltic waters mean that no measurable threat to the stability of their biogeographic populations will occur.
an analysis of the effects of impacts on bats in the context of the risk of collision with turbine blades and injury/death caused by barotrauma, also in cumulative terms, carried out on the basis of continuous acoustic monitoring during the spring and autumn migration periods, as well as taking into account the results of acoustic surveys using high-quality ultrasonic equipment (Avisoft, Batcorder) at a minimum of 10 buoys distributed within the project area in two rows parallel to the coastline, so as to represent the full length of the project area, over a period of two to three years;	This issue has been addressed: • in Chapters 8.3.4, 8.4 and 10.2.8 of the ESPOO Report • in Sections 3.12, 5.1.1, 5.1.2, 6.6, 8.9, 11.8 of the EIA Reports and in Appendix 1 to the EIA Reports As part of the impact assessment, the risk of direct collision with operating turbine blades and of injury and mortality resulting from barotrauma (pressure shock caused by sudden drops in air pressure behind the rotating rotor blades) was analysed in detail. These phenomena were analysed taking into account the cumulative and transboundary nature of the bat migration. The hybrid methodology applied, based on stationary listening points (a buoy and points on the vessel) and surveys along mobile transects from the vessel (over 53 km in length), was fully sufficient and representative. The methodology was based on national guidelines and the international EUROBATS standards. Thanks to this spatial coverage, the results obtained provided a complete data set with an appropriate temporal and spatial resolution, necessary for a reliable assessment of the risk to chiropterofauna. The entire Baltic West area, together with the 2 nautical mile buffer zone, was surveyed. The impact assessment also took into

ISSUES	HOW ADDRESSED IN THE ENVIRONMENTAL IMPACT ASSESSMENT
	account the results of surveys for the Baltic Pipe pipeline, located closest to the Baltic West area.
presentation of a post-investment monitoring methodology for bats, taking into account their monitoring (over a period of 2 years – from the beginning of April to mid-June and from the beginning of August to mid-November) at nacelle height, together with a second, synchronously operating recording system, placed on the tower just above the lowest point of the rotor of the offshore wind turbine, and preventing a significant increase in the risk of collisions (e.g. through temporary shutdowns during periods of high bat activity, the application of appropriate solutions relating to the lighting of the structure);	This issue has been addressed: • in Chapters 4.10, 8.3.4, 8.4.3 and 10.2.8 of the ESPOO Report • in Sections 5.1.2, 10.1.4 and 11.8 of the EIA Reports
	The post-investment monitoring will be carried out for 3 years (instead of the requested 2 years), using broadband ultrasonic recorders (e.g. Pettersson D-500, Batcorder) installed directly on the turbine towers, at a density of at least 1 device per 5 turbines. Night-time lighting of the farms will be reduced to the absolute minimum required by safety regulations. The intensity of upward-directed light will be reduced, which will minimise the phenomenon of attracting insects and the bats foraging on them. Due to the negligible intensity of the bat migration in this region (only a short autumn peak), no top-down shutdown systems have been proposed at the current stage. However, if the 3-year monitoring during the operational phase shows a significant increase in the bat activity or mortality, additional mitigation measures will be implemented.
the impact of underwater impulsive noise on marine mammals, in particular on the protected areas *Pommersche Bucht mit Oderbank (DE1652301) and Pommersche Bucht (DE1552401)*, carried out on the basis of the noise protection concept of the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety [BMU, 2013], with the presentation of noise modelling taking into account areas exposed to noise above 160 dB SEL and 140 dB SEL (in accordance with the requirements arising from the measurement regulations concerning the quantitative determination of the effectiveness of acoustic insulation measures (report No. 100004/05), available on the BSH website (www.bsh.de);	This issue has been addressed: • in Chapters 8.3.5, 8.4.1, 8.4.4, 10.2.2 of the ESPOO Report • in Sections 5.1.1, 5.3, 6.6, 8.7, 8.10.2, 10.1, 11.1 and 11.7 of the EIA Reports and in Appendix 3 to the EIA Reports
	This issue was analysed in detail on the basis of the advanced underwater noise propagation modelling. In order to guarantee the most rigorous assessment possible, rather than the older 2013 concept, the modelling applied the latest and most rigorous international NMFS (2024) criteria for hearing damage (including, among others, the 144 dB SELcum threshold for the harbour porpoise and 168 dB SELcum for seals) and the guidelines of Tougaard et al. (2021) for behavioural responses. Calculations were carried out, among other things, by determining noise isophones for single-location piling and for cumulative scenarios. These analyses were related directly to the boundaries of the protected areas, including *Pommersche Bucht mit Oderbank (DE1652301)* and SPA *Pommersche Bucht (DE1552401)*. The modelling results clearly showed that, with the mandatory application of double noise mitigation systems (e.g. CRS+DBBC), the acoustic hearing damage thresholds for marine mammals will not be exceeded at the boundaries of the German Natura 2000 sites in any of the scenarios analysed (including in the most unfavourable winter variant for the cumulation of several farms). The impact in this respect was ultimately assessed as low or negligible. Additionally, the Investor has committed to carrying out rigorous underwater noise monitoring during piling works. In accordance with the documentation, the technical measurement methodology (with respect to instrument parameters and acoustic signal recording procedures) was developed directly on the basis of, among other things, the BSH (2011) guidelines cited by the German side. On the other hand, the thresholds for permissible underwater noise and the distances of the measurement stations (including the designation of a mobile station at a distance of 6.7 km from piling and the carrying out of

