# Environmental Impact Forecast for the update of Marine Waters Protection Program

CHROŃ MORZE

MINISTERSTWO INFRASTRUKTURY

Państwowe Gospodarstwo Wodne Wody Polskie

## Table of contents

## List of figures

## List of tables

## List of annexes

## List of abbreviations

| Abbreviation: | Full name |
|---|---|
| **aMRPiMZP** | Update of the Flood Risk and Flood Hazard Maps (*Aktualizacja Map Ryzyka Powodziowego i Map Zagrożenia Powodziowego*) |
| **uRBMP** | Update of the Water (River Basin) Management Plans |
| **aPOWM** | Update of the Marine Waters Protection Programme (*Aktualizacja Programu Ochrony Wód Morskich*) |
| **aWORP** | Update of the Preliminary Flood Risk Assessment (*Aktualizacja Wstępnej Oceny Ryzyka Powodziowego*) |
| **BSAP** | Baltic Sea Action Plan |
| **BaU** | *Business as usual* "i.e. the hypothetical development of the situation if the programme of measures (POM) proposed within the framework of KPOWM was not adopted and implemented". |
| **BDOT** | Topographic Database (*Baza Danych Obiektów Topograficznych*) |
| **BIAS** | Baltic Sea Information on the Acoustic Soundscape |
| **BSII** | *Baltic Sea Impact Index* |
| **BSPA** | Baltic Sea Protected Areas |
| **BSPI** | *Baltic Sea Pressure Index* |
| **CBA** | *Cost Benefit Analysis* |
| **CBDG** | Central Geological Database (*Centralna Baza Danych Geologicznych*) |
| **CEA** | *Cost Effectiveness Analysis* |
| **DCT** | *Deepwater Container Terminal* |
| **SEA Directive** | Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment |
| **UNECE** | United Nations Economic Commission for Europe |
| **GDOŚ** | General Director for Environmental Protection |
| **GES** | Good Environmental Status |
| **GIOŚ** | Chief Inspectorate of Environmental Protection |
| **GIS** | Chief Sanitary Inspector |
| **GPU** | Main Useful Aquifer |
| **GUS** | The Central Statistical Office of Poland |
| **GZWP** | Main Groundwater Reservoirs |
| **HCB** | Hexachlorobenzene (pesticide) |
| **HCH** | Hexachlorocyclohexane (pesticide) |
| **HELCOM** | Baltic Marine Environment Protection Commission |
| **IMGW-PIB** | Institute of Meteorology and Water Management |

| Abbreviation: | Full name |
|---|---|
| **SWB** | Surface water body |
| **GWB** | Groundwater body |
| **EC** | European Commission |
| **MC** | Maritime Code |
| **KPOSK** | The National Programme for Municipal Waste Treatment (*Krajowy program oczyszczania ścieków komunalnych*) |
| **KPOWM** | The National Marine Waters Protection Programme (*Krajowy Program Ochrony Wód Morskich*) |
| **KZGW** | National Water Management Authority |
| **MAI** | *Maximum Input Ceiling* |
| **NIC** | *Nutrient Input Ceilings* |
| **NMM** | National Maritime Museum |
| **OchK** | Protected landscape area |
| **EIA** | Environmental Impact Assessment |
| **PIG** | Polish Geological Institute |
| **GDP** | Gross Domestic Product |
| **PMŚ** | State Environmental Monitoring System |
| **PoM** | Program of Measures |
| **POM** | Polish Maritime Area (Polski obszar morski) |
| **PPiEZRiG** | Przedsiębiorstwo Poszukiwań i Eksploatacji Złóż Ropy i Gazu Petrobaltic SA |
| **PPSS** | The Drought Effects Counteracting Plan |
| **Water Law** | Water Law Act of 20 July 2017 (unified text Journal of Laws of 2021, item 624, as amended, item 784) |
| **Forecast** | Environmental Impact Forecast for the update of the Marine Waters Protection Programme |
| **FRMP** | Flood Risk Management Plan |
| **Ramsar** | Iranian city, in which on February 2, 1971 The Convention on Wetlands of International Importance, in particular as an environment for waterfowl was signed. |
| **MSFD** | Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for Community action in the field of marine environmental policy (Official Journal of EU L 164/19 of 25.6.2008) |
| **WFD** | Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (Official Journal of EU L 327/1, 22.12.2000) |
| **RZGW** | Regional Water Management Authority |
| **SMIOUG** | The Hel Marine Station of the Institute of Oceanography of Gdansk University (*Stacja Morska Instytutu Oceanografii Uniwersytetu Gdańskiego*) |

| Abbreviation: | Full name |
|---|---|
| **SEA** | Strategic Environmental Assessment |
| **SPA** | Strategic adaptation plan for sectors and areas sensitive to climate change up to 2020 with a perspective until 2030 |
| **SRT** | Transport Development Strategy to 2020 (*Strategia Rozwoju Transportu do roku 2020 – SRT*) |
| **SST** | Sea Surface Temperature |
| **SWAN** | SWAN (Simulating WAves Nearshore) wind-generated wave model in coastal regions |
| **UM** | Maritime Office (*Urząd Morski*) |
| **WIOS** | Provincial Inspectorate for Environmental Protection (*Wojewódzki Inspektorat Ochrony Środowiska*) |

# 1 Introduction

## 1.1 Purpose and scope of the document

**Grounds for carrying out the strategic assessment**

This document is an Environmental Impact Forecast[1] prepared for the purpose of verifying the environmental impact of the implementation of the document entitled: "Update of the marine waters protection Programme" (aPOWM).

The requirement to conduct a strategic environmental assessment of the draft document results from Article 46 (2) of the Act of 3 October 2008 on access to information on the environment and its protection, public participation in environmental protection and environmental impact assessments (consolidated text: Journal of Laws of 2021, item 247 as amended), hereinafter referred to as the EIA Act. Pursuant to Article 46 (2) of the EIA Act, the strategic environmental assessment is to be carried out on the basis of a draft *'policy, strategy, plan and programme in the fields of industry, energy, transport, telecommunications, water management, waste management, forestry, agriculture, fisheries, tourism and land use, developed or adopted by the administrative authorities, which sets the framework for the subsequent implementation of projects which may materially affect the environment'.*

The EIA Act implements Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment (Official Journal of EU L 197, 21.7.2001, p. 30; hereinafter referred to as the SEA Directive) by, inter alia, the provision of Article 46 (2) of the Act.

**Objective of the strategic assessment**

According to the SEA Directive, *'environmental impact assessment is an important tool to take into account environmental aspects in the preparation and adoption of certain plans and programmes that have the potential to have significant environmental impacts in the Member States, as it ensures that such impacts are taken into account when preparing and prior to their adoption*'. The purpose of the strategic assessment, in accordance with Article 1 of the abovementioned Directive, *is' to ensure a high level of environmental protection and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes in order to promote sustainable development, by ensuring that, in accordance with this Directive, an environmental impact assessment is carried out for certain plans and programmes which have the potential to have significant effects on the environment.*

At the same time, the assessment verifies the inclusion of the principle of sustainable development in the aPOWM study, which is required by Article 159 (3) (3) of the Act of 20 July 2017. Water Law (consolidated text Journal of Laws of 2021, item 624, as amended, item 784).

**This objective is understood as:**

1. as the implementation of the principle of sustainable development - one of the pillars of the Lisbon and Goeteborg strategies, as well as one of the basic constitutional principles of the system of the Polish state (Article 5 of the Constitution of the Republic of Poland)

[1] According to the nomenclature introduced in the Act of October 3, 2008 on access to information on the environment and its protection, public participation in environment protection and environmental impact assessments, consolidated text Journal of Laws of 2021, item 247, as amended

and the formal systemic principle of the European Union (Treaty establishing the European Community[2]), and recognized as the basis in other international documents;

2. in accordance with the requirements of national law, in particular in accordance with the requirements set out in Section IV of the EIA Act transposing the provisions of the Directive into the Polish legal order.

**Elements for the strategic environmental assessment**

In accordance with the EIA Act, a strategic environmental assessment is an environmental impact assessment procedure for the implementation of a policy, strategy, plan or programme, including in particular:

1. agreeing on the level of detail of the information contained in the Environmental Impact Forecast in accordance with Article 53. clause 1 of the Act.
2. preparing an Environmental Impact Forecast containing the information indicated in Articles 51 and 52 of the Act,
3. obtaining the required opinions for the draft document together with the environmental impact forecast, in accordance with Article 54 (1) of the Act,
4. ensuring public participation in accordance with the provisions of section III, Chapters 1 and 3 of the Act.

The general scheme of the proceedings on the environmental impact assessment for the implementation of aPOWM is presented in the figure below.

[2] Treaty of Lisbon amending the Treaty on European Union and the Treaty establishing the European Community, done at Lisbon on 13 December 2007 Journal of Laws 2009, No. 203, item 1569

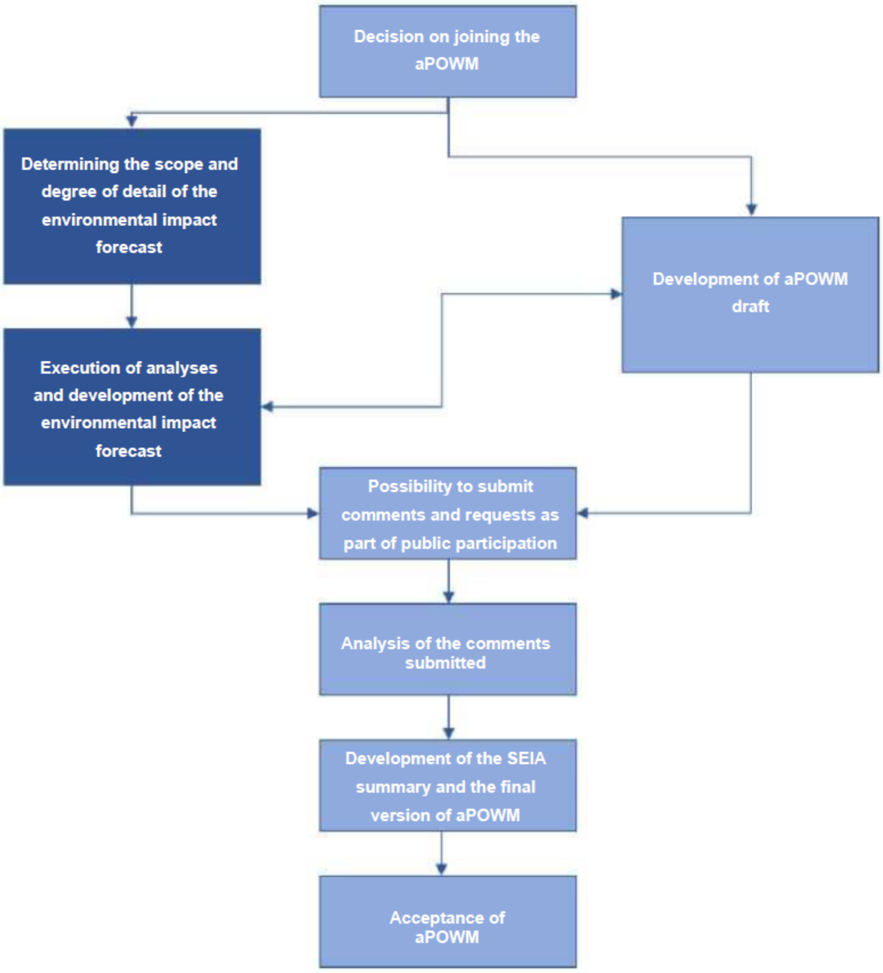



**Fig. 1 Overview of the environmental impact assessment procedure for the implementation of aPOWM (Strategy Paper)**

*Source: Own study*

**Public consultation**

Conducting a public consultation on the draft of the Programme in question is an element of a strategic environmental assessment resulting from the provisions of Article 54 (2) of the EIA Act, in which it was indicated that "The authority developing the draft ensures the possibility of public participation, in accordance with the provisions of Section III, Chapters 1 and 3, in a strategic environmental assessment", i.e. without undue delay, publishes information about:

- commencement of the drafting of the document and its subject matter;
- the possibility of getting acquainted with the necessary documentation of the case and the place where it is placed for inspection;
- the possibility of submitting comments and requests;
- the manner and place in which comments and requests are to be submitted, and at the same time the deadline for their submission shall be at least 30 days;
- the authority competent to consider comments and requests;
- the procedure for transboundary environmental impact, if any.

The reference to any comments and conclusions of the public, submitted at the stage of public consultations, will be presented in accordance with Art. 55 (3) of the EIA Act in the Programme Summary.

International legal requirements for public consultations are, however, specified in the following documents:

- Aarhus Convention - Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Journal of Laws 2003, No. 78, item 706). The Convention facilitates the participation of non-governmental organisations in the decision-making process, ensures compliance with assessment procedures, presupposes the need for consultation and access to information, ensures public participation in the preparation of environmental plans, programmes and guidelines and in the preparation of legal acts;
- Directive 2001/42/EC of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment - hereinafter referred to as the SEA Directive, which requires that the decisions taken be widely communicated and that documents be made available in the form of plans and programmes, opinions, results, consultations and the reasons for the choice as regards alternatives;
- Directive 2003/35/EC of 26 May 2003 providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment and amending, as regards public participation and access to justice, Directives 85/337/EEC and 96/61/EC - provides for public participation in respect of individual decisions and programmes, provides for public participation at an early stage, provides for the possibility to submit comments and requests, lays down the rules for the participation of environmental NGOs;
- Directive 2008/56/EC establishing a framework for Community action in the field of marine environmental policy (Marine Strategy Framework Directive) - sets out rules to ensure active public participation in the development, implementation and updating of marine strategies;
- Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (Water Framework Directive (WFD)) - ensures the participation of all stakeholders in the formulation of water policy.

On the basis of the above provisions, the public is entitled to express comments and opinions before decisions are taken on the adoption of plans and programmes.

**Scope of the Forecast**

The draft programme for the protection of marine waters is developed by the Polish Waters, and then the draft programme for the protection of marine waters is submitted to the Minister of Infrastructure as the minister responsible for water management. When carrying out measures aimed at developing the aPOWM draft and carrying out a strategic environmental impact assessment of the implementation of this document, the competent administrative authorities were asked to agree on the scope and level of detail of the information contained in the Environmental Impact Forecast. The agreements were issued by the following institutions:

1. The General Director for Environmental Protection, letter dated 10.05.2021, ref. no.: DOOŚ-TSOOŚ.411.13.2021.aba,
2. Chief Sanitary Inspector, letter dated 28.04.2021, ref.: HŚ.NS.530.4.2021.AM,

3. Director of the Maritime Office in Gdynia, letter of 14.05.2021, ref. no.: INZ.8103.43.2021.AD,
4. Director of the Maritime Office in Szczecin, letter dated 12.04.2021, ref. no.: OW.52001.3.21.AZ(2)

The content of the approvals is included in Annex 6 to the forecast.

The environmental impact forecast complies with the requirements of Article 51 (1) of the EIA Act, takes into account the degree of detail of the assessed strategic document, which is the aPOWM draft, and the approvals of the above-mentioned administrative bodies. The forecast was developed in accordance with the state of modern knowledge and the assessment methods used, discussed in Chapter 3.

The manner in which the issues contained in the EIA Act are included in this Forecast is summarized in the table below (Table 1 ).

**Table 1 The manner of including the requirements of Article 51 (2) of the EIA Act in the documentation in question**

| The provisions of Article 51 (2) of the EIA Act (consolidated text Journal of Laws of 2021, item 247, as amended) | | | Method of inclusion in the documentation |
|---|---|---|---|
| **2. Environmental Impact Forecast:** | 1) Contains: | a) information about the content, main purposes of the drafted document and its links with other documents, | 4 Environmental objectives established at international, Community and national level, relevant to the draft document, and how these objectives have been taken into account in the preparation of the document<br>4.1 Identification of environmental objectives relevant to aPOWM<br>4.2 How to include the identified environmental protection objectives in aPOWM |
| | | b) information on the methods used to prepare the forecast | 3 Assessment methodology<br>3.1 Determination of the spatial extent, scope and detail of the analyses<br>3.2 Information on the methods used in drawing up the analyses |
| | | c) proposals regarding the envisaged methods of analysis of the effects of the implementation of the provisions of the designed document and the frequency of its implementation, | 12 Proposals for the envisaged methods of analysis of environmental impacts of the implementation of the provisions of the proposed document and its frequency |
| | | (d) information on possible transboundary effects on the environment, | 11 Possibility of transboundary impacts |
| | | e) a summary in a non-specialist language, | 13 Summary in non-specialist language |

| The provisions of Article 51 (2) of the EIA Act (consolidated text Journal of Laws of 2021, item 247, as amended) | | Method of inclusion in the documentation |
|---|---|---|
| | f) statement of the author, and in the event that the author of the forecast is the team of authors – team leader, on compliance with the requirements referred to in Article 74a (2), constituting an attachment to the forecast, | Appendix No. 7 |
| | g) the date of preparation of the forecast, the name, surname and signature of the author, and if the author of the forecast is a team of authors – the name, surname and signature of the leader of this team and the names, surnames and signatures of members of the team of authors; | Date of forecast – page 1<br>Name and signature of the team leader and names and signatures of the members of the team of authors – Chapter 14 Authors of the Environmental Impact Forecast |
| 2) Identifies and analyses | a) the existing state of the environment and potential changes in this state in the absence of the implementation of the designed document, | 5 The state of the environment and environmental protection problems in the aPOWM spatial range and Forecasts<br>7 Forecast of the state of the environment in the absence of aPOWM implementation |
| | (b) the state of the environment in the areas affected by the projected significant impact | 5 The state of the environment and environmental protection problems in the aPOWM spatial range and Forecasts |
| | (c) existing environmental problems relevant to the implementation of the proposed document, in particular concerning protected areas under the Nature Conservation Act of 16 April 2004, | 6 Environmental problems relevant to the implementation of the aPOWM draft - pressures |
| | (d) the environmental objectives laid down at international, Community and national level relevant to the draft document and how those objectives and other | 4 Environmental objectives established at international, Community and national level, relevant to the draft document, and how these objectives have been taken into account in the preparation of the document |

| The provisions of Article 51 (2) of the EIA Act (consolidated text Journal of Laws of 2021, item 247, as amended) | | Method of inclusion in the documentation |
|---|---|---|
| | environmental problems have been taken into account in the preparation of the document, | 4.1 Identification of environmental objectives relevant to aPOWM<br>4.2 How to include the identified environmental protection objectives in aPOWM<br>Annex 1 Environmental objectives established at international, Community and national level |
| | (e) the expected significant impacts, including direct, indirect, secondary, cumulative, short-term, medium and long-term, permanent and temporary, and positive and negative, on the objectives and object of the conservation of the Natura 2000 site and on the integrity of the site, and in particular on:<br>– biodiversity,<br>– people,<br>– animals,<br>– plants,<br>– water,<br>– air,<br>– ground surface,<br>– landscape,<br>– climate,<br>– natural resources,<br>– monuments,<br>– tangible goods<br>– taking into account the relationship between these elements of the environment and the effects on these elements; | 8 Expected significant impacts of aPOWM<br>8.11 Interactions and cumulation of impacts<br>Annex 3 - Objects of protection of Natura 2000 sites |
| 3) Presents | a) solutions aimed at preventing, limiting or compensating for negative environmental impacts that may result from the implementation of the | 10 Proposed solutions aimed at preventing, reducing or compensating for negative environmental impacts that may result from the implementation of aPOWM, in particular on the objectives and objects of protection and integrity |

| The provisions of Article 51 (2) of the EIA Act (consolidated text Journal of Laws of 2021, item 247, as amended) | | Method of inclusion in the documentation |
| --- | --- | --- |
| | proposed document, in particular for the purposes and object of protection of the Natura 2000 area and the integrity of this area, | of Natura 2000 sites and the coherence of the Natura 2000 network |
| | (b) taking into account the objectives and geographical scope of the document and the objectives and object of the protection of the Natura 2000 site and the integrity of that site, alternative solutions to the solutions contained in the proposed document, together with the justification for their selection and a description of the assessment methods leading to this choice, or an explanation of the lack of alternative solutions, including an indication of the difficulties encountered due to technical deficiencies or gaps in modern knowledge. | 8.12 Alternative solutions |

*Source: Own study*

## 1.2 The context of aPOWM resulting from the principles of the Marine Strategy Framework Directive and the Water Law

### 1.2.1 Legal assumptions for the development of aPOWM

Preserving the good environmental status of Europe's seas while ensuring and maintaining their resources and capacity to use maritime services is a challenge that requires an integrated approach between Member States. In 2008, the Framework Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for Community action in the field of marine environmental policy, known as the Marine Strategy Framework Directive (MSFD) was adopted, as a single solution for the diverse seas of the European Union, including the Baltic Sea.

The aim of the Directive is to achieve a good environmental status of marine waters by 2020. This is done primarily by preventing the degradation of the marine environment, restoring marine ecosystems and preventing and eliminating pollution of the marine environment. Many goals will probably not be achieved in such a short time, especially considering the long-term processes of transformation and the time of the ecosystem's response to the reduction of loads (the time of water exchange in the Baltic Sea is 25 years).

In accordance with Article 1 of the MSFD, Member States shall develop and implement marine strategies to:

- *'protect and preserve the marine environment, prevent its degradation or, where practicable, restore marine ecosystems in areas where they have been adversely affected;*
- *prevent and progressively eliminate pollution of the marine environment… in order to avoid significant impacts on or risks to marine biodiversity, marine ecosystems, human health and legitimate uses of the sea. '*

The maritime strategy consists of:

- development of a preliminary assessment of the state of the marine water environment
- determination of characteristics typical of good environmental status of marine waters
- setting environmental objectives for marine waters and associated features
- development and implementation of a marine water monitoring programme
- development and implementation of a marine water protection programme.

The provisions of the MSFD were implemented into Polish legislation by the Act of 4 January 2013 amending the Water Law and certain other Acts (Journal of Laws of 2018, item 165).

Marine strategies include programmes for the protection of marine waters, referred to in Article 13 of the MSFD as Programs of Measures (PoM), aimed at achieving or maintaining a good state of the marine environment. In Poland, a program of measures, defined in Article 13 of the MSFD, was developed in the form of the National Marine Waters Protection Programme (KPOWM) adopted by the Regulation of the Council of Ministers of 11 December 2017 on the adoption of the National Marine Waters Protection Programme (Journal of Laws of 2017, item 2469). The criteria and methodological standards regarding the good environmental status of marine waters in force during the first cycle of implementation of marine strategies were set out in Commission Decision 2010/477/EU of 1 September 2010 (Official Journal of EU L 232, 04.05.2016, p. 14).

In accordance with Article 17 of the MSFD, Member States shall ensure that marine strategies, including the programme of measures, are updated every six years.

Currently, the Act implementing the MSFD is the Act of 20 July 2017. - Water Law (consolidated text Journal of Laws of 2021, item 624, as amended, item 784). In accordance with that law (Article 144 (2)), 'the Marine Strategy shall comprise the following set of measures:

1) the development of a preliminary assessment of the state of the marine environment;
2) development of a set of characteristics typical of good environmental status of marine waters;
3) the development of a set of environmental objectives for marine waters and associated indicators, hereinafter referred to as' the set of environmental objectives for marine waters';
4) development and implementation of a marine water monitoring programme;
5) the development and implementation of a programme for the protection of marine waters. '

Therefore, on the basis of the cited act, an update of the maritime strategy documents, including the draft Update of the Marine Waters Protection Programme (aPOWM), has been developed.

MSFD and the provisions of the Water Law assume a comprehensive approach to the determination of the status of the environment, the introduction of measures necessary to achieve GES or justification of an exception to the assumed goal and the monitoring of the introduced measures over a six-year cycle. The next stages, together with the links between the individual stages aimed at achieving them and the assumed timetable for their implementation in the current cycle of implementation of the Marine Strategy, are presented in the diagram shown in the figure below.

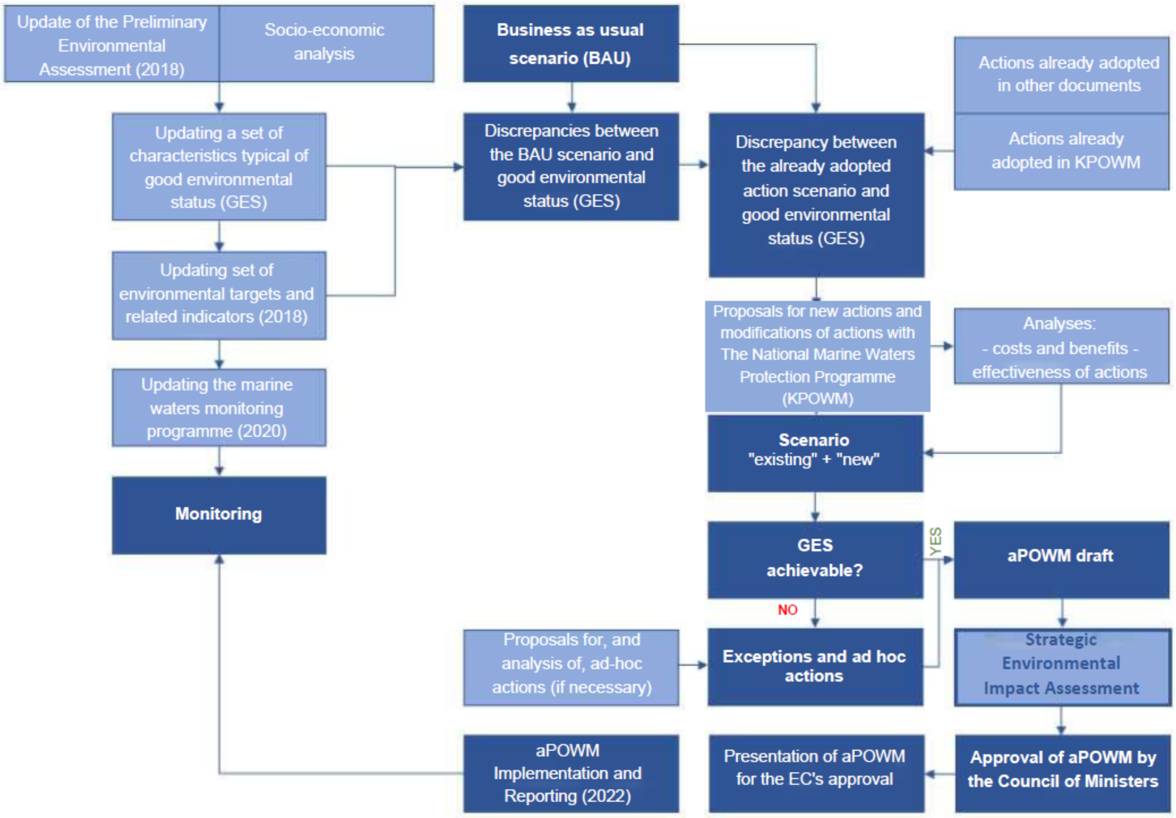



**Fig. 2** **The logic of acting in accordance with the MSFD along with the schedule of individual steps of updating the Marine Strategy assumed in it**

*Source: Own study*

According to the concept of implementation of marine strategies contained in the MSFD, the initial assessment is to provide the basis for assessing whether the GES is to be achieved or maintained. In order to maintain or achieve the GES, environmental objectives (Article 10 of the MSFD) shall be established, the aim of which is to direct the pursuit from the status quo to the GES. The environmental objectives, in turn, form the basis for the definition of the action programme (included in the Marine Waters Protection Programme), in accordance with Article 13 of the Directive. The monitoring programme, on the other hand, is intended to allow for a regular assessment of the state of the marine environment, progress in achieving the GES and the effectiveness of the adopted measures. Setting environmental objectives is the starting point for the action programme, determining the effectiveness of measures already taken and identifying the need for new measures necessary to achieve the GES.

### 1.2.2 Preparation for the development and implementation of aPOWM

According to the Act, the Act of 20 July 2017 - Water Law (i.e. Journal of Laws of 2021, item 624, as amended, item 784), the provisions of the MSFD in the scope of updating the maritime strategy in Poland will include the development of:

1. updating the preliminary assessment of the status of the marine water environment,
2. updating the set of characteristics typical of good environmental status of marine waters,
3. updating the set of environmental objectives for marine waters and associated indicators, hereinafter referred to as' the set of environmental objectives for marine waters',
4. updating the marine waters monitoring programme,
5. update the marine waters protection programme.

The update of the set of characteristics typical of good environmental status (GES) and the sets of environmental objectives for marine waters have been developed on the basis of the update of the preliminary assessment of the environmental status of marine waters. The current update covers the period from 01.01.2011 to 31.12.2016.

A set of environmental objectives for Polish marine areas was developed in the first cycle of MSFD implementation in 2014, and then adopted by the Regulation of the Minister of Environment of 17 February 2017 on the adoption of a set of environmental objectives for marine waters (Journal Of Laws, item 593), while in the current planning cycle, the set was reviewed and updated in accordance with Article 17 of the MSFD and Article 157 (11) of the Act of 20 July 2017. – Water law. The objectives are presented both at the level of individual features as well as at the level of individual criteria, taking into account all elements of their composition, in accordance with the Commission Decision (EU) 2017/848 of 17 May 2017 laying down the criteria and methodological standards for good environmental status of marine waters and specifications and uniform methods of monitoring and evaluation, and repealing Decision 2010/477/EU (Official Journal of 43), hereinafter referred to as' Commission Decision 2017/848 '. Specific objectives were also formulated, taking into account individual components of the ecosystem – in the case of state features or isolated areas – in the case of pressure features.

All the measures set out in points 1-4 above have been carried out in accordance with the schedule indicated **Błąd! Nie można odnaleźć źródła odwołania.** above.

The update of the set of environmental objectives for marine waters was adopted by the Regulation of the Minister of Infrastructure of 25 February 2021 on the adoption of the update of the set of environmental objectives for marine waters (Journal of Laws, item 569).

GIOŚ has also developed a document **"Update of the marine waters monitoring programme"** containing: a list of monitoring test sites with the assignment of the scope and frequency of measurements and tests as well as reference methodologies or conditions for ensuring the quality of measurements and tests for individual indicators referred to in Article 153 (1) (1) of the Water Law. The document was published in the form of a report to the European Commission.[3]

The MSFD defines 11 descriptive indicators (features, in accordance with the Water Law) for the determination of good environmental status, for which an assessment should be carried out in relation to the defined criteria of good environmental status.

[3] Update of the Marine Waters Monitoring Programme (Report to the European Commission), GIOŚ, Warsaw 2020 (https://MSFD.gios.gov.pl/images/projekt-aktualizacji-PMWM.pdf)

**Table 2 Descriptive indicators (features) used to determine good environmental status**

| Indicators/features | | Description of the indicator/feature |
|---|---|---|
| **Indicators in accordance with MSFD** | **Features in accordance with the Water Law** | |
| **Annex 1 p. 1** | Article 153 (1) (1a) | D 1 Biological diversity |
| **Annex 1 p. 2** | Article 153 (1) (b) | D2 Non-native species |
| **Annex 1 p. 3** | Article 153 (1) (c) | D3 Commercially exploited fish and invertebrate species |
| **Annex 1 p. 4** | Article 153 (1) (d) | D 4 Food chains |
| **Annex 1 p. 5** | Article 153 (1) (e) | D5 Eutrophication, |
| **Annex 1 p. 6** | Article 153 (1) (f) | D 6 Seabed integrity |
| **Annex 1 p. 7** | Article 153 (1) (g) | D7 Hydrographic conditions |
| **Annex 1 p. 8** | Article 153 (1) (1h) | D8 Pollutants and pollutant effects |
| **Annex 1 p. 9** | Article 153 (1) (1i) | D9 Harmful substances in fish and seafood |
| **Annex 1 p. 10** | Article 153 (1) (1j) | D10 Marine litter |
| **Annex 1 p. 11** | Article 153 (1) (1k) | D11 Underwater noise and other energy sources |

*Source: Own study*

Commission Decision (EU) 2017/848 is an implementing act to the MSFD. Decision 2017/848 established the breakdown of the indicators that must be included in the assessment of the status of the marine environment into two groups: the group covering the **features of pressure:** D2, D3, D5, D6, D7, D8, D9, D10 and D11; and groups **of status features**: D1, D4 and D6 for ecosystem elements: mammals, fish, birds, pelagic habitats, benthic habitats. The main difference between the update of the assessment and the preliminary assessment of the status of the marine waters of the Polish Baltic Sea Zone (GIOŚ 2014) is the method of assessing the status features. The update uses the 'integrated biodiversity assessment', which is carried out within each ecosystem component and refers simultaneously to characteristics 1, 4 and 6. In the adopted method, separate assessments for mammals, seabirds, fish, benthic habitats and pelagic habitats refer to feature D1 (biodiversity), the assessment of benthic habitats is common to features D1 and D6 (seabed integrity), the assessment of pelagic habitats is characterized by feature D1, and the assessment of ecosystems, including food chains, refers to features D1 and D4 (food chains) [4].

[4] Annex 1 to Resolution No 8 of the Council of Ministers of 18 January 2019 on the consent to the submission to the European Commission of an update of the preliminary assessment of the environmental status of marine waters together with a draft update of a set of properties typical of the good environmental status of marine waters (M.P. of 2019, item 230).

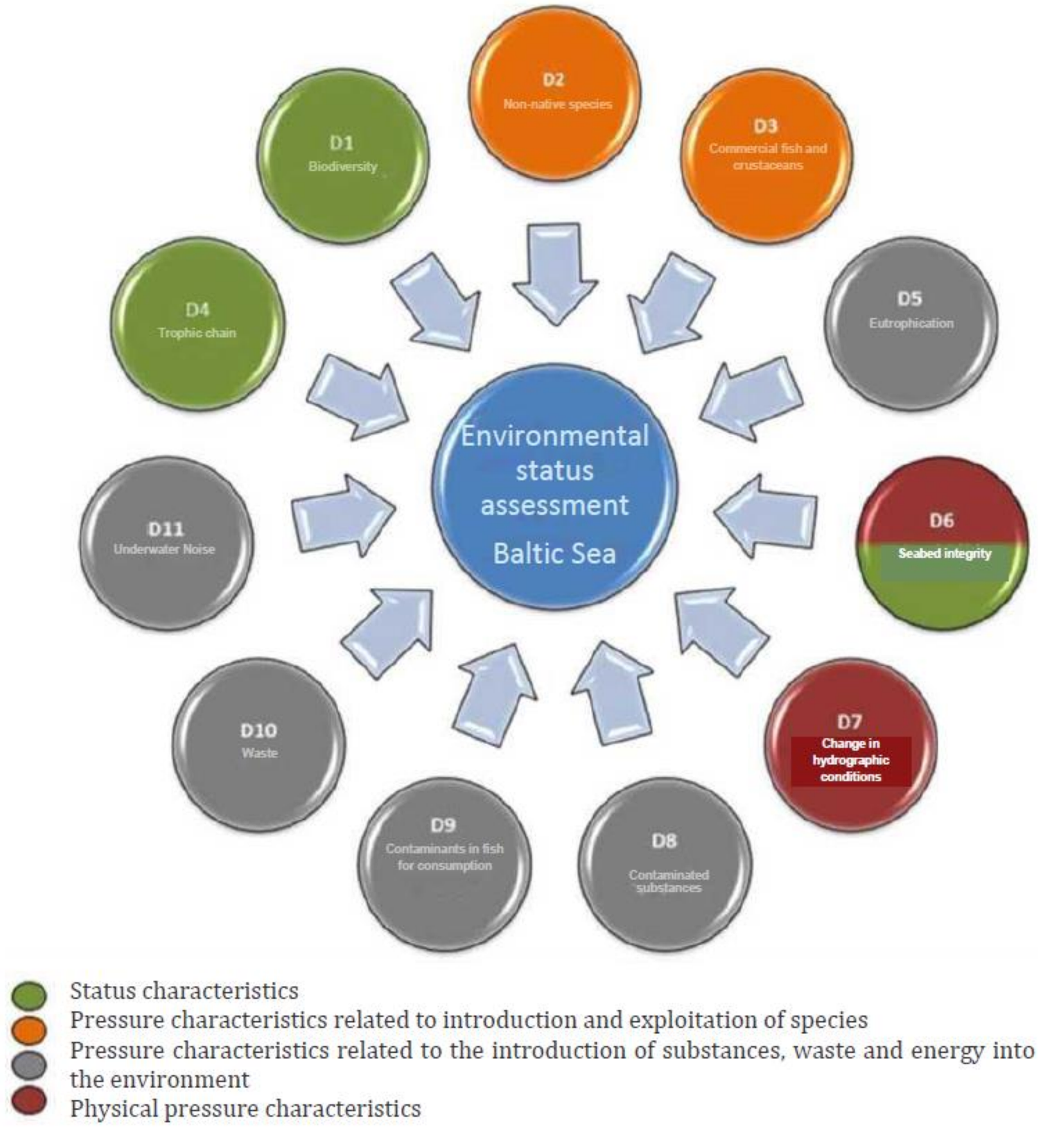



**Fig. 3 Scheme for the assessment of the status of the marine environment in the Baltic Sea**

*Source: Update of the preliminary assessment of the status of marine waters environment [5] (based on Decision 2017/848)*

The status of the environment of Polish maritime areas in accordance with the MSFD was determined on the basis of the assessment of basic indicators assigned to descriptive indicators of the status. The final result is expressed in two classes corresponding to the achievement of GES (denoted as' GES ') or non-achievement of GES (denoted as: “subGES” or “non-GES”). The assessment takes into account the limits of the status and values of indicators used to assess the ecological status for transitional and coastal waters developed in accordance with the Water Framework Directive, while the boundary of good environmental status (GES) is 3/5 of the value of the maximum scale of WFD assessments that a given indicator can achieve. This corresponds to the delineation of the boundary between "good and very good" and "bad, weak and moderate" according to the WFD.

[5] Annex 1 to Resolution No 8 of the Council of Ministers of 18 January 2019 on the consent to the submission to the European Commission of an update of the preliminary assessment of the environmental status of marine waters together with a draft update of a set of properties typical of the good environmental status of marine waters (M.P. of 2019, item 230).

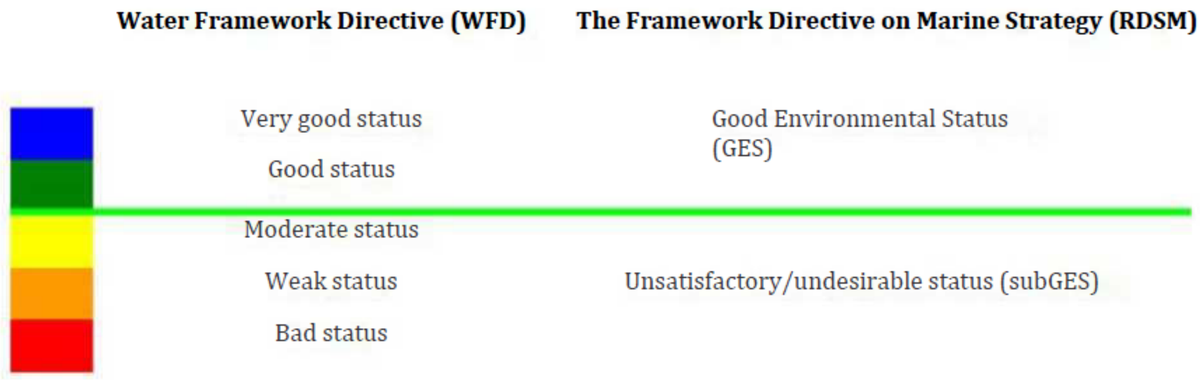



**Fig. 4 Correlation of good status/potential of water according to WFD and GES in accordance with MSFD**

*Source: Update of the preliminary assessment of the status of marine water environment, Warsaw 2018*

A summary of the assessments contained in the update of the preliminary assessment of the status of marine environment is presented in the table below.