ISSUES	HOW ADDRESSED IN THE ENVIRONMENTAL IMPACT ASSESSMENT
	monitoring at the boundaries of the selected Natura 2000 sites) were defined on the basis of the 2024 US NMFS guidelines and the results of dedicated sound propagation modelling, which take into account local environmental conditions and ensure effective protection of marine mammals against hearing damage. Moreover, as part of the monitoring, it has been proposed to locate at least one measurement station directly at the boundary of the German *Pommersche Bucht (DE1552401) Natura 2000 site*, at which compliance with the condition of not exceeding the permissible limits for the harbour porpoise and seals will be continuously verified.
indicating, in accordance with the current state of the art, measures that prevent and limit the emission of impulsive sounds resulting from implementation of the project, taking into account the coordination of construction activities excluding the simultaneous performance of pile-driving works, in order to ensure the absence of transboundary effects on marine mammals;	This issue has been addressed: • in Chapters 4.10, 8.3.5, 8.4.1 and 10.2.2 of the ESPOO Report • in Sections 2.4.2.2, 5.1.1, 6.6, 8.7, 8.10.2 and 10.1.2 of the EIA Reports and in Appendix 3 to the EIA Reports
	In accordance with the request, rigorous measures based on the best available technologies (BAT) have been proposed, which will entirely eliminate transboundary impacts on marine mammals: Noise Reduction System (NRS): Mandatory application of a system with an effectiveness no lower than the reference system adopted in the modelling (based on close-range solutions, e.g. HSD, and a double DBBC curtain). In order to maintain flexibility and the possibility of implementing newer technologies, other solutions are permissible, subject to the absolute condition of meeting the environmental criteria: no exceedance of the hearing damage (TTS) threshold at a distance of 6.7 km and at the boundaries of Natura 2000 sites, and, for simultaneous piling during the summer season, also no exceedance of the harbour porpoise behavioural thresholds at the boundaries of protected areas. The application of such an effective NRS will limit the hearing damage zone (TTS/AINJ) to approximately 100 m. Soft-start procedure and MMO supervision: Gradually increasing the piling energy will allow the animals to flee, and the process will be supervised by marine mammal observers with the authority to postpone the commencement of works. Coordination of piling: Restrictions have been implemented for simultaneous pile driving at several locations within the Baltic West area (during the period June–October for the 14.E.1 and 14.E.2 projects, and during the months of July–August for the 14.E.3 and 14.E.4 projects) if simultaneous piling would cause a behavioural impact on Natura 2000 sites where the harbour porpoise is a conservation subject.
the impact on fish stocks and fisheries, in particular on catches of cod, herring and flatfish, together with a socio-economic assessment of the project's effects on fishing enterprises, taking into account the possibility of shared use of the investment area by fisheries;	This issue has been addressed: • in Chapters 8.3, 8.4 of the ESPOO Report • in Sections 3.9.2, 3.12.1, 5.1.1, 5.1.2, 6.6, 8.1, 8.6 and 8.10 of the EIA Reports and in Annexes 1 and 3 to the EIA Reports
	In accordance with the request, appropriate assessments were carried out for the Baltic West area: Fish stocks: This sea area is mainly a foraging ground, not a key spawning ground (for cod, herring, flounder). The mitigation of the piling noise (CRS+DBBC) will minimise the risk of hearing damage. Temporary deterrence will be offset by the subsequent, ecologically positive 'artificial reef' effect.

ISSUES	HOW ADDRESSED IN THE ENVIRONMENTAL IMPACT ASSESSMENT
	Costs for fisheries: The significance of this sea area is marginal (only around 1% of the volume of Polish Baltic catches, with no foreign vessels present). The lengthening of the routes to fishing grounds will generate costs for local vessel owners (including from Świnoujście, Dziwnów, Kołobrzeg and Darłowo), but overall the impact was assessed as low. These losses may be offset by involving fishermen in the servicing of the farms (local content). Shared use of the sea area (co-use): During the operational phase, conditional access for fishing vessels within the boundaries of the farms will be possible. The principles for the shared use of the space will be determined through dialogue with the Applicant, according to the final layout of the turbines.
the impact on various fish and crustacean species in connection with changes to the seabed and sea currents resulting from implementation of the Project;	This issue has been addressed: • in Chapters 8.2, 8.3.1 and 8.4.1 of the ESPOO Report • in Sections 3.12.1, 5.1.1, 5.1.2, 6.6, 8.1 and 8.6 of the EIA Reports
	In accordance with the request, assessments of physical and hydrodynamic changes were carried out: Changes in sea currents: Flow disturbances will be strictly point-like in nature (in the immediate vicinity of the foundations) and will not disrupt the circulation of Baltic waters. Their impact on fish and crustaceans was assessed as negligible. Changes to the seabed (loss of habitats): Installation works will destroy local benthos on only approximately 5–6% of the Baltic West area. Owing to the mobility of fish and the extensive nature of the surrounding foraging grounds, this loss will not noticeably deplete the overall food base. 'Artificial reef' effect: During the operational phase, the foundations will create new, hard substrates. These will be colonised by benthic fauna (including bivalves and crustaceans), creating new foraging grounds and shelter sites for, among others, cod and flounder. This impact was assessed as locally positive.

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