**Table 3** **Environmental status assessment for the status features: D1 and D6 – integrated biodiversity assessment**

| **Water body** | **Ecosystem elements** | | | | | |
|---|---|---|---|---|---|---|
| | Feature D1 | | | | | Feature D6 |
| | Mammals | Wintering Birds | Breeding Birds | Fish | Pelagic habitats | Benthic habitats |
| **POM** | | | | | | |
| **Polish waters of the Bornholm Basin** | | | | | | |
| **Polish waters of the eastern Gotland Basin** | | | | | | |
| **Polish waters of the Gdańsk Basin** | | | | | | |
| **Polish coastal waters of the Bornholm Basin** | | | | | | |
| **Polish coastal waters of the eastern Gotland Basin** | | | | | | |
| **Polish coastal waters of the Gdańsk Basin** | | | | | | |

*Source: Update of the preliminary assessment of the status of marine water environment, Warsaw 2018*

**Table 4** Assessment of the status of the environment for the features of pressure: D2, D3, D5, D6 (part), D7, D8, D9, D10, D11

| Water body | Pressure characteristics | | | | | | | | | | Average of grades for individual features |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D2 | D3 | | D5 | D6 | D7 | D8 | D9 | D10 | D11 | |
| | | sprat | herring | | | | | | | | |
| POM | | | | | | | | | | | |
| Polish waters of the Bornholm Basin | | | | | | | | | | | 0.55 |
| Polish waters of the eastern Gotland Basin | | | | | | | | | | | 0.55 |
| Polish waters of the Gdańsk Basin | | | | | | | | | | | 0.55 |
| Polish coastal waters of the Bornholm Basin | | | | | | | | | | | 0.00 |
| Polish coastal waters of the eastern Gotland Basin | | | | | | | | | | | 0.40 |
| Polish coastal waters of the Gdańsk Basin | | | | | | | | | | | 0.00 |
| Summary by the features of pressure | | | | | | | | | | | 0.55 |

*Source: Update of the preliminary assessment of the status of marine waters environment, Warsaw 2018*[6]

**Legend**

- subGES

- GES

The preliminary assessment of the status of marine waters environment also includes a socio-economic analysis of the use of marine waters, including an analysis of the changes in the **impact of human socio-economic activity on the marine environment and presents a reference scenario - business as usual (BaU),** i.e. a hypothetical development of the situation if the Programme of Measures (PoM) proposed under aPOWM was not adopted and implemented. This baseline scenario – the situation of the lack of implementation of measures resulting from aPOWM (the so-called "zero option") analysed as part of the aPOWM draft and thus in the Forecast.

[6] Annex 1 to Resolution No 8 of the Council of Ministers of 18 January 2019 on the consent to the submission to the European Commission of an update of the preliminary assessment of the environmental status of marine waters together with a draft update of a set of properties typical of the good environmental status of marine waters (M.P. of 2019, item 230).

## 1.3 Helsinki Convention and Baltic Sea Action Plan

The marine waters protection Programme is a strategic document containing a set of measures the application of which is to lead to the achievement of the GES. The necessity to implement the POWM and its subsequent application results directly from the MSFD and is obligatory for all Member States with a maritime border.

The Helsinki Convention, with its strategic document – the Baltic Sea Action Plan – is an organisation associating only the countries in the Baltic Sea basin. Baltic Sea Action Plan, HELCOM Baltic Sea Action Plan (BSAP) is a document of a declarative and general nature (as opposed to the POWM for which Poland will be held accountable). The plan, once implemented, has not been accepted by major environmental organizations such as Greenpeace or WWF. They accuse the Baltic States of not committing themselves to concrete and real measures to improve the ecological status of the Baltic Sea.

The HELCOM Baltic Sea Action Plan was adopted on 15 November 2007 in Krakow by all parties to the Helsinki Convention and aims to improve the environment of the Baltic Sea and restore its good ecological status by 2021. Despite improvements in the environment, BSAP targets will not be achieved by 2021 and countries are still far from achieving their targets. Therefore, at the ministerial meeting of HELCOM 2018, an update of BSAP until 2021 was agreed.

Below is the status of implementation of the individual 177 measures of the Baltic Sea Action Plan.

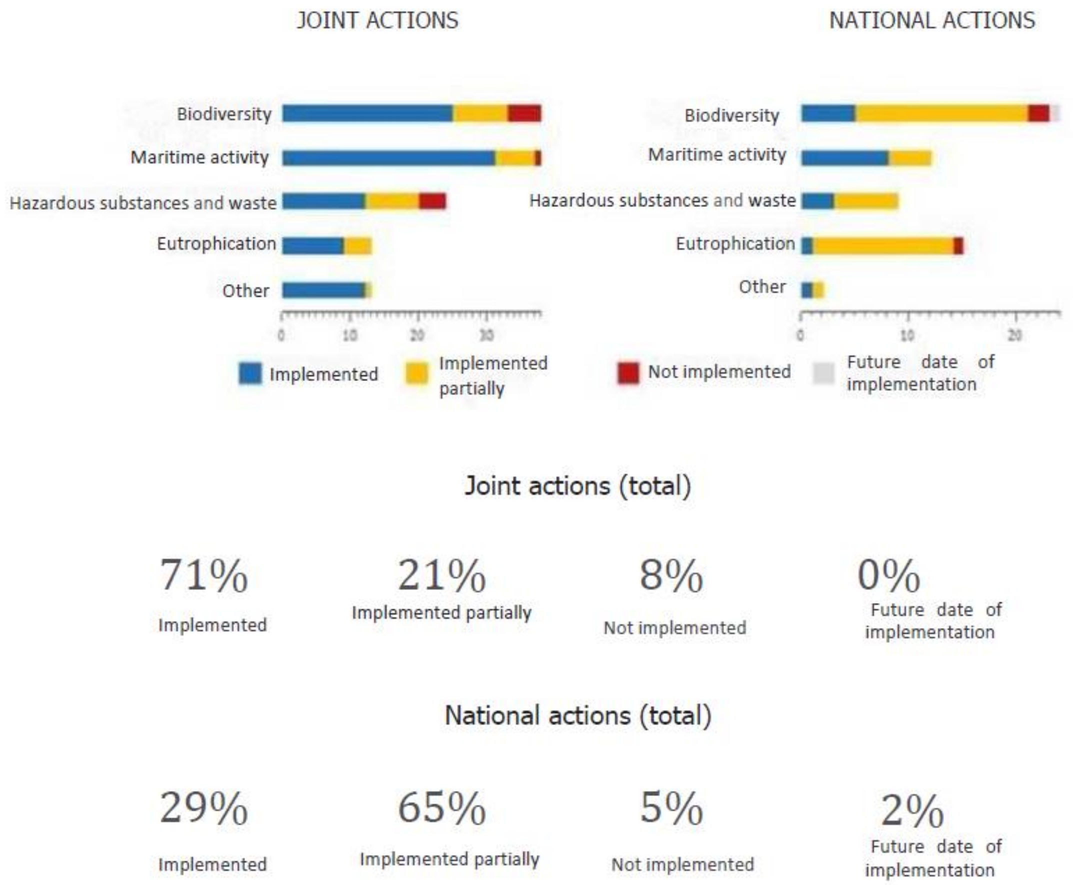



**Fig. 5 Status of measures of the Baltic Sea Action Plan (as of 12 March 2021)**

*Source: https://helcom.fi/baltic-sea-action-plan/follow-up-of-helcom-agreements/*

### 1.3.1 Helsinki Convention

The Convention for the Protection of the Marine Environment of the Baltic Sea Area, drawn up in Helsinki on 22 March 1974, the Helsinki Convention (Journal Laws of 1980, No. 18, item 64), was signed by Poland and entered into force on 3 May 1980. Almost 20 years later, the original convention was replaced. The Convention for the Protection of the Marine Environment of the Baltic Sea Area, drawn up in Helsinki on 9 April 1992 (Journal of Laws of 2000, No. 28, item 346; hereinafter referred to as the Helsinki Convention). The Polish Government ratified the Convention on 8 October 1999, and it entered into force on 17 January 2000. The signatories of the Convention are all countries within the Baltic Sea basin and the European Community.

The subject of the Convention is the protection of the marine environment of the Baltic Sea area, which includes water and the seabed with their living resources and other forms of marine life (Article 4 of the Helsinki Convention).

The basic principles and obligations are set out in Article 3 of the Convention, according to which the Parties undertake to:

- take legislative, administrative and other appropriate measures to prevent and eliminate pollution in order to promote the ecological renewal of the Baltic Sea area and to preserve its ecological balance,
- to apply the precautionary principle, that is to say to take measures where there are grounds for believing that substances or energy introduced, directly or indirectly, into the marine

environment may constitute a danger to human health, harm living resources and marine ecosystems, damage its properties or interfere with the legitimate uses of the sea, even where there is no clear evidence that there is a causal link between the introduction and its presumed effects,

- promote the application of Best Environmental Practice and Best Available Technology in order to prevent and eliminate pollution in the Baltic Sea area,
- the application of the polluter-pays principle,
- ensure that measurements and calculations of emissions and discharges from point sources and from diffuse sources into water and air are carried out in a scientifically sound manner in order to assess the state of the marine environment of the Baltic Sea area and to ensure the implementation of the Convention,
- making every effort to ensure that the implementation of the Convention does not cause transboundary pollution in areas outside the Baltic Sea area, and the appropriate measures should not lead to undesirable ecological effects affecting the quality of air and the atmosphere or water, soil and groundwater, to unacceptable harmful or increasing waste disposal or to increased risks to human health.

The Helsinki Commission (HELCOM), established in Helsinki and associating all signatory States, was established to carry out the tasks specified in the Convention. It is an executive body acting through its permanent or ad-hoc groups.

### 1.3.2 Baltic Sea Action Plan

HELCOM Baltic Sea Action Plan is a document that was adopted on 15 November 2007 in Krakow by all parties to the Helsinki Convention.

It was created as part of a regional strategy aimed at improving the environment of the Baltic Sea and restoring its good ecological status by 2021.

The essence of the plan is the provision on the restoration of good ecological status, mainly by counteracting eutrophication and the discharge of hazardous substances. In addition, the plan focuses on protecting and preserving biodiversity while ensuring sustainable economic activity. It is important that the plan does not have legal force. It is a set of jointly developed and accepted recommendations of individual countries. The Helsinki Commission is responsible for monitoring progress in the implementation of the plan.

The programme **is to operate on the basis of recommendations**, i.e. "*moral and partly legal obligations of individual HELCOM countries*".

The plan sets out four main strategic objectives to deliver concrete results:

1. **Prevention of eutrophication:**
    - clean water,
    - natural algal bloom level,
    - natural occurrence and spread of plant and animal species,
    - natural oxygenation level.
2. **Counteracting the discharges of hazardous substances:**
    - concentration of hazardous substances at a level similar to that of natural waters,
    - all fish edible,
    - healthy wildlife,
    - radioactivity at the level prior to the Chernobyl nuclear accident.

3. **Biodiversity protection:**
    - natural marine and coastal landscape,
    - sustainable plant and animal populations,
    - viable species populations.
4. **Ensuring sustainable maritime transport:**
    - strengthening of international regulations – no illegal discharges
    - safe movement of ships, reduction of pollution caused by accidents,
    - effective response to threats,
    - minimising sewage pollution from ships,
    - limiting the introduction of alien species from ships,
    - minimising pollutant emissions from ships into the air,
    - prohibition of discharges from offshore platforms,
    - minimising the risks from offshore installations.

At the HELCOM 2018 ministerial meeting, it was agreed to update the Baltic Sea Action Plan (BSAP) until 2021. In accordance with the updated work plan for the BSAP update[7], the adoption of the update is scheduled for autumn 2021. Overall, the essence of the original BSAP will be preserved, and in particular its emphasis on eutrophication, hazardous substances, maritime measures and biodiversity will be maintained. The update should enhance the integration of horizontal issues, such as the ecosystem approach, the achievement of good environmental status or climate change, and better reflect the current topics addressed in HELCOM, such as marine litter, underwater noise, seabed loss and disturbance, and biodiversity protection measures.

[7] In accordance with the schedule approved by HOD 58-2020, the adoption of the BSAP update should take place at the autumn ministerial meeting of HELCOM 2021 (https://helcom.fi/baltic-sea-action-plan/bsap-update-2021/).

# 2 aPOWM characteristics

## 2.1 Information on aPOWM content

aPOWM is the KPOWM update document[8] and completes the multi-stage process based on the requirements of the MSFD in the next cycle of planning and implementation of marine strategies. Pursuant to Article 159 (1) of the Water Law (consolidated text: Journal of Laws of 2021, item 624, as amended, item 784) POWM/aPOWM defines:

1. **Basic measures** necessary to achieve or maintain good environmental status of marine waters, including legal, administrative, economic, educational and control measures:
   a) affecting the permitted intensity of human activity,
   b) affecting the permissible degree of disturbance in marine ecosystems,
   c) affecting the location and date of implementation of the planned projects,
   d) contributing to the identification of marine pollution,
   e) which, for reasons of economic interest, encourage users of marine ecosystems to act in such a way as to achieve or maintain good environmental status in marine waters,
   f) for restoring damaged elements of marine ecosystems,
   g) ensuring the contribution of all concerned to the achievement of good environmental status of marine waters and aiming at raising public awareness of the achievement or maintenance of good environmental status of marine waters;
2. **Ad hoc measures** to further pursue environmental objectives for marine waters in order to prevent further deterioration of the marine environment for the reasons indicated in points 2 to 4 of paragraph 2[9], and to mitigate the negative impact on the waters of the Baltic Sea region or the marine waters of other Member States of the European Union, if any;
3. Areas of marine waters, including their boundaries, for which the environmental objectives are not achieved through the measures set out in the Marine Waters Protection Programme;
4. A network of marine waters covered by a form of nature protection within the meaning of the Nature Conservation Act of 16 April 2004;
5. Analysis of the impact of individual basic and ad hoc measures on the status of the marine waters environment, including an analysis of the costs and benefits associated with their implementation;
6. An analysis of the impact of the basic measures, and of the ad hoc measures, on waters outside marine waters in order to minimise the risks and, if possible, to achieve a positive impact on those waters;
7. How and to what extent basic and ad hoc measures contribute to the achievement of the environmental objectives for marine waters;

[8] National Marine Waters Protection Programme adopted by the Regulation of the Council of Ministers of 11 December 2017 on the adoption of the National Marine Waters Protection Programme (Journal of Laws of 2017, item 2469)

natural [9] causes; force majeure; changes in the physical characteristics of marine waters caused by measures of major public interest which are considered to be more significant than the negative environmental impact, including transboundary impact, provided that they do not permanently preclude the achievement of good environmental status in the marine environment of other Member States of the European Union and do not jeopardise the achievement of such status.

8. tools to ensure coordination of management, in particular deadlines, templates for reporting on the implementation of measures and other reporting requirements.

Derogations from the GES provided for in the POWM/aPOWM must meet the conditions provided for in Article 14 of the MSFD.

The basic measures provided for in the aPOWM can be divided into:

1. '**Existing**' measures – measures resulting from already adopted documents or existing legal acts and aimed at achieving the objectives set out in the 'Set of environmental objectives for marine waters'.
2. **Measures from KPOWM to be continued** in the current planning cycle (aPOWM proposes appropriate modifications of measures)
3. **"New" measures** – measures resulting from the notifications of the institutions indicated in the Water Law and proposed by the experts developing the aPOWM draft. Here, too, there are new measures recommended within HELCOM.
4. Measures resulting from gap analysis.
5. In addition, it **defines ad-hoc measures** – used in the situation of sub-basins for which a derogation from the designated environmental objectives for marine waters has been provided for and justified.

The development and reporting of the POWM shall be carried out in close correlation with measures undertaken within the framework of Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (Water Framework Directive). Taking into account the fact that many measures aimed at improving the status of the marine environment are located on land - and therefore subject to the provisions of the WFD - there is a need to coordinate both directives has resulted in the aPOWM measures being aggregated into the WFD implementation guidelines and a set of types of measures called Key Types of Measures (seeTable 5, KTM 1 -25), supplemented by the Key Types of Measures from the implementation of the obligations under the MSFD (seeTable 6, KTM 26 - 39).

**Table 5 List of key types of measures (KTMs) designated for reporting under the WFD with reference to the MSFD**

| Item | Description of the WFD KTMs | Assignment to indicators/characteristics resulting from MSFD |
|---|---|---|
| **1** | Construction and modernisation of sewage treatment plant | **Significant for reducing nutrient and particulate loads**<br>(D5 - Biological diversity<br>D10 - Waste in the marine environment) |
| **2** | Reduction of pollution by fertilisers from agriculture | **Significant for reducing fertiliser loads**<br>(D5 - Eutrophication) |
| **3** | Reduction of pollution by pesticides from agriculture | **Significant for reducing pollutant loads**<br>(D8 - Pollutants and pollutant effects<br>D9 - Harmful substances in fish and seafood) |
| **4** | Remediation of contaminated sites (historical contamination, including | **Significant for reducing pollutant loads** |

| Item | Description of the WFD KTMs | Assignment to indicators/characteristics resulting from MSFD |
|---|---|---|
| | bottom sediments, groundwater and soil) | (D8 - Pollutants and pollutant effects<br>D9 - Harmful substances in fish and seafood) |
| **5** | Improvement of the continuity of watercourses (e.g. construction of passes, removal of old dams) | **Relevant for diadromous fishes**<br>(D1 - Biological diversity)<br>and sediments<br>(D7 - Hydrographic conditions) |
| **6** | Improvement of hydromorphological conditions of water bodies other than the continuity of watercourses (e.g. restoration of rivers and their coastal zone, removal of embankments, reconstruction of the connection of the river with the floodplain, improvement of hydromorphological conditions of transitional and coastal waters, etc.), | **Significant**<br>(D7 - Hydrographic conditions) |
| **7** | Improving flows/ obtaining ecological (biological) flows | **Significant**<br>(D7 - Hydrographic conditions) |
| **8** | Technical measures for the economical management of irrigation water, industry, energy and households | **Unlikely** |
| **9** | Policy action on water prices to implement the reimbursement of water services from households | **Unlikely** |
| **10** | Policy action on water prices to implement the reimbursement of water services from industry | **Unlikely** |
| **11** | Policy action on water prices to implement the reimbursement of water services from agriculture | **Unlikely** |
| **12** | Advisory services for agriculture | **Relevant for the reduction of nutrients and pesticides**<br>(D5 - Eutrophication<br>D8 - Pollutants and pollutant effects<br>D9 - Harmful substances in fish and seafood) |
| **13** | Measures taken for the protection of drinking water (such as establishment of protection zones, buffer zones, etc.) | **Relevant for seawater desalination**<br>(D7 - Hydrographic conditions) |
| **14** | Research, Increasing the Knowledge Resource to Limit Uncertainties | **Relevant, may be adequate to all indicators** |

| Item | Description of the WFD KTMs | Assignment to indicators/characteristics resulting from MSFD |
|---|---|---|
| **15** | Measures to phase out or reduce emissions, discharges and losses of priority hazardous substances. | Significant for reducing pollutant loads<br>(D8 - Pollutants and pollutant effects<br>D9 - Harmful substances in fish and seafood) |
| **16** | Upgrades and improvements of industrial sewage treatment plants (including industrial animal husbandry) | **Significant for reducing nutrient loads, particulates and contaminants**<br>(D5 - Biological diversity<br>D8 - Pollutants and pollutant effects<br>D9 - Harmful substances in fish and seafood<br>D10 - Waste in the marine environment) |
| **17** | Measures to reduce sediments from soil erosion and surface runoff | **Possibly relevant for reducing nutrient loads and sediments**<br>(D5 - Eutrophication<br>D7 - Hydrographic conditions) |
| **18** | Measures to prevent or reduce the adverse impact of invasive alien species and (introduced) diseases | **Significant**<br>(D2 - Non-native species) |
| **19** | Measures to prevent or reduce adverse effects on recreation, including fishing | **Significant**<br>(D2 - Non-native species<br>D3 - Commercially exploited fish and invertebrate species<br>D10 - Waste in the marine environment<br>D11 - Underwater noise and other energy sources) |
| **20** | Measures to prevent or reduce the adverse impact of fishing and other uses/disposal of animals and plants | **Significant**<br>(D1 - Biological diversity<br>D3 - Commercially exploited fish and invertebrate species<br>D4 - Food chains<br>D6 - Seabed integrity) |
| **21** | Measures to prevent or reduce pollution from urban areas, transport and infrastructure (built-up areas) | **Relevant for overall pollution reduction**<br>(D5 - Biological diversity<br>D8 - Pollutants and pollutant effects<br>D9 - Harmful substances in fish and seafood<br>D10 - Waste in the marine environment<br>D11 - Underwater noise and other energy sources) |

| Item | Description of the WFD KTMs | Assignment to indicators/characteristics resulting from MSFD |
|---|---|---|
| **22** | Measures to prevent or reduce the negative impact of pollution from forestry | **Possibly important for reducing nutrient loads and contaminants**<br>(D5 - Eutrophication<br>D8 - Pollutants and pollutant effects<br>D9 - Harmful substances in fish and seafood) |
| **23** | Measures for natural retention | **Significant for positive impact on nutrient loads and sediment transport**<br>(D5 - Eutrophication<br>D7 - Hydrographic conditions) |
| **24** | Adapting to climate change | **Significant, especially for the coastal zone**<br>(D1 - Biological diversity<br>D4 - Food chains<br>D6 - Seabed integrity<br>D7 - Hydrographic conditions) |
| **25** | Steps taken to prevent acidification | **Unlikely** (RDW KTMs refer to freshwater) |

*Source: European Commission. 2018. Reporting on Programmes of Measures (Article 13), on exceptions (Article 14), and on interim reports (Article 18) for the Marine Strategy Framework Directive. DG Environment, Brussels. Pp 43 (MSFD Guidance Document 12) (https://circabc.europa.eu/sd/a/60728950-8791-45a2-9891-e7defdf785c7/GD12%20-%20Guidance%20on%20Art%2013-14-18%20Reporting_post-consultation.pdf )*

**Table 6 List of KTMs developed for the purposes of reporting on the implementation of obligations under the MSFD**

| Item* | KTM description |
|---|---|
| **26** | Measures to reduce the physical loss of seabed habitats in marine waters (and not addressed in the WFD Coastal Waters Criteria 6) |
| **27** | Measures to reduce the physical damage to the seabed in marine waters (and not mentioned in KTM 6 for coastal waters covered by the WFD) |
| **28** | Measures to reduce energy emissions to the marine environment, including underwater noise |
| **29** | Measures to reduce marine litter |
| **30** | Measures to reduce disruption of hydrological processes in the marine environment (and not mentioned in KTM 6 for coastal waters covered by the WFD) |
| **31** | Measures to reduce pollution by hazardous substances (synthetic substances, non-synthetic substances, radioactive substances) and to reduce the systematic or deliberate release of these substances into the marine environment from sources located at sea or in the air. |
| **32** | Measures to reduce marine pollution from accidents |
| **33** | Measures to reduce the inflow of nutrients and organic matter into the marine environment from sources located at sea or in the air |
| **34** | Measures to reduce the inflow and spread of alien species in the marine environment and to reduce their populations |
| **35** | Measures to reduce biological disturbances in connection with the extraction of species, including by-catches |
| **36** | Measures to reduce other types of biological disturbances, including death, injury, disturbance, displacement of native marine species, introduction of microbial pathogens and introduction of genetically modified marine species (e.g. from aquaculture) |
| **37** | Measures leading to the restoration and preservation of marine ecosystems, including habitats and species |
| **38** | Spatial Protection Measures for the marine environment (not covered by other KTMs) |
| **39** | Other measures |

*the continuous numbering from the table no. 4 presenting the KTM prepared for the purposes of reporting on the implementation of the obligations under the WFD in accordance with the source document is maintained.

*Source: European Commission. 2015. Reporting on Programmes of Measures (Art. 13) and on exceptions (Art. 14) for the Marine Strategy Framework Directive. DG Environment, Brussels. Pp34. (https://circabc.europa.eu/sd/a/aa788b20-badf-4125-87a7-08aba9633016/GD12%20-%20Guidance%20on%20Art%2013-14%20Reporting.pdf)*

In addition to the measures foreseen in the aPOWM, the measures foreseen in other strategic documents, included in the aPOWM draft as "measures resulting from other policies", may also contribute to the achievement or maintenance of the GES.

The new measures adopted in the aPOWM draft include primarily non-technical measures as well as measures of a technical nature. The latter, as well as selected non-technical measures (e.g. increasing the requirements for the disposal of biogenes in waste water treatment plants) may provide a framework for the subsequent implementation of projects which may materially affect the environment.

In the framework of aPOWM, basic non-technical measures include the following categories:

- legal measures,
- administrative,
- economic,
- educational,
- Control measures.

As part of the work on aPOWM, characteristic sheets were developed, in which both measures resulting from the already adopted strategic documents (existing measures) as well as new measures proposed under the aPOWM draft and continued measures with KPOWM adapted with or without changes to the new planning period were given. In addition, action sheets have also been developed for each new and continued action and are included in Annex 4 to the aPOWM draft.

## 2.2 Information on the objectives of aPOWM

The aPOWM draft aims to achieve environmental objectives for marine waters, which have been defined and submitted to the European Commission on the basis of MSFD requirements.

Pursuant to Article 156 (3) of the Act of 20 July 2017 – Water Law (i.e. Journal of Laws of 2021, item 624, as amended, item 784), when developing a set of environmental objectives for marine waters, the following shall be taken into account:

- the characteristics and properties of marine waters,
- pressures and impacts on marine waters,
- the characteristics and environmental impacts of the transboundary waters of the Baltic Sea region and the need to ensure that the environmental objectives for marine waters are consistent with those of other Member States of the European Union in the Baltic Sea region and of countries outside the borders of the European Union bordering the Baltic Sea region,
- the need to define the environmental objectives in such a way as to enable the monitoring of marine waters and the ongoing assessment of the status of the marine environment and the operational objectives related to the measures undertaken to achieve the environmental objectives,
- the characteristics of the target or maintained environmental status of the marine waters and the need to determine that status, taking into account the characteristics and properties of the marine waters,
- the coherence of the environmental objectives for marine waters,
- a description of the parameters used to monitor progress and to guide the measures taken to achieve the environmental objectives for marine waters,
- the need to take account of social, economic and spatial issues.

A set of environmental objectives for Polish maritime areas was developed in the first cycle of MSFD implementation. In the current cycle, its update was developed and adopted by the Regulation of the Minister of Infrastructure of 25 February 2021 on the adoption of an update of the set of environmental objectives for marine waters (Journal of Laws, item 569).

The objectives were set both at the level of individual features as well as at the level of individual criteria, taking into account all elements of their composition, in accordance with Commission Decision

(EU) 2017/848 of 17 May 2017 laying down the criteria and methodological standards for good environmental status of marine waters and specifications and uniform methods of monitoring and evaluation, and repealing Decision 2010/477/EU (Official Journal of EU L 125, 04.05.2016, p. 43). Specific objectives have also been defined, taking into account individual ecosystem components (in the case of state features) or isolated areas (in the case of pressure features). The objectives have been defined in a descriptive manner and, where justified, referred to the limit values defining the characteristics typical of good condition, without mentioning their values.
A summary of the set of environmental objectives defined at the level of each characteristic is presented below (as indicated above, the environmental objectives are also defined at the level of criteria and indicators relating to each assessment area).

**Table 7 List of environmental objectives**

| Feature no. | Description |
|---|---|
| **STATUS CHARACTERISTICS** | |
| **D.1 Biological diversity** | Target for feature: Reducing or maintaining anthropogenic pressure to a level that ensures the maintenance of natural habitats in which the natural biodiversity of the biotic elements present is preserved, including in fisheries, and the protection of habitats within Natura 2000 protected areas is ensured. |
| **D.4 Food chains** | Target for feature: Limiting the impact of human activity to the level enabling the ecosystem to reach a state in which all elements of the marine trophic chain will exhibit a natural and stable level of abundance and diversity, and the productivity of biotic components guarantees the proper functioning of the trophic network. |
| **PRESSURE CHARACTERISTICS** | |
| **D.2 Non-native species** | Target for feature: Reducing the possibility of the spread of alien species introduced into the environment as a result of human activity in order to ensure the presence of alien species at levels that do not disturb the structure and functioning of the ecosystem, in particular for individual groups of species, areas particularly vulnerable to introduction and general habitat types, by taking appropriate measures. |
| **D.3 Commercially exploited fish and invertebrate species** | Target for feature: The objective is to maintain the stocks of commercially exploited fish and crustaceans within safe biological limits commensurate with their natural conditions by ensuring that all commercially exploited fish stocks are exploited at or below maximum sustainable yield, ensuring that all commercially exploited fish are within safe biological limits, and by reducing or maintaining the exploitation of fish stocks to a level that ensures that their full reproductive capacity and the full range of age and individual size are maintained. |
| **D.5 Eutrophication** | Target for feature: Maintaining the inflow of annual nitrogen and phosphorus loads introduced into the Baltic Sea by rivers and in the form of atmospheric deposition below the MAI values established under the regional arrangements (HELCOM), which will allow the concentration of biogenic substances in the sea to be reduced to a level not exceeding the limit values that are consistent with the recommendations of the current national and European Union legislation and which guarantee the achievement or maintenance of good environmental status and do not cause negative effects in the form of excessive growth of algae, increased concentrations of chlorophyll 'a' in the water column, reduction of the |

| | |
|---|---|
| | transparency of sea water and the level of oxygenation of seabed waters, which in turn promotes the proper development of pelagic and benthic habitats. |
| **D.6 Seabed integrity** | Target for feature: Limiting the accumulated pressure on the seabed to a level that allows benthic habitats to operate close to the natural level. |
| **D.7 Hydrographic conditions** | Criterion D7C1 (secondary): Spatial extent and distribution of constant changes in hydrographic conditions (e.g. changes in wave activity, currents, salinity, temperature) of the seabed and the water column related in particular to the physical loss of the natural seabed.<br><br>Environmental objective: Reduction of pressures related to constant changes in hydrographic conditions.<br><br>Criterion D7C2 (secondary): The spatial extent of each adversely affected benthic habitat (physical and hydrographic properties and associated biological communities) due to permanent changes in hydrographic conditions.<br><br>Environmental objective: Reduce cumulative pressures on habitats. |
| **D.8 Pollutants and pollutant effects** | Criterion D8C1 (basic): Within coastal and territorial waters and outside territorial waters, concentrations of pollutants shall not exceed certain threshold values.<br><br>Environmental objective: Reduction or maintenance at current levels of inputs of pollutants from marine sources, including the application of measures to minimise releases of pollutants resulting from incidents of a sudden nature, and from land-based releases into the marine environment, in order to achieve or maintain concentrations of pollutants in the biotic and abiotic elements of the marine ecosystem at levels below the acceptable threshold values, below which adverse effects on marine organisms are likely to occur, which are consistent with the recommendations of existing national and international legislation, and which guarantee the achievement or maintenance of good environmental status.<br><br>Criterion D8C2 (secondary): The health of the species and the status of the habitats, such as their species composition and the relative abundance in long-term contaminated sites, have not been adversely affected due to pollutants, including cumulative and synergistic effects.<br><br>Environmental objective: The impact of pollutants on organisms of marine fauna and flora at various levels: molecular, cellular, tissue, organ, individual, population, taking into account cumulative and synergistic effects, is at a level that guarantees the proper functioning of organisms, taking into account the maintenance of normal physiological functions and thus guarantees the maintenance of the proper structure of species and the range of habitats.<br><br>Criterion D8C3 (basic): The spatial extent and duration of significant pollutants […], including crude oil and similar emergency components, is minimised.<br><br>Environmental objective: The occurrence of pollution of an emergency nature involving pollutants, as defined in Article 2 (2) of Directive 2005/35/EC of the European Parliament and of the Council of 7 September 2005 on ship-source pollution and on the introduction of penalties, including criminal penalties, for pollution-related offences, including crimes involving oil and the like, shall be |

| | |
|---|---|
| | reduced to a minimum by the implementation of appropriate measures at operational level and safeguards.<br><br><u>Criterion D8C4</u> (secondary): The negative effects of significant emergency pollutants on the health of species and the condition of habitats (such as species composition and relative abundance) are minimised and, where possible, eliminated.<br><br>Environmental objective: The impact of pollutants resulting from releases resulting from emergencies on the structure of species (listed in Table 1 of Part II of the Annex to Commission Decision 2017/848) and the extent of habitats (listed in Table 2 of Part II of the Annex to Commission Decision 2017/848) shall be reduced to a minimum by the implementation of containment measures and systems aimed at eliminating the occurrence of sudden pollutants. |
| **D.9 Harmful substances in fish and seafood** | Environmental objective: Reducing or maintaining at current levels inputs of pollutants from different marine and terrestrial sources introduced into the marine environment in order to achieve or maintain concentrations of pollutants in fish and seafood intended for human consumption at levels not exceeding limit values that comply with standards and recommendations of applicable national and European Union legislation and that guarantee the safety of consumption and achieve or maintain good environmental status. |
| **D.10 Marine litter** | General environmental objective: Reducing the amount of newly emerging and deposited solid waste from different land and sea sources in the marine environment to levels that guarantee the proper functioning of the ecosystem, taking into account its natural resilience, or completely eliminating emerging waste. |
| **D.11 Underwater noise and other energy sources** | <u>Criterion D11C1</u> (basic): Spatial distribution, temporal extent and waterborne impulse sound levels associated with human activity do not reach levels that adversely affect marine animal populations.<br><br>Environmental objective: Reduction of pressures associated with the temporal and spatial occurrence of man-made impulse sounds in the sea, above levels having a negative impact on marine animal populations.<br><br><u>Criterion D11C2</u> (basic): The spatial distribution, temporal extent and levels of continuous low-frequency sounds in water associated with human activity do not reach levels that adversely affect marine animal populations.<br><br>Environmental objective: Reduce the pressures associated with the temporary and spatial occurrence in the sea of continuous low-frequency human-activity sounds, above levels that have a negative impact on marine animal populations. |

*Source: Regulation of the Minister of Infrastructure of 25 February 2021 on the adoption of an update of the set of environmental objectives for marine waters (Journal of Laws, item 569).*

In the update of the set of environmental targets for marine waters, a deadline for achieving the environmental targets for 2022 has been set: '*MSFD requires the achievement or maintenance of good environmental status of the marine environment, including environmental objectives, for all characteristics by 2020. In turn, the Baltic Sea Environment Protection Commission (HELCOM), through the development of the Baltic Sea Action Plan, assumed the achievement of the GES by 2021. However, given the 6-year update cycle of the marine environmental assessment, the updated environmental targets for marine waters should be achieved by 2022. This is due to the fact that the next update of* *the preliminary assessment of the marine water environment will be carried out for the period 2017–2022, which will allow to determine in practice the effectiveness of measures taken to achieve the set environmental objectives for marine waters* "[10].

## 2.3 Links between aPOWM and other strategic documents

aPOWM is a document that identifies measures aimed at achieving GES. Achieving or maintaining good health is influenced by measures taken both at sea and on land. In addition, the factors determining the ecological status of marine waters are primarily natural conditions and processes that affect waters (such as climate change).

The measures referred to above result from a number of strategy papers. More than 70 documents adopted at Community, national and regional level have been reviewed to identify them[11].

**Community documents** that are relevant in the context of aPOWM include, in particular:

- 'European Union Strategy for the Baltic Sea Region',
- "EU Biodiversity Strategy 2030", which sets out the main objectives for the restoration of natural resources up to 2030,
- 'Sustainable Europe 2030',
- Environment Action Programme to 2020 (7th EAP) / Draft Environment Action Programme to 2030 (8th EAP).

In addition to the strategic documents, they also include such documents as: The common agricultural policy or the common fisheries policy, which relate to those measures which have an impact on the state of maritime areas.

**Documents at national level that** result in measures directly or indirectly supporting the achievement of the objectives directly or indirectly affecting the aPOWM (which does not mean that they do not include measures that may adversely affect the achievement of the objectives) are, in particular:

- Water (River Basin) Management Plans for the Baltic catchment - planning documents for individual river basin areas, which are the basis for decisions shaping the status of water resources, improving the process of achieving or maintaining good water status and related ecosystems (documents resulting from the process of preparing the current update of the Water Management System (IIuRBMP) were also used – the documents were not adopted by the Council of Ministers). The IIuRBMP contains an Action Programme aimed at achieving the environmental objectives for surface water, groundwater and protected areas. In particular, with regard to individual coastal and transitional water bodies in IIuRBMP for the Vistula and Odra river basins, measures were proposed in the following categories: Prevention of further anthropogenic changes of the coastal zone, Restoration and improvement of the condition of hydromorphological elements, Protection against the entry of pollutants from ships into water, measures resulting from protection plans/plans of protection tasks established for areas intended for the protection of habitats or species, as laid down in the Nature Conservation Act, for the protection of which the maintenance or improvement of water

[10] Regulation of the Minister of Infrastructure of 25 February 2021 on the adoption of an update of the set of environmental objectives for marine waters (Journal of Laws, item 569).
[11] If it was considered that a document could be of significant importance in the context of indicating directions and measures that could have an impact on maritime areas and has not yet been adopted, then the draft of that document, if it was published, was analysed.

status is an important factor, Sewage management in non-urbanised areas, Protection against the inflow of anthropogenic pollutants into water, Sewage management in agglomerations.

- V update of the National Programme for Municipal Waste Treatment (KPOSK) 2017 / draft VI update of KPOSK 2020 - the basic instrument for implementing the provisions of Directive 91/271/EEC on urban waste water treatment.
- Strategic Adaptation Plan for sectors and areas sensitive to climate change up to 2020 with a 2030 perspective.
- Strategy for Responsible Development to 2020 (with a perspective to 2030)) – The SRD is the basis for the preparation of sectoral strategies, the objectives, directions of intervention, measures and strategic projects set out in the SRD should be reflected in all strategic documents.
- The Sustainable Development Strategy for Rural Areas, Agriculture and Fisheries 2030 (SDRAAF 2030) – the document defines the key directions of development of rural areas, agriculture and fisheries consistent with the objectives of the RA, including the planned measures for 2030 to carry out agricultural and fisheries production in accordance with the principles of environmental protection and adaptation of the agri-food sector to climate change.
- State Environmental Policy 2030 - development strategy in the field of environment and water management (PEP 2030) – PEP 2030 is a clarification and operationalization of the provisions of the SRD and defines, in particular, specific objectives regarding health, economy and climate in a way that allows for harmonization of environmental issues with economic and social needs.
- Sustainable Transport Development Strategy until 2030 – sets out the directions of interventions and measures, which are a refinement of the provisions of the SRD in the field of transport, an important element of the strategy is, among others, the development of maritime transport and the development of port infrastructure, including measures in the field of increasing shipping safety and reducing marine pollution.
- Action programme for the reduction of pollution of waters by nitrates from agricultural sources and the prevention of further pollution – the national programme adopted by means of a regulation implements the provisions of Council Directive 91/627/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources.
- National Waste Management Plan 2022.
- The Drought Effects Counteracting Plan (PPSS).

In addition, documents at the regional level, such as strategies for the development of provinces, especially those directly related to marine waters: Zachodniopomorskie, Pomorskie or Warmińsko-Mazurskie, were also analyzed. APOWM is also linked to a number of different strategic documents, which primarily provide for directions of action or even specific measures that may have a significant negative impact on the marine environment. These include, among others, such documents as:

- National Energy and Climate Plan 2021-2030 Assumptions and objectives and policies and measures,
- Poland's energy policy until 2040,
- Polish Nuclear Power Programme,
- Long-term Programme "Construction of a waterway connecting the Vistula Lagoon with the Gulf of Gdańsk" - draft,

- Program for the development of Polish seaports until 2030
- Flood Risk Management Plans - a basic document for individual river basin districts, specifying flood protection measures (documents resulting from the process of preparing the current update of the FRMP were also used – the documents were not adopted by the Council of Ministers).

Most of the analyzed documents define a longer time horizon until 2030 or occasionally (e.g. Polish Energy Policy until 2040).

The list of analyzed documents, which show measures that may have a potential impact on the quality of the marine environment, is presented in Annex 4 to the Forecast. In turn, Annex 5 to the Forecast presents the results of the analysis of environmental impact forecasts for strategic documents.

Directions and measures contained in the analyzed documents may be directly or indirectly relevant in the context of individual KTMs (indicated in the table in this Annex), and thus may affect the objectives set for the protection of marine waters. The analyzed documents within individual KTMs may have both supporting and weakening impact in the context of achieving the objectives set for the protection of marine waters.

The analyzed documents define the objectives and directions of measures in the field of the subject matter specified in the document. Some of them are directly related to the maritime area, but the vast majority concern land-based measures that may indirectly affect the marine environment.

For most of the strategic documents analysed, a strategic evaluation was carried out. Where no strategic evaluation was carried out, this was due to the nature of the strategy paper, and a deviation from the strategic evaluation was warranted. This applies, among others, to such documents as: V KPOSK, National Urban Policy 2023, Strategy for the Sustainable Development of Rural Areas, Agriculture and Fisheries 2030 (SDRAAF 2030), update of the Polish Nuclear Power Program (PNP2020). As indicated above, the results of the analysis of environmental impact forecasts for strategic documents are presented in Annex 5 to the Forecast.

## 2.4 Considered aPOWM variants

The methodology adopted for the development of aPOWM is based on the approach of identifying the setting of limit values for indicators for each feature (D1-D11), and then searching for such solutions (measures) that will enable its achievement or improvement and then on the assessment of the effectiveness of the proposed measures.

Below are the options that were analysed:

- The baseline scenario, also called the zero scenario, i.e. the lack of implementation of measures resulting from aPOWM – this is the equivalent of the so-called Business as Usual (BaU) option,
- Recommended option – containing new measures identified as a result of gap analysis and aimed at achieving the environmental objectives of marine waters.

In addition, in the context of the possibility of achieving GES, in particular in the field of eutrophication, aPOWM analyzed the options assuming the implementation of KPOWM and aPOWM measures in connection with a different degree of implementation of HELCOM's obligations by the Baltic States.

In accordance with the update of the Set of Environmental Objectives for Marine Waters, environmental objectives have been developed at the level of features, criteria and individual basic indicators. Some indicators are described quantitatively and some qualitatively. Depending on whether the indicators are expressed quantitatively or qualitatively, it is possible to quantify the activity or there is a need for a qualitative assessment, and this determines the method of assessing effectiveness.

A comparative analysis of the options was carried out in relation to the achievement of the environmental objectives for the indicators (features) and sub-bodies of the Polish Baltic Sea Zone. However, due to the use of a multidimensional, dynamic mathematical model of the Baltic Sea, physical, chemical and biological processes on the scale of the entire Baltic Sea were taken into account~~.~~ The comparative analysis of the options was carried out in the first place for the various identified ways of achieving the goal, using the CEA cost-effectiveness analysis. This analysis included options for achieving the environmental objective, which were compared in terms of cost-effectiveness.

A cost-benefit analysis (hereinafter 'CBA') was also carried out as part of the assessment of the validity of the implementation of the measures. The results of the analysis were aimed at determining the measures that should be implemented due to their clearly beneficial impact, both ecological, social and economic. Due to the fact that it was not possible to quantify and measure the effects of their implementation in monetary units for all measures, as part of the analyzes carried out, a quantitative analysis (for tangible measures) and a qualitative analysis (for intangible measures) were carried out.

The result of the CBA qualitative analysis was the ranking of measures according to effectiveness and recommendations regarding the legitimacy of the implementation of a given activity. A detailed description of the planned measures, including their assignment to particular features and KTMs, the authorities responsible for their implementation and the expected effects of their implementation, is presented in Annex 4 to the aPOWM. In addition, the aPOWM describes, for each feature:

- the contribution of the measures to the achievement of the environmental objectives by 2022 and 2027.
- the likelihood that the implementation of the measures will result in the achievement of the GES in 2027 and in 2050.
- an indication of whether the exceptions referred to in Article 14 of the MSFD apply.

The following tables present the results of the impact of the measures proposed in the aPOWM draft on the achievement of GES designated for individual sub-water bodies. Table 8 presents the time perspective for achieving the GES by 2027, while Table 9 by 2050.

The results of this assessment are also presented in Annex 2 to the Forecast where:

- In the first series of maps, for each sub-water body (according to the division of HELCOM), an assessment of the achievement of a good status of the marine environment was presented on the basis of the Preliminary assessment of the state of the marine water environment,
- The second series of maps presents for the areas analyzed in aPOWM (in accordance with PMŚ) a forecast of achieving good state of the marine environment in 2027 (in a 5-point probability scale) assuming that Poland will implement all measures in aPOWM, and other HELCOM countries will not,
- The third series of maps presents for the areas analyzed in aPOWM (in accordance with PMŚ) a forecast of achieving good state of the marine environment in 2050 (in a 5-point probability scale) assuming that Poland will implement all measures in aPOWM, and other HELCOM countries will not.

**Table 8 Results of the analysis of the achievement of GES by 2027**

| | | | Descriptive indicators up to 2027 | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **No.** | **Water category** | **Sub-water body** | **D1 mammals,** | **D1 hibernating birds** | **D1 Breeding birds** | **D1 fish,** | **D1 pelagic habitats** | **D6 benthic habitats** | **D2** | **D3 sprat,** | **D3 herring,** | **D5** | **D6 (remaining part)** | **D7** | **D8** | **D9** | **D10** | **D11 Impulse Noise** | **D11 Continuous noise** |
| **1.** | Ot | Open waters of the Bornholm Basin | | | | | | | | | | | | | | | | | |
| **2.** | Ot | Eastern Baltic Open Waters | | | | | | | | | | | | | | | | | |
| **3.** | Ot | Open Waters of the Gulf of Gdansk | | | | | | | | | | | | | | | | | |
| **4.** | Pb | Coastal waters of the Gulf of Pomerania | | | | | | | | | | | | | | | | | |
| **5.** | Pb | Polish coastal waters of the Bornholm Basin | | | | | | | | | | | | | | | | | |
| **6.** | Pb | Polish coastal waters of the Gotland Basin | | | | | | | | | | | | | | | | | |
| **7.** | Pb | Hel Peninsula | | | | | | | | | | | | | | | | | |
| **8.** | Prz | Kamieński Lagoon | | | | | | | | | | | | | | | | | |
| **9.** | Prz | Szczecin Lagoon | | | | | | | | | | | | | | | | | |

| No. | Water category | Sub-water body | Descriptive indicators up to 2027 | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | D1 mammals, | D1 hibernating birds | D1 Breeding birds | D1 fish, | D1 pelagic habitats | D6 benthic habitats | D2 | D3 sprat, | D3 herring, | D5 | D6 (remaining part) | D7 | D8 | D9 | D10 | D11 Impulse Noise | D11 Continuous noise |
| **10.** | Prz | Puck Lagoon | | | | | | | | | | | | | | | | | |
| **11.** | Prz | Outer Puck Bay | | | | | | | | | | | | | | | | | |
| **12.** | Prz | Mouth of the Vistula River | | | | | | | | | | | | | | | | | |
| **13.** | Prz | Inner Gulf of Gdańsk | | | | | | | | | | | | | | | | | |
| **14.** | Prz | Vistula Lagoon | | | | | | | | | | | | | | | | | |

**Key**

| | |
|---|---|
| | **Achieving GES is virtually impossible** |
| | Achievement of GES unlikely |
| | Achievement of GES quite probable |
| | Achievement of GES highly probable |
| | Achievement of GES almost certain |
| | Extremely uncertain forecasting |
| | Indicator does not apply to sub-water body or it is not possible to carry out an assessment |

*Source: Own study based on the aPOWM draft*

**Table 9 Results of the analysis of the achievement of GES by 2050**

| No. | Water category | Sub-water body | Descriptive indicators up to 2050: D1 mammals | D1 hibernating birds | D1 Breeding birds | D1 fish | D1 pelagic habitats | D6 benthic habitats | D2 | D3 sprat, | D3 herring, | D5 | D6 (remaining part) | D7 | D8 | D9 | D10 | D11 Impulse Noise | D11 Continuous noise |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.** | Ot | Open waters of the Bornholm Basin | | | | | | | | | | | | | | | | | |
| **2.** | Ot | Eastern Baltic Open Waters | | | | | | | | | | | | | | | | | |
| **3.** | Ot | Open Waters of the Gulf of Gdansk | | | | | | | | | | | | | | | | | |
| **4.** | Pb | Coastal waters of the Gulf of Pomerania | | | | | | | | | | | | | | | | | |
| **5.** | Pb | Polish coastal waters of the Bornholm Basin | | | | | | | | | | | | | | | | | |
| **6.** | Pb | Polish coastal waters of the Gotland Basin | | | | | | | | | | | | | | | | | |
| **7.** | Pb | Hel Peninsula | | | | | | | | | | | | | | | | | |
| **8.** | Prz | Kamieński Lagoon | | | | | | | | | | | | | | | | | |
| **9.** | Prz | Szczecin Lagoon | | | | | | | | | | | | | | | | | |

| No. | Water category | Sub-water body | Descriptive indicators up to 2050 | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | D1 mammals | D1 hibernating birds | D1 Breeding birds | D1 fish | D1 pelagic habitats | D6 benthic habitats | D2 | D3 sprat, | D3 herring, | D5 | D6 (remaining part) | D7 | D8 | D9 | D10 | D11 Impulse Noise | D11 Continuous noise |
| **10.** | Prz | Puck Lagoon | | | | | | | | | | | | | | | | | |
| **11.** | Prz | Outer Puck Bay | | | | | | | | | | | | | | | | | |
| **12.** | Prz | Mouth of the Vistula River | | | | | | | | | | | | | | | | | |
| **13.** | Prz | Inner Gulf of Gdańsk | | | | | | | | | | | | | | | | | |
| **14.** | Prz | Vistula Lagoon | | | | | | | | | | | | | | | | | |

**Key**

| | |
|---|---|
| | **Achieving GES is virtually impossible** |
| | Achievement of GES unlikely |
| | Achievement of GES quite probable |
| | Achievement of GES highly probable |
| | Achievement of GES almost certain |
| | Extremely uncertain forecasting |
| | Indicator does not apply to sub-water body or it is not possible to carry out an assessment |

*Source: Own study based on the aPOWM draft*

According to the analyses carried out for the needs of aPOWM, despite the application of additional measures to be implemented in the aPOWM draft, in the current cycle until 2027, it will not be possible to achieve GES for most features. In particular, due to the distant (2036) deadline for full implementation of the measures and the long response time of the ecosystem to the reduction of loads (the time of exchange of waters in the Baltic Sea is 25 years), no significant improvement in eutrophication rates is expected by 2027. The achievements of GES in the perspective of 2050 can be expected mainly in transitional waters, where water exchange times are shorter, waters are regularly mixed to the bottom, and the influences of loads from other countries are small. In open waters, it is to be expected that even if other countries reduce their charges to NIC, the achievement of GES[12] by 2050 is unlikely due to a very slow improvement in aerobic conditions. If in the analyzed period, in accordance with the "Business as Usual" scenario described in aPOWM, the expected economic changes occur, including, above all, a further intensification of agriculture, then the distance to the national cargo ceilings (NIC) will increase. Nevertheless, the full implementation of aPOWM will mean huge progress in the protection of the Baltic Sea and inland waters.

The measures recommended in the aPOWM, although they will not bring the expected results in the very limited time specified in the update of environmental objectives (i.e. until 2022), will certainly have a positive impact on the improvement of the condition and will gradually improve it until 2027 and in the following years, due to natural conditions and the specificity of the Baltic Sea, for which the process of full water exchange and real improvement of the situation is estimated at approx. 30 years.

Due to the fact that for some areas with certain features, achieving environmental goals or good ecological status by 2022 seems very unlikely, the aPOWM presents justifications for exceptions to their achievement. For those characteristics for which good environmental status indicators (GES) are not achieved, the following reasons for failure to achieve (in relation to the provisions of Article 14.1 of the MSFD) shall be indicated:

| Feature / Feature element | Art. 14 1a). | Art. 14 1b) | Art. 14 1c) | Art. 14 1d) | Art. 14 1e) | No prerequisites Art. 14 | No information |
|---|---|---|---|---|---|---|---|
| **C1, 4 Fish** | YES | | | | YES | | |
| **C1, 4 Birds** | YES | YES | | | YES | | |
| **C1, 4 Marine mammals** | YES | | | | YES | | |
| **C1, 4 Pelagic habitats** | YES | | | | YES | | |
| **C1, 6 Benthic habitats** | YES | | | YES | YES | | |
| **C2 Non-native species** | YES | YES | | | | | |
| **C3 Commercially exploited fish and invertebrate species** | YES | | | | YES | | |

[12] HELCOM Baltic Sea Action Plan (BSAP) national nutrient input ceilings (NICs)

| Feature / Feature element | Art. 14 1a). | Art. 14 1b) | Art. 14 1c) | Art. 14 1d) | Art. 14 1e) | No prerequisites Art. 14 | No information |
|---|---|---|---|---|---|---|---|
| **C5 Eutrophication,** | YES | | | | YES | | |
| **C7 Hydrographic conditions** | | | | YES | YES | | |
| **C8 Pollutants** | YES | | | | YES | | |

*Source: aPOWM draft*

*1a: action or absence of action for which the Member State concerned is not responsible*

*1b: natural causes*

*1c: force majeure*

*1d: modifications or alterations to the physical characteristics of marine waters caused by measures taken for important reasons of public interest which are considered to be more significant than the negative impact on the environment, including transboundary impact*

*1e: natural conditions which do not permit rapid improvement of the marine waters concerned*

In addition to the above table regarding the reasons hindering the achievement of environmental goals within the specified period of time, the aPOWM specifies individual cases:

- Fish - subGES is the result of eutrophication and overfishing for which all countries are responsible (1a); even if the burden is immediately reduced to MAI / NIC levels, it will take decades to improve habitat conditions and condition (1e);
- Birds - the status is assessed at the supra-regional level, therefore the responsibility for the state is common and lies with other countries (1a); a number of species included in the indicators for breeding birds do not nest or their occurrence is extremely rare due to natural causes (1b); in addition, in order for the planned measures in the field of active protection in Poland to bring significant effects, time is needed (1e);
- Marine mammals - in the case of porpoise, all countries are jointly responsible for the status due to the generated pressures, including by-catch and underwater noise (1a); in the case of the grey seal, even with active protection measures (traffic restrictions in the haul-out area), the only Polish colony needs time to become a breeding colony (if at all) (1e);
- Pelagic habitats - subGES is the result of eutrophication, for which all countries are co-responsible (1a), while ecosystem restoration will take decades even with the immediate implementation of the necessary restrictions and measures (1e);
- Alien species - indirectly, all countries are responsible for some of the alien species introduced into the waters that have taken place so far (1a); most non-native species in the Baltic are virtually impossible to eradicate due to the nature of these species (1b), and any possible attempts would entail disproportionate costs in relation to the environmental benefits obtained;
- Commercially exploited fish and invertebrate species - stocks decline mainly due to overfishing and eutrophication, for which all countries are responsible (1a); even if catches are reduced to zero and biogenic loads reach MAI / NIC levels, it will take decades to restore cod to GES status due to degraded habitats (1e);
- Eutrophication - all countries are co-responsible for the state of eutrophication of the Baltic, and the efforts made have not significantly changed this situation for years (1a); even if the

content of biogens is reduced to the level of MAI / NIC, the response of the Baltic will take decades (1e);

- Benthic habitats - subGES is largely the result of eutrophication (1a, 1e); in some monitored and assessed waters there is an additional problem of existing human-induced coastal and bottom changes, and restoring them to natural conditions would entail disproportionate socio-economic costs (1d);
- Hydrographic conditions - in some monitored and assessed waters there is a problem of existing changes in the coast and bottom caused by humans, which affected subGES in these places, and restoring natural conditions would involve disproportionate socio-economic costs (1d);
- Pollutants - pollutants, such as persistent organic pollutants or heavy metals, will require time before they decompose/ sink into sediments (1e); some pollutants, such as mercury, originate mainly from outside Poland and even outside Europe (1a).

# 3 Assessment methodology

## 3.1 Determination of spatial extent, scope and detail of the analyses

**Spatial scope of analysis**

The spatial extent of the analyzes carried out as part of the Forecast was determined on the basis of the spatial extent of the documents developed so far, listed in chapter 1.2.2 and includes marine waters, as defined in the MSFD, taking into account also coastal waters under the jurisdiction of Poland, including the sea shore zone as a transitional zone between land and sea. This limit was determined smoothly depending on the described elements of the environment, e.g. in accordance with the opinion of the Directors of Maritime Offices in Gdynia and Szczecin – protected areas located in the coastal zone were included in the description of the state of the environment and in the impacts resulting from the implementation of the measures provided for in the aPOWM~~.~~ The spatial extent of the analyzes also results from the specificity of measures (their scale, type and scale of impact) that may provide a framework for the implementation of subsequent projects reported and/or determined on the basis of the gap analysis to be implemented under aPOWM.

When determining the spatial scope of the analyzes, the cumulative impact (internal accumulation) of the above-mentioned measures with a link to accumulation in time and space was also taken into account – as far as it was possible to determine it in the framework of the strategic document, which is aPOWM and thus in the Forecast for it. It should be noted that, where possible, measures were associated with specific sub-water bodies. Their location is presented in the figure below.

**Table 10 List of sub-water bodies analyzed as part of the Forecast**

| HELCOM_ID | Polish title | English title |
|---|---|---|
| **22** | polskie wody przybrzeżne wschodniego Basenu Gotlandzkiego | Eastern Gotland Basin Polish Coastal waters |
| **SEA-009** | wschodni Basen Gotlandzki | Eastern Gotland Basin |
| **24** | polskie wody przybrzeżne Basenu Gdańskiego, | Gdansk Basin Polish Coastal waters |
| **SEA-008** | Basen Gdański | Gdansk Basin |
| **26** | polskie wody przybrzeżne Basenu Bornholmskiego | Bornholm Basin Polish Coastal waters |
| **SEA-007** | Basen Bornholmski | Bornholm Basin |

*Source: Own study based on HELCOM Monitoring and Assessment Strategy (HELCOM MAS)*

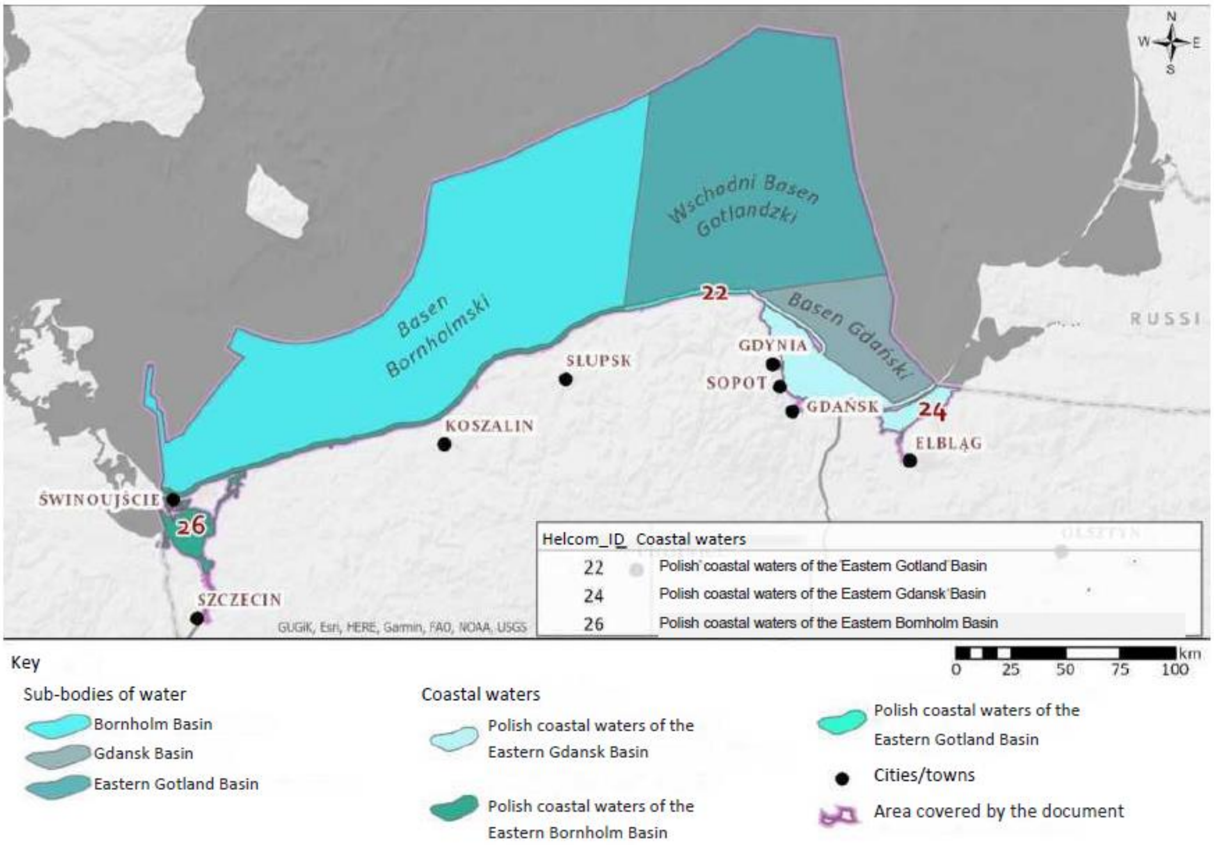



**Fig. 6 Map of analyzed sub-water bodies – aPOWM spatial extent of analyzes**

*Source: Own study based on HELCOM*

Chapter 5.3.2. presents additional information on the division of the waters of the Baltic Sea, taking into account the information on the division used in the Preliminary Assessment of the Marine Environmental Status of the Polish Baltic Sea Zone and the presentation of surface water bodies (surface water bodies) coastal and transitional.

In addition, the Forecast analyzes the already adopted strategic documents related to aPOWM, which made it possible to determine the external cumulative impacts resulting from the implementation of the measures planned to be implemented in these documents in combination with the measures provided for under aPOWM (external cumulation). Due to the specificity of aPOWM consisting in the protection of marine waters, the quality of which is influenced by land-based measures, strategic documents for the sectors: water, agriculture and fisheries, energy, transport, tourism and others, which cover almost the entire country, were analyzed as part of the Forecast. Thus, the spatial scope of the analyzes includes both the space within which they were reported to perform the activity in aPOWM, as well as the national space due to the measures resulting from other strategic documents, the implementation of which may affect the quality of marine waters - they contribute to the achievement / maintenance of good environmental status of marine waters or may inhibit /negatively affect their achievement.

**Scope and detail of the analyses**

The scope and detail of the analyzes performed results from the conditions of the applicable law (the EIA Act), and they were also determined by the opinions of the competent administrative bodies (GDOŚ, GIS, UM in Gdynia and Szczecin). The scope of key analyses resulting from the opinions of administrative bodies is summarised in the table below.

**Table 11 Summary of opinions on the scope and degree of detail of the aPOWM draft Environmental Impact Forecast**

| Item | Body | Scope - key issues |
|---|---|---|
| **1** | Chief Sanitary Inspector | • The risks for water intakes used for providing water for human consumption along with the areas of protection zones of these intakes should be taken into account.<br>• Threats to groundwater, in particular to the Main Groundwater Bodies, should be taken into account.<br>• Risks to transitional, coastal and inland waters should be taken into account for parts of the water intended for leisure purposes, i.e. the organisation of bathing sites and bathing sites on an occasional basis.<br>• Exposure to noise, vibration and air pollution shall be taken into account.<br>• Consideration should be given to the need to maintain permissible noise levels in acoustically protected areas, especially in residential areas/human habitats, buildings related to the permanent or temporary stay of children and adolescents and recreational and leisure areas.<br>• The need to ensure appropriate air quality standards should be taken into account.<br>• In the case of identifying the risk of negative impacts on human health and life related to the implementation of measures provided for by the aPOWM, particular reference should be made to possible methods of their effective elimination or maximum reduction.<br>• whenever reference is made to environmental impact, it should also be understood as impact on human health. |
| **2** | General Director for Environmental Protection | • The forecast should refer to the full version of the draft document and cover all planned measures which may materially affect the environment.<br>• It should be emphasized that in the light of Article 51 (2) (2) (a) of the Environmental Protection Act, the description of the status of the environment does not have to refer to the entire area of the country, especially if the document presents a specific scope of intervention.<br>• The forecast should take into account the content of environmental impact forecasts prepared for other documents related to the draft document under investigation, in particular national and international documents concerning the Baltic Sea area, as well as land areas related to marine areas in the context of environmental impact.<br>• The forecast should specify the impact of the implementation of aPOWM on the condition and functioning of the protected |

areas under the Nature Conservation Act of 16 April 2004. (Journal of Laws of 2020, item 55, as amended), in particular for the objects and purposes of the protection of Natura 2000 sites and the integrity and coherence of the Natura 2000 sites network, as well as the impact on protected species and the preservation of animal migration opportunities.

- However, it is recommended that the following recommendations be taken into account:
  - In measure BALPL-M010 - Analysis of the feasibility of implementing the guidelines of the International Maritime Organization (IMO) on the practice of control and management of biofouling on ships – development of tools for the implementation of a management system in maritime and inland waterway transport - it is recommended to specify the species of biofouling organisms to the species or genus, which will make it possible to determine whether they are legally protected species and, if they may occur, to take into account this fact and its consequences in the developed methods of conduct.
  - In the case of the BALPL-M034 measure, the examination of the scale of environmental hazards resulting from the deposition of wrecks on the seabed should include in the assessment proposals for preventive and minimizing measures against the occurrence of crisis situations caused by the conduct of works related to the above-mentioned research, and, if possible, include in the forecast maps with the distribution of such objects against the background of elements sensitive to possible impacts. Wreck locations can be found in the database https://sipam.gov.pl/.
  - In the case of the introduction of the new measure No. 12 consisting in the reduction of invasive crayfish, methods of reducing the population of crayfish, which will not adversely affect native invertebrate species, should be recommended. Similarly, methods that are safe for other species should be designed for other measures involving the reduction of undesirable organisms.
  - Research on the impact of bottom dredging on benthic communities, sediment release and bottom water chemistry (new Measure 28) as well as the legal determination of the maximum scale and extent of permanent coastal and seabed transformations (new Measure 29) and the use of dredging waste and rational management of spoil (new Measure 30) are measures potentially, directly or indirectly related to the parameters of the seabed, the changes of which may result in negative impacts on elements of the marine environment. It is recommended to develop a typology of such measures, taking into account the type, scale of the activity, the nature of the area in which it will be

| | | |
|---|---|---|
| | | implemented (including the characteristics of the environment and the presence of forms of nature protection, including Natura 2000 sites) and other identified parameters, relevant from the point of view of potential environmental impacts and, if the risk of significant negative impacts is identified, to recommend solutions to prevent such impacts.<br>• The document cannot be accepted if its implementation may have a significant negative impact on Natura 2000 sites, and all the conditions referred to in Article 34 of the Nature Conservation Act are not met. |
| **3** | Director of the Maritime Office in Gdynia | • The EIA forecast should be prepared in accordance with the requirements set out in Article 51 (2) and Article 52 of the EIA Act.<br>• The EIA forecast should identify, analyse and assess the environmental objectives established at international, Community and national level, which are relevant to the draft, and how these objectives and other environmental problems have been taken into account in the drafting of the document.<br>• The EIA forecast should take into account the protected areas referred to in Article 6 of the Nature Conservation Act of 16 April 2004 (Journal Laws of 2020, item 55, as amended) located in maritime areas and in the coastal belt, as well as for the purposes of nature protection listed in Art. 2 (1) of the above-mentioned Act.<br>• The impact of the implementation of aPOWM provisions, including on the coastal zone and natural values, should be determined, taking into account the impact on the condition of natural habitats, plant and animal species and their habitats for which marine Natura 2000 sites have been designated, as well as on the integrity and coherence of these areas<br>• The presented aPOWM measures should be assessed in relation to the prohibitions and restrictions resulting from the legal acts in force in the protected areas, in particular those resulting from Article 33 of the Nature Conservation Act. The EIA forecast should also be assessed in the context of the indications and recommendations contained in the established and proposed protection task plans or protection plans for Natura 2000 sites. |
| **4** | Director of the Maritime Office in Szczecin | • Existing and planned protected areas referred to in Article 6 of the Nature Conservation Act should be taken into account.<br>• The measures presented should be assessed in relation to the prohibitions and restrictions resulting from the legal acts in force in the protected areas, and they should also be assessed in the context of the indications and recommendations |

| | |
|---|---|
| | contained in the established and proposed conservation task plans or conservation plans for Natura 2000 sites<br>• The impact of the implementation of aPOWM provisions, including on the coastal zone and natural values, should be determined, taking into account the impact on the condition of natural habitats, plant and animal species and their habitats for which marine Natura 2000 sites have been designated, as well as on the integrity and coherence of these areas<br>• The EIA forecast should identify, analyse and assess the environmental objectives established at international, Community and national level - relevant for the draft update of the marine waters protection programme.<br>• The document cannot be accepted if its implementation may have a significant negative impact on Natura 2000 sites, and all the conditions referred to in Article 34 of the Nature Conservation Act are not met. Therefore, the Forecast should clearly indicate and justify the existence of these premises. |

*Source: Own elaboration on the basis of the scope and level of detail of the Forecast[13].*

In addition, significant assumptions to the Forecast result from the following guidelines and other documents and materials, such as:

- European Commission Guidance on Integrating Climate Change and Biodiversity into Strategic Environmental Assessment, European Commission 2013[14];
- KPOWM, Environmental Impact Forecast;
- Projections of the environmental impact of the sectoral strategies as well as of the programmes and strategies which may be linked to the document being drawn up;
- Available results of research work in the area of marine waters protection, in particular included in the update of the preliminary assessment of the state of the marine waters environment (GIOŚ 2018) and in HELCOM publications.

The most important strategic documents at the global level, the EU and Poland, which have an impact on the objectives of aPOWM, were also taken into account. A detailed analysis of these documents is presented later in the forecast.

In the specific case of aPOWM, which is a programme of measures aimed at the protection of water, species, habitats and human health / safety, and its pro-environmental effects are an argument for the use of individual measures, the forecast developed for the purposes of the SEA focuses primarily on the effects on other values and aspects of the environment, not covered by the aPOWM, such as: land surface and soil protection (on land), landscape, air quality, climate, cultural heritage, material goods and interactions between these impacts. Such an assumption was previously successfully adopted in the development of the KPOWM draft environmental impact forecast. The Forecast also takes into account the quality of onshore waters affecting the quality of marine waters and assesses the impact of the measures provided for in the aPOWM draft on the achievement of GES.

[13] See Annex 6 to the Forecast

[14] Polish language version: Poradnik dotyczący uwzględniania problematyki zmian klimatu i różnorodności biologicznej w strategicznej ocenie oddziaływania na środowisko https://sdr.gdos.gov.pl/Documents/bio-clia_SEA_2015.pdf

In addition, the detail of the analyses also results from the degree of detail of the aPOWM draft, including the reported and/or specified for it as part of the analysis of the gaps in measures providing a framework for the subsequent implementation of projects which may materially affect the environment and/or Natura 2000. Due to the ongoing (in parallel to the work on the Forecast) work on the aPOWM draft and the arrangements received from administrative bodies, it was assumed that the analysis will be based on the specificity of measures (their purpose, type and location). Thus, on the basis of the analysis of the measures reported to aPOWM and resulting from the defined gaps, the following groups of measures assigned to the key types of measures (KTMs[15]) described in chapter 2.1 were selected. The division into the following groups of measures results generally from the leading characteristic of GES, which corresponds to individual measures.

**A. Conservation and restoration measures (KTM 14, 18, 19, 20, 27, 28, 35, 36, 37, 38, 39)**

Within this group, measures were listed for extending the number of protected species, ensuring active protection of selected bird species, limiting anthropogenic measures related to noise emissions in Natura2000 areas where marine mammals are protected. In addition, additional measures dedicated to the protection of porpoise (adding as a subject of protection in the Natura2000 area - Słupsk Bank or limiting by-catches of porpoises in POM) and seals (limiting the disturbance of seals by people at the place of their reproduction) were indicated. Measures to improve monitoring of breeding birds (silver seagull not yet monitored on the Polish coast) and monitoring and control of land predator populations (raccoon dog, mink, raccoon, fox) were also programmed.

**B. Measures to reduce eutrophication (KTM 1, 2, 14, 16, 22, 23, 33, 37, 39)**

Measure group B specifies measures related to limiting the supply of biogenes, in particular from agricultural sources, as well as municipal economy. These are measures aimed at reducing biogenes from agriculture and forestry, such as the introduction of catchment programmes to reduce agricultural pollution, changing the rules of manure management, the use of drainage channels for water retention or limiting the use of forests in the vicinity of waters. This group includes tasks stimulating the increase in the removal of biogens in sewage treatment plants, such as: expanding monitoring and increasing the requirements for the removal of biogens in sewage treatment plants, introducing fees for biogens in wastewater or differentiation of increased fees for biogens.

**C. Measures to reduce invasive species (KTM 14, 18, 34, 37)**

As part of this group of measures, the continuation of educational and legal measures indicated in KPOWM (along with their modification) in the scope of preventing the release of alien species into the environment, as well as control and management of vegetation organisms were programmed. New measures dedicated to the reduction of the population of invasive Gobiidae species in transitional waters by biomanipulation with the use of predatory fish and the reduction of the population of the Chinese mitten crab in the area of the Szczecin Lagoon were also indicated. In addition, it was assumed to develop methods of reducing invasive species of cancers, on the basis of a pilot program on the Vistula Lagoon and the reduction of the population of the Chinese mitten crab in marine and inland waters in the west of the country, and to develop optimal methods of combating this species.

[15] KTM - Key Types of Measures designated for reporting under the WFD and MSFD (see chapter 2.1.). The assignment of measures to KTM in this Forecast is indicative.

**D. measures aimed at preserving and improving the integrity of the seabed (KTM 6, 14, 26, 27, 39)**

Within this group of measures, new measures related to the legal limitation of setting the maximum scale and scope of permanent transformations of coasts and seabed and increasing the knowledge base on the environmental impacts of trawling (study of the impact of bottom dredging on benthic communities, release of matter from sediments and bottom water chemistry) were specified. In addition, an action on the principles of the use of waste from dredging and rational management of spoil is specified.

**E. Pollutant reduction measures (KTM 14, 15, 16, 21, 31, 32)**

As part of this group of measures, the continuation of educational and legal measures indicated in KPOWM (along with their modification) was programmed in terms of increasing the effectiveness of combating pollution at sea and examining the scale of environmental threats resulting from the deposition of wrecks on the seabed. The above measures, after modification under aPOWM, concern the construction, modernization and purchase of new units for combating pollution at sea and the tasks of the Interministerial Team for Hazards arising from hazardous materials in the maritime areas of the Republic of Poland and the implementation of recommendations developed by the Team (modified BALPL-M034 - Examination of the scale of environmental hazards resulting from the deposition of wrecks on the seabed). A control action was also proposed, including inspections of installations emitting heavy metals to air and water.

**F. Measures aimed at reducing the amount of waste, including micro and nanoparticles of plastics (KTM 14, 29, 31)**

Action Group F specifies measures to reduce the supply of solid waste to the marine environment and to reduce the amount of existing litter. The implemented action of cleaning sea beaches was extended by taking into account the cleaning of the banks of rivers and beaches on lakes. In addition, the municipalities were equipped with modern equipment for cleaning beaches. Lobbying is also envisaged to ban the use of micro- and nanoparticles of plastics. In addition, a continuation of measures in the field of "Fishing for litter" - sea cleaning and action aimed at implementing an effective system of marking fishing nets (preventing the emergence of spectrum networks) was assumed.

## 3.2 Information on the methods used in drawing up the analyses

For the purposes of the evaluation and the Forecast as a result document from the evaluation, an iterative working method was used. This is a method of assessing further approximations (aPOWM draft version) and recommendations for the team developing it. The expert team analyzed the current, shared versions of sets of measures or the Programme design and prepared recommendations for changes.

During the development of the Forecast, the knowledge about the likely (typical) environmental impacts caused by the measures provided for in the Program and the knowledge of changes occurring in the environment under the influence of natural phenomena and pressure caused by external factors in relation to the Program was used. The following information was used:

- on the characteristics and properties of marine waters (referred to in Article 150 (1) (1) of the Water Law Act)[16];

[16] A set of properties typical of a good state of the Marine Waters Environment, Report to the European Commission, GIS, Warsaw 2014/

- a list of pressures of impacts on marine waters included in the analysis (referred to in Article 150 (1) (2) of the Water Law Act);
- effects on marine waters in a transboundary context;
- elaboration: "Update of the Marine Waters Monitoring Program", Report to the European Commission, GIOŚ, Warsaw 2020;
- other documents listed in chapter 1.2.1 and in the literature used.

In addition, other methods were used, including:

- identification and spatial assessment of significant environmental aspects supported by analyses in the GIS system,
- expert assessment – as the leading method, which allows for gathering in a team of expert competences covering all environmental aspects of the assessed document. As part of the work of the expert group, panel discussion and techniques such as: brainstorming, work in the subassemblies of specific expert groups, etc. were used.
- assessment of the effects of accumulated impacts on the environment, consisting in examining whether the excessive concentration of small impacts did not cause a significant impact, supported by spatial analyses using the GIS technique,
- verification of work results – the working version of the Forecast was verified by two independently working experts.

**Maintaining methodological consistency with KPOWM forecast**

As part of the work on the aPOWM environmental impact forecast, methodological consistency with the forecast developed for the updated document, i.e. KPOWM, was maintained. Therefore, in order to carry out a strategic environmental impact assessment of the Programme project, the "objectives-led" method was adopted, as in the case of the KPOWM environmental impact forecast. Only the evaluation module was expanded by listing separately the groups of measures determined according to the leading feature of GES. In addition, the forecast document retains the structure of the document, developed as part of the strategic environmental impact assessment of the KPOWM draft, updating the text to include, in particular, a description of the status of marine waters and analyses in accordance with the measures proposed under the aPOWM draftt and the provisions of current strategic documents that affect the conditions for the protection of the Baltic waters.

**Objectives-led Approach**

In order to carry out a strategic environmental impact assessment of the project of the Programme, similarly to the KPOWM draft environmental impact forecast, a method based on objectives ("objectives-led" - the SEA process is undertaken in relation to environmental objectives and priorities) was adopted.

Strategic environmental objectives constituting the backbone of the analysis Forecasts for aPOWM are determined by the adopted (binding) strategic documents being higher in the hierarchy than the assessed document and by obligations, such as international treaties, conventions, etc. During the analysis of strategic documents, environmental protection objectives binding on aPOWM were identified and criteria questions were identified to assess the impact of the implementation of the provisions of the Program on the implementation of these objectives. Analyses of the impact of the Programme on the implementation of individual environmental protection objectives focused on answering criteria questions covering key issues.

The assessment of the impact of aPOWM implementation on the implementation of strategic environmental objectives is carried out by answering the criterion questions ("evaluation") – in relation to two issues:

1. Structure and quality of the evaluated document, in relation to the strategic (overarching) objectives of environmental protection;
2. Impacts on individual environmental components to which strategic environmental objectives refer.

The individual steps of the objective-led assessment are as follows:

1. Identification of overarching strategic documents relevant to the assessed document – previously adopted (binding) defining sustainable development;
2. Determination of the environmental context of the Programme, i.e. identification of environmental issues related to the Project. Designation of experts/problem groups for individual aspects;
3. Defining strategic objectives for specific aspects – resulting from strategic objectives, called the objectives of the SEA and defining a list of "evaluation questions";
4. Having regard to the provisions of the GDOŚ, the Maritime Offices and the GIS on the scope and level of detail of the assessment, criteria or indicators and environmental objectives to be achieved are defined by establishing an assessment framework;
5. Consideration and assessment of possible and rational alternative ways of achieving the objectives of the Programme;
6. Evaluation of the Programme and its alternatives in accordance with the evaluation framework set out above;
7. Presentation of the likely significant impacts in relation to the identified objectives of the SEA;
8. Indication of the scope and method of monitoring.

**Determination of environmental protection objectives adequate for aPOWM**

To this end, the content of selected international agreements (conventions), Community documents (plans, programmes, communications, recommendations and opinions) and strategy papers established at national level (policies, plans and programmes) were analysed.

The main strategic objectives of environmental protection resulting from the adopted strategic documents and related to the Programme are as follows:

1. **Assuring human health and safety**
2. **Protection of biodiversity**
3. **Supporting the achievement or maintenance of good environmental status of marine waters (GES)**
4. **Supporting the achievement of the environmental objectives for water bodies on land**
5. **Reducing vulnerability and preparing for climate change**
6. **Protection of earth surface, including soils on land**
7. **Protection and, if possible, improvement of landscape values**
8. **Protection of cultural heritage, including underwater archaeological monuments**
9. **Economic objectives and protection of material goods of high value**

These objectives do not include reduction of nitrogen and phosphorus load in wastewater, reduction of noise and electromagnetic fields, drinking water resources or waste management. These issues are contained in the above-mentioned objectives, e.g. the reduction of nitrogen and phosphorus load in wastewater concerns the land area, but has an impact on the achievement of objectives 3 and 4, and indirectly also on objectives 1, 2 and 6.

At the same time, the indicated objectives are sectoral, i.e. they are dedicated to the protection, rationalization of use or restoration of the proper condition of specific components of the environment, and – taking into account the strategic nature of the analysis – they should be perceived horizontally. Their implementation requires the integration of measures in various sectors of the economy and the activation of mechanisms of change at the level of various environmental components. In this way, the overarching objective of protecting the environment as a whole is pursued.

The correlation of the distinguished environmental protection objectives with individual environmental components allows for the systematic analysis of the strategic environmental impact assessment through the appropriate use of criteria questions. This correlation is shown on the map below.

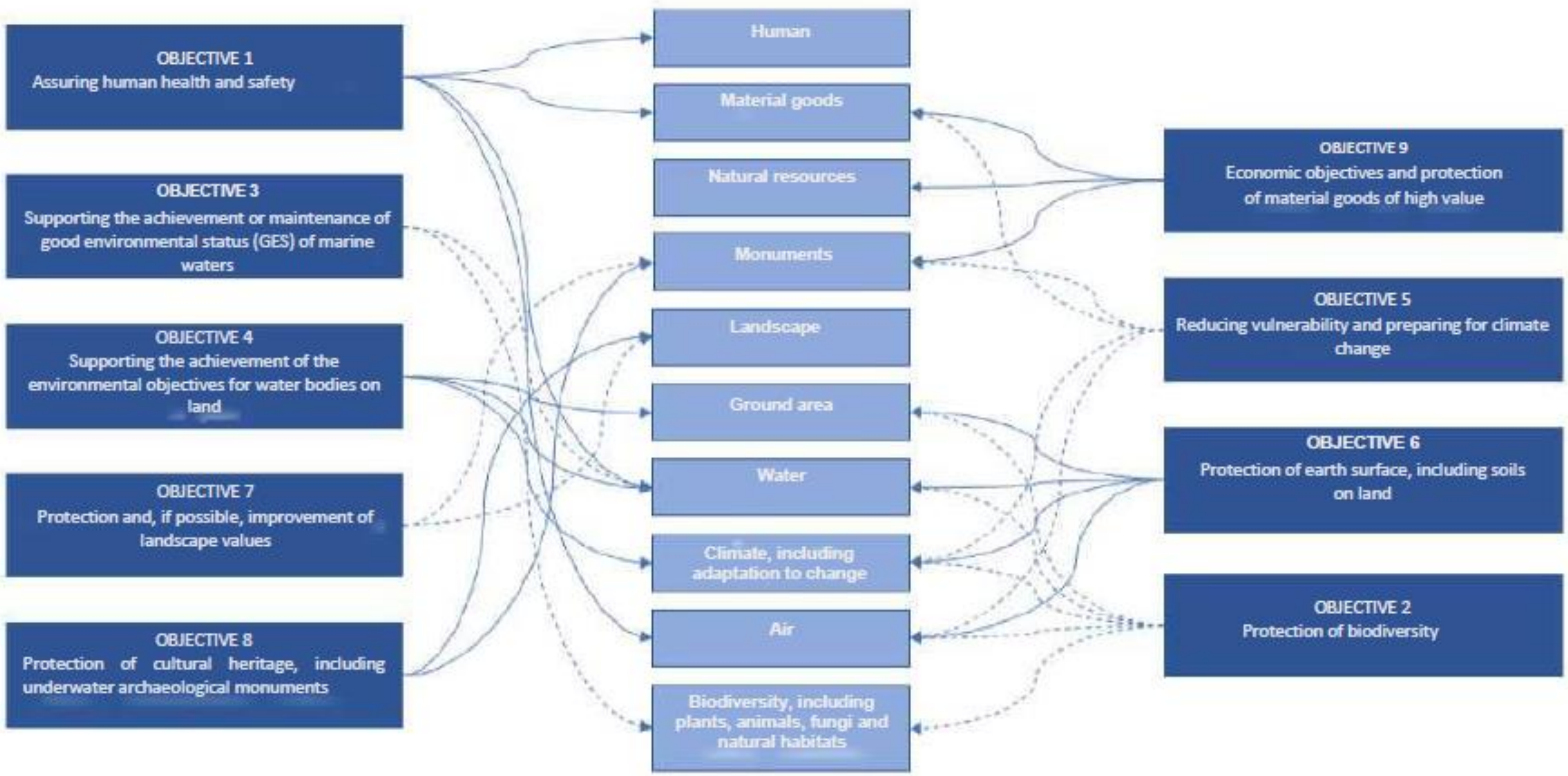



**Fig. 7** **Correlation of the selected environmental protection objectives with the environmental components indicated in the EIA Act**

*Source: Own study*

The indicated interdependence also allows for confirming that the *"objectives-led"* assessment of the strategic document meets the requirements set out in the EIA Act. Environmental objectives relate to changes in individual environmental components, but they are not only these components. The link between the individual components and the treatment of the environment and economic development as a whole is also expressed.

There are numerous interrelationships and relationships between environmental interactions and components, which must be taken into account in order to fully understand the processes taking place in the environment, as well as the occurrence of additive or synergistic effects of many interactions. At the same time, from the beginning of the process of assessing the impact of the implementation of the Programme on the implementation of strategic environmental objectives, attention should be paid to the specific nature of the objectives related to the protection of biodiversity. They concern the most sensitive elements of the environment in relation to the Program, and at the same time they condition the possibility of later implementation of the projects for which the framework is created by aPOWM.

**Critical Environmental Impact Questions**

In order to verify the compliance of the projects covered by the Programme with environmental protection objectives, criteria were formulated. These questions are presented in the table below.

**Table 12 Preliminary proposals for criteria questions for environmental protection objectives**

| No. | Strategic objectives for environmental protection | Questions defining the criteria for the environmental impact assessment |
|---|---|---|
| **1** | Assuring human health and safety | Can the proposed measures affect the safety of people (public safety)?<br>Can the proposed measures affect human health (water intakes, direct protection zones, sea bathing areas)?<br>Can the proposed measures affect the sanitary and epidemiological situation (possibility of chemical contamination, bacterial contamination, etc.)? |
| **2** | Protection of biodiversity | Will the proposed measures contribute to the preservation or enhancement of biodiversity? (including marine mammals, fish and molluscs)?<br>Will the proposed measures promote the creation of new and the proper functioning of existing Natura 2000 protected areas (will they not have a significant negative impact on Natura 2000 sites) as well as other protected areas and ecological corridors?<br>Will the proposed measures contribute to the protection and preservation of the integrity of the seabed?<br>Will there be an imbalance in the marine trophic chain? |

| | | |
|---|---|---|
| | | Will the proposed measures affect the level of anthropogenic pressure in the context of biodiversity protection? |
| **3** | Supporting the achievement of GES | Can and to what extent the proposed measures change the risk of marine pollution?<br>Can the proposed measures significantly change the hydromorphological parameters of marine waters?<br>Can the proposed measures significantly change the chemical parameters of marine waters?<br>Can the proposed measures significantly change the biological parameters of marine waters? |
| **4** | Supporting the achievement of environmental objectives for the water body, in particular for the coastal zone | Can and to what extent the proposed measures prevent or delay the achievement of the environmental objectives for the water body?<br>Can and to what extent the proposed measures change the risk of GUPW pollution?<br>Can and to what extent the proposed measures change the risk of GZWP pollution? |
| **5** | Reducing vulnerability and preparing for climate change | Do the planned measures take into account adaptation to climate change?<br>Can the planned measures affect climate change (e.g. GHG emissions from maritime transport, changes in agriculture, $CO_2$ uptake by walrus waters, etc.)?<br>Are the planned measures addressing the main issues related to climate change mitigation and adaptation identified in the European Commission's Strategic Environmental Assessment guidelines for climate change and biodiversity[17]?<br>Do the planned measures address the main problems related to the issue of biodiversity (in the context of the projected effects of climate change) identified in the abovementioned guidelines?<br>Do the planned measures fall within the scope of mitigation and mitigation measures related to climate change mitigation and adaptation indicated in the above-mentioned guidelines?<br>Do the planned measures fall within the scope of mitigation and mitigation measures related to climate |

[17] Guide on taking into account the issues of climate change and biodiversity in the strategic environmental impact assessment https://sdr.gdos.gov.pl/Documents/bio-clia_SEA_2015.pdf

| | | |
|---|---|---|
| | | change mitigation and adaptation indicated in the above-mentioned guidelines? |
| **6** | Protection of earth surface, including soils | Can the proposed measures affect the dynamics/nature of the erosion processes of the sea shore?<br><br>Can the proposed measures cause changes in the processes and conditions of the soil and water environment relevant to the formation of habitat conditions in the bank zone? |
| **7** | Protection and, if possible, improvement of landscape values | Will the visual qualities, including the marine landscape, change as a result of the implementation of the measures?<br><br>Will the proposed measures contribute to improving the recreational and tourist attractiveness of the sea and the coastal zone? |
| **8** | Preservation of cultural heritage | Will the proposed measures affect the monuments and their surroundings in the bank zone?<br><br>Will the proposed measures have an impact on archaeological monuments at the bottom of the sea? |
| **9** | Economic objectives and protection of material goods of high value | Can the proposed measures affect the exploited/planned for exploitation natural resources (gas, oil, other)?<br><br>Can the planned measures have an impact on the fisheries economy?<br><br>Can the planned measures affect maritime transport?<br><br>Can the planned measures affect the development of maritime tourism?<br><br>Will the planned measures affect production plants employing a large number of people? |

*Source: Own study based on KPOWM, Environmental impact forecast*

**In addition, it is necessary to answer the following questions:**

- As a result of the implementation of the measures provided for in the Programme, are significant impacts on the environment of a cumulative nature expected to arise?
- What mitigation measures should be taken in case of negative impacts?

**Critical questions about the content of the document being evaluated. The Forecast Contractor has adopted the following set of questions regarding the Programme document:**

- Has the diagnosis of the current state been prepared taking into account environmental aspects?
- Have objectives been proposed to limit the potential negative impact on the environment?
- Has (and if so, to what extent) the environmental impact of the proposed objectives and measures been quantified?

**Assessment of the occurrence of potential significant impacts:**

- The expert groups assessed the overall positive and negative impacts of aPOWM and identified the characteristics of the impact depending on the specificity of the impact on the implementation of individual strategic objectives of environmental protection.

The assessment was made in the system as shown in the following diagram.

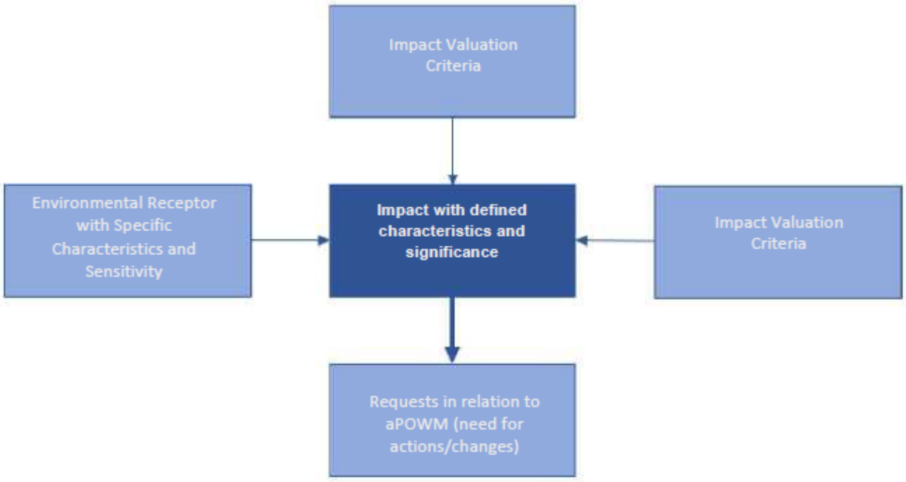



**Fig. 8 Drawing of the evaluation process**

*Source: Own study*

The assessment was carried out within the framework outlined above for each environmental objective and group of measures identified. The summary tables in Chapter 8 collect the characteristics of the interactions, an example of which is shown in the following table. For the purposes of the characteristics of the interactions, each of the authors (each group of authors) assessing the implementation of aPOWM for a specific environmental protection purpose defined the understanding of individual elements of the characteristics in relation to their type, duration, interactions vector, etc.

**Table 13 Example of the characteristics of the identified impacts on the achievement of environmental objectives**

| Type of measures foreseen in the aPOWM / impact | Overall assessment of impacts on the achievement of the objective | direct | indirect | secondary | cumulative | short-terminal | medium-terminal | long-terminal | Permanent | momentary | positive | negative |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. measures to conserve and restore biodiversity** | 0 | - | - | - | - | - | - | - | - | - | - | - |
| **B. measures to reduce eutrophication** | ++ | x | - | - | x | | | | x | - | x | |
| **C. Measures to reduce invasive species** | 0 | - | - | - | - | - | - | - | - | - | - | - |
| **D. measures aimed at preserving and improving the integrity of the seabed** | 0 | | | | | | | | | | | |
| **E. measures aimed at reducing pollutants** | ++ | | x | x | x | | | | x | | x | |
| **F. measures aimed at reducing the amount of waste, including micro and nanoparticles of plastics** | ++ | | x | x | x | | | | x | | x | |

(x) – impact occurs

(-) – impact does not exist

*Source: Own study*

**KEY**

**Type:**

- direct interactions that may occur as a result of direct interaction between the measure itself and the environment (receptor), e.g. improvement of the visual qualities of the landscape as a result of the reconstruction/modernization of the objects, or reduction of the visual qualities by the appearance of new anthropogenic objects in the space, clearly distinguished from the landscape,
- indirect impacts that may arise as a result of measures not directly related to the measures in aPOWM, e.g. improving the attractiveness for tourism in connection with improving the quality of sea water,
- secondary, are impacts resulting from direct and indirect interactions resulting from subsequent interactions with the environment, e.g. improvement or deterioration of the visual value of the landscape as a result of the manner of development resulting from secondary measures,
- cumulated, is the accumulation of changes in the same landscape/space due to the implementation of at least two types of measures.

**Duration:**

- short-term impacts occurring during the construction/implementation period of a given activity,
- medium-term are impacts occurring within a period of up to 6 years (current planning cycle),
- long-term effects may occur for more than 6 years,

**Reversibility:**

- permanent are impacts resulting from the implementation of types of measures, the effects of which are lasting for many years and setting new conditions in the landscape, without the possibility of spontaneous return to the original state,
- temporary, transient, reversible, of short duration, which may recur with high frequency or occur incidentally, such as temporary changes in the landscape as a result of the location of the construction site facilities, the movement of ships during construction, etc.

**Nature:**

- positive impact contributing to the protection and even improvement of landscape values and increasing attractiveness for tourists,
- **negative,** is the impact causing adverse changes in the landscape, e.g. the emergence of dominants having an adverse impact on the visual qualities of the space.

The assessment for individual strategic objectives of environmental protection was carried out using criteria (evaluation) questions. The presented approach allows to summarize partial results within one objective, while it is unacceptable to summarize partial assessments between objectives, with each question and subsequent assessment evaluating the separation of positive and negative impacts.

At this level, there will also be general and specific recommendations on mitigation and possible compensation.

The chapter summarizing the assessment of aPOWM implementation carried out as part of the Forecast presents a table collecting the performed analyses, which summarizes the identified environmental impact on the adopted scale from +3 to -3.

| | | |
|---|---|---|
| **When the Program serves directly to achieve the goal** | **Strengthening** | **+++** |
| **When the Program significantly supports the possibility of achieving the goal or avoids the risks associated with limiting the possibility of achieving the goal** | Favourable | **++** |
| **When the positive effects expected as a result of the implementation of the Programme clearly outweigh the possible negative effects, however, their achievement requires the fulfilment of additional conditions in the form of, for example, the use of measures to strengthen the positive effects or to minimize the negative effects** | Slightly beneficial | **+** |
| **When no significant effect or positive and negative effects are found, they shall be balanced** | Neutral | **0** |
| **When the negative effects of the Programme's implementation outweigh or exceed its positive impact within the scope of achieving the objective. It is possible to limit the negative impact using standard minimising measures** | Slightly negative | **-** |
| **When the implementation of the Programme entails unavoidable environmental costs prevailing in this respect, it limits the possibility of achieving the objective. It is possible to limit the impact, but in addition to the standard measures for a given type of project, individual mitigation measures should be indicated.** | Negative | **- -** |
| **When the implementation of the Program entails unavoidable conflicts in the context of the possibility of achieving the goal. The need to apply compensation, i.e. the restoration of damaged environmental resources. Indicate the feasible compensation arrangements and the conditions for its implementation or the need for exceptions** | Conflict | **- - -** |

*Source: KPOWM, Environmental Impact Forecast.*

**Knowledge gaps and uncertainties**

During the analysis in the strategic evaluation we encountered some gaps in knowledge that could have an impact on the forecasting outcome. The most important deficiencies and uncertainties are:

- The proposed measures are aimed at maintaining or achieving good environmental status of the marine environment (GES), including by improving the status of the water body on land. These measures mostly do not directly concern interference with the environment, but only as a result, in the future, technical measures may be more expensive, the scope of which and possible impacts on the environment are difficult to predict at this stage.
- The forecasting of potential impacts that may occur in the environment is fraught with uncertainty due to climate change, which in turn can have a significant impact on the marine environment. The KLIMADA project presents various scenarios of climate change in the 21st century. Unfortunately, they are burdened with many uncertainties resulting from the gaps in knowledge and a relatively short period of observation of climate change.

- Climate change and its effects do not significantly affect the results of the analyses, but it should be borne in mind that the frequency and strength of extreme phenomena, which may determine the achievement of GES, is increasing.

In addition, with regard to aPOWM itself, apart from the majority of cases in which, thanks to a known measured value of a given indicator and a known threshold value of GES, the mere fact of finding a gap in measures does not pose any difficulties, there are also numerous cases in which, due to the lack of monitoring data, the lack of a set threshold value or even the lack of a set indicator illustrating a given criterion, it is not possible to find a gap in the measures implemented so far, but only a gap in knowledge.

# 4 Environmental objectives set at international, Community and national level relevant to the draft document and how these objectives have been taken into account in the preparation of the document

## 4.1 Identification of environmental objectives relevant to aPOWM

In accordance with the adopted methodology, the analyses carried out specified the objectives related to environmental protection resulting from the strategic documents, both at the international and national level. These strategic documents were taken into account, which define the general objectives of environmental protection, but also those which define the objectives and directions of measures related to marine areas and thus may be related to aPOWM. Subsequently, these objectives were aggregated into a number of the most important objectives of the so-called strategic environmental protection objectives resulting from the sustainable development of the country. These objectives form the basis for assessing whether the measures provided for in the aPOWM draft support their achievement or, on the contrary, are contradictory to them.

The following strategic environmental objectives have been identified:

1. Assuring human health and safety.
2. Preservation of biodiversity.
3. Supporting the achievement or maintenance of good environmental status of marine waters (GES).
4. Support the achievement of the environmental objectives for water bodies on land.
5. Reducing vulnerability and preparing for climate change.
6. Protection of earth surface, including soils on land.
7. Protection and, if possible, improvement of landscape values.
8. Protection of cultural heritage, including underwater archaeological monuments.
9. Economic objectives and protection of material goods of high value.

A detailed list of strategic documents and their short characteristics, as well as the most important objectives resulting from them are presented in Annex No. 1 to the Forecast. In addition, this annex presents the relationship between the objectives resulting from the analyzed strategic documents and the strategic environmental objectives listed above (9 objectives).

## 4.2 How to include the identified environmental protection objectives in aPOWM

The aim of aPOWM is to define the optimal set of measures that will lead to the achievement of a good environmental status of marine waters within a certain period of time. APOWM takes into account the measures already existing, resulting from other documents, continued measures (specified in KPOWM for the previous marine strategy planning period and adapted to aPOWM) and, in particular, proposes new measures. The selection of new and continued measures was made on the basis of economic cost-benefit analyses. The measures set out in the aPOWM are measures which, as a result of their implementation, are intended to improve the state of the marine environment and naturally form a direct part of the strategic objective of environmental protection No. 3 "Supporting the achievement or maintenance of good environmental status of marine waters (GES)" and indirectly contribute to the achievement of other strategic objectives of environmental protection. The verification of the achievement of GES takes place through the analysis of the measures proposed in aPOWM in relation to 11 indicators/features (D – for a feature) determined in each of the individual sub-bodies of marine waters.

The relation of environmental objectives to GES indicators is presented in the following table.

**Table 14 Strategic environmental objectives and corresponding indicators (characteristics) for GES**

| Strategic environmental objectives | Indicators (characteristics) for good environmental status in the marine environment [1] |
|---|---|
| **Objective 1 Assuring human health and safety** | D5, D8, D9 |
| **Objective 2 Protection of biodiversity** | D1 – D11 |
| **Objective 3 To promote the achievement or maintenance of good environmental status in marine waters (GES)** | D1 – D11 |
| **Objective 4 To promote the achievement of the environmental objectives for the water bodies on land (transitional and coastal waters)** | D1 – D11 |
| **Objective 5 Reducing vulnerability and preparing for climate change** | D1, D2, D4-D7 |
| **Objective 6 Protection of earth surface, including soil on land** | D6, D7 |
| **Objective 7 Protection and, where possible, improvement of landscape assets** | D6 |
| **Objective 8 Protection of cultural heritage, including underwater archaeological monuments** | D6, D8, D10 |
| **Objective 9 Economic objectives and protection of high value tangible goods** | D1-D6, D8, D9, D11 |

[1] as in the English version of Directive 2008/56/EC, the symbol D was used – for the feature

*Source: Own study based on the KPOWM draftt environmental impact forecast*

The strategic objectives of environmental protection were taken into account in the development of the aPOWM draft in relation to the marine environment, as the measures indicated in the aPOWM are aimed at achieving and maintaining the GES. The strategic objectives of environmental protection cover a broader issue than only the marine environment, which is why the Forecast refers to the environmental impacts/effects that may also occur on land.

# 5 The state of the environment and environmental protection problems in the aPOWM spatial range and Forecasts

## 5.1 Society and socio-economic potential

Three provinces have direct access to the sea:

- pomorskie,
- zachodniopomorskie,
- warmińsko-mazurskie

These provinces are characterized by social, economic and economic diversity. In this area, one can clearly distinguish the areas of the Szczecin and Tricity agglomerations, which are the centre of development for the region.

**Pomorskie province**

In accordance with the division according to HELCOM MAS (HELCOM, 2013), the following sub-bodies of water adhere to the Pomeranian province:

- polish coastal waters of the eastern Gotland Basin,
- the eastern Gotland Basin,
- polish coastal waters of the Gdansk Basin,
- The Gdańsk Basin.

Pomorskie province has an area of 18 321 $km^2$, which equals almost 6% of the country's area. In 2019, it was inhabited by over 2.3 million people. According to the National Strategy for Regional Development, in the perspective of 2030, a decline in the population or demographic stagnation is forecast for almost all provinces, apart from Pomorskie, Mazowieckie and Małopolskie provinces. The capital of the region is the city of Gdańsk, and other important centres are Gdynia, Słupsk and Sopot[18].

The main pan-European routes running through the province include:

- corridor IA Helsinki – Tallinn – Riga – Kaliningrad – Gdańsk, which is a branch of corridor I,
- corridor VI Gdańsk – Katowice – Žilina, which is a connection of Scandinavia with Central and Eastern Europe and the Mediterranean countries.

In the province, international and national transport routes in the north-south and east-west systems intersect. Gdańsk is an important interchange where road, rail, water and air transport connections intersect. Thanks to Gdańsk and Gdynia ports, goods are transited between the south of Europe and the Baltic Sea countries.

The economic capacity of the Pomeranian province has improved since the introduction of the DCT terminal (Deepwater Container Terminal), after which the port of Gdańsk took up a significant part of the containerized cargoes of Polish foreign trade previously handled in Hamburg. Currently, Polish seaports handle approx. 30%.[19] This is a factor of competitive advantage over other Baltic ports (in

[18] Forecast of the environmental impact of the Pomeranian province Development Strategy 2030 project, Gdańsk 2020

[19] National Strategy for Regional Development 2030, Warsaw 2019

Riga, Klaipeda). With the appropriate use of the potential of maritime, rail and road infrastructure, OMG-G-S can become a logistics hub of European importance[20].

The Pomeranian province is characterized by a strip spatial arrangement, in which three main landscape structures are distinguished: the seaside, lake and the landscape of the Lower Vistula Valley with its alluvial estuary of Żuławy Wiślane.[21]

The coastal location of the province and its physiographic conditions determine (especially in the north-eastern part) the risk of flooding. This threat is most evident in the Vistula valley and in Żuławy. The level of risk is increasing due to the development of coastal areas.

Pomeranian province is characterized by high economic activity of residents. Attention is drawn to the high saturation of the number of enterprises per 1000 inhabitants, in 2017 it amounted to 59.3. The sectors particularly developed in the province include: petrochemical, electromechanical, wood and furniture, food, tourism and, of course, maritime economy.

The provinces located in eastern Poland (Podkarpackie, Lublin and Podlasie) and the Pomeranian province, where there was a dynamic increase in investment in research and development measures, are particularly positive compared to the country, resulting in the majority of these regions approaching the national average in terms of both indicators.[22]

The Pomeranian province, due to its geographical location and geological past, is distinguished in the country by its great diversity of both nature and landscape. Cultural diversity is an important factor of local development resulting from the regional and local identity of Kashubia, Kociewia, Powiśle, Żuławy and maritime and historical traditions.

**Province Zachodniopomorskie**

In accordance with the division according to HELCOM MAS (HELCOM, 2013), the following sub-bodies of water adhere to the West Pomeranian province:

- Polish coastal waters of Bornholm basin
- Bornholm basin

Zachodniopomorskie province covers an area of 22,892.5 km$^2$ and occupies 5th place in Poland in terms of size. The main administrative, economic and cultural centre is Szczecin. In 2018, the population of the Zachodniopomorskie province amounted to 1,703,009 inhabitants. In addition, the largest urban centers include: Koszalin, Stargard, Kołobrzeg, Świnoujście and Szczecinek.

In the Zachodniopomorskie province, international and national transport routes in the north-south and east-west systems intersect. In the province, sea, rail, road and inland navigation routes are connected, the axis of which is the Odra Waterway, which is important for transport on very long stretches from Scandinavia to the south of Europe. The location on the south-western coast of the Baltic Sea is a potential and prospect of development for the province.

An important link in the economy of the Zachodniopomorskie province is the fisheries sector, including fishing and fish processing, in which many thousands of people are employed. In addition, the economy is based on the wood industry, furniture industry, energy industry, chemical industry, construction industry, shipbuilding industry and agri-food production. The construction of the LNG terminal in

[20] National Strategy for Regional Development 2030, Warsaw 2019
[21] Forecast of the environmental impact of the Pomeranian province Development Strategy 2030 project, Gdańsk 2020
[22] National Strategy for Regional Development 2030, Warsaw 2019

Świnoujście and a permanent connection between the islands of Usedom and Wolin are very important for the economy of the region and the country.

Very valuable natural conditions, such as the wealth of inland water resources (lakes of the western part of the Pomeranian Lake District, the Odra delta, the Szczecin Lagoon and the waters of the Baltic Sea, including mainly the Gulf of Pomerania), a large share of wooded area and protected areas determine the importance of tourism for the economy of the Zachodniopomorskie province. Equally important are numerous architectural monuments, historical trails, spas and a diverse tourist base that allows you to relax throughout the year.

**Warmian-Masurian province**

According to the division according to HELCOM MAS (HELCOM, 2013), one sub-body of water is adjacent to the Warmian-Masurian province:

- polish coastal waters of the Gdansk Basin,

The province is located in the north-eastern part of Poland, on the Vistula Lagoon, in the immediate vicinity of the eastern border of the European Union with the Kaliningrad region. The region of Warmia and Mazury is the fourth largest province in the country, with an area of 24 173 km$^2$. The main economic centres with development potential are Olsztyn and Elbląg. Due to its specific location, the region has all modes of transport, from road, rail, air, inland waterway and sea. A number of roads run through the province, including international E77 (on national roads No. 7, 22 and 54) and E28 (on national road No. 7), express (S7, S16, S22, S51), national and province. In 2016, Olsztyn-Mazury Airport was launched. The province has smaller seaports, which operate on the Vistula Lagoon. The port of Elbląg serves the floodplain and Baltic coastal freight and passenger-tourism shipping and carries more than 30,000 passengers every year. Frombork, Nowa Pasłęka and Tolkmicko ports serve as passenger ports, mainly used for tourism.

The main and branches of the economy of the Warmian-Masurian province include tourism, the production of healthy food, the wood industry, the production of machinery and equipment, ecological forest management, the production of yachts and ecotourism. The region has achieved a high level of specialization in the following industries: furniture production, production of rubber and plastic products, production of food products and production of wood, cork and wicker.

Warmia and Masuria are among the regions with valuable nature and attractive landscape. In the Warmian-Masurian province, there are 11.1% of all national areas with special natural values legally protected, which gives the region the first place in the country. At the same time, these areas account for 46.7% of the province's area.[23] Areas offering opportunities for water tourism and those with cultural heritage are of particular interest to tourists.

[23] Report on the state of the Warmian-Masurian province in 2019, Olsztyn 2020

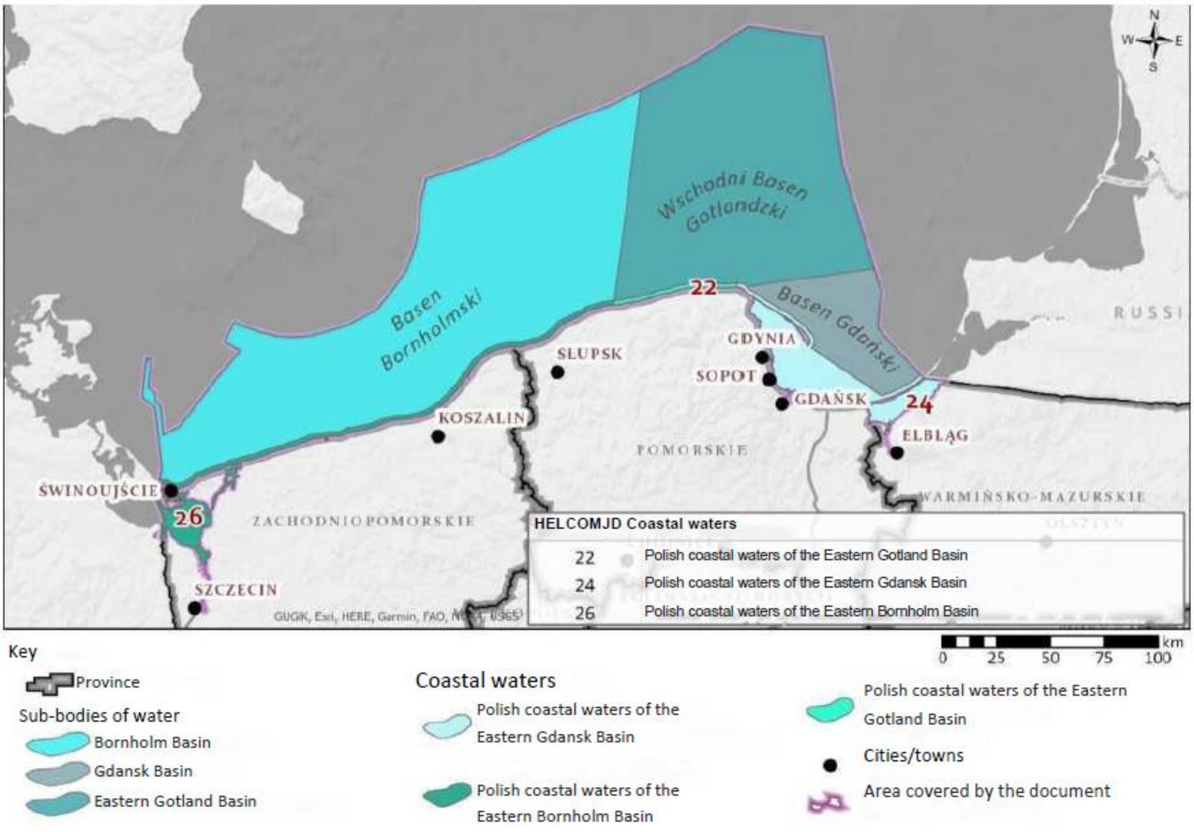



**Fig. 9** **Baltic Sea sub-bodies of water designated for POM according to HELCOM MAS (HELCOM 2013)**

*Source: Own study based on HELCOM*

## 5.2 Biodiversity, including protected areas

### 5.2.1 Biodiversity of the coastal zone

**Resources and natural assets of the dune coast**

On the Polish coast of the Baltic, whose coastline is almost 500 km long, coastal dunes constitute over 85% of its length and are an extremely valuable area, which, due to the sea and land border, constitutes a unique system of natural and landscape connections.[24] A typical accumulation (increasing) dune coast is built of coastal embankments covered with vegetation of various phases of succession. This process reflects the pace of development of forms: from the oldest, covered with pine forest (brown dunes), through covered with sand grass (grey dunes), to the youngest – covered with pioneer grasses (white dune – primary dune), less often preceded by the field of the initial dune on the upper beach.[25] Each zone is dominated by a different type of vegetation. As a result of the increasing erosion of the shores, related to the rise in sea level and human activity, the length of the shore with sections with all these zones decreases.[26]

[24] Ewelina Mruk, Tomasz A. Łabuz, Environmental protection of coastal dunes on the Polish coast – areas, forms and effects, Lublin, 2020

[25] Tomasz Łabuz "Ways to protect the sea shores and their impact on the natural environment of the Polish Baltic coast. Report", WWF, 2013

[26] Ewelina Mruk, Tomasz A. Łabuz, Environmental protection of coastal dunes on the Polish coast – areas, forms and effects, Lublin, 2020

On the youngest coastal dunes: embryonic and formed primary dunes, there is a community of the second phase of succession, i.e. the Elymo Ammophiletum complex with grass species: *Ammophila arenaria* and *Leymus arenarius*. The vegetation of sand grasslands, belonging to the Helichryso Jasionetum team, is a phase of succession on partially fixed and stable dunes, the so-called grey or yellow dunes. These dunes are covered with numerous species of vascular herbaceous plants, mosses, lichens, algae, and even fungi, extracting nutrients from the forming soil. The last phase of the succession of moving dunes is pine forest. Coniferous forests occur on brown dunes in various varieties, depending on the humidity and fertility of the substrate.[27]

**Natural resources and assets of the cliff coast**

The cliff coast of the southern Baltic Sea within the borders of Poland is represented by different sections due to their height, geological structure, dynamic state and covering with plant habitats that are difficult to classify into one group.

The cliff shores of the southern Baltic coast are mostly made of clayey glacial formations, sands and gravel of fluvioglacial formations, as well as silt and stagnant clays.[28] On clay cliffs, as a pioneering habitat, clumps of *Poo-Tussilaginetum farfarae* develop. In the next stage of fixing such a cliff, sea buckthorn shrubs, rose and rowan, less often young beeches, appear, as long as they grow on the crown of the cliff. On stable – dead or partially stabilized clay cliffs, there are one of two types of beech: Galio odorati-Fagetum, with lower trees and species lined like *Melica sp*. or *Carex sp*. or *Luzulo* pilosae-Fagetum with large beech specimens, sometimes with single pine trees. Carici-Fagetum balticum *is less* common. Another type is the *Ficario-Ulmetum violetosum odoratae, which* is most common on the slopes of a fixed (dead cliff) with groundwater outflows. On the clay cliffs, where eolithic sands are present in the upper layer, one can find species characteristic for sand grasslands or for pine forest (*Empetro nigri-Pinetum*). Cliffs built of sand in whole or in part, have a separate structure of vegetation.[29]

On the active cliffs built of sand, the pioneering community is *Trifolio-Anthylidetum maritimae* with a passage, clover and sand reed; on the blown sand, psammophilic species will appear, such as Lyme grass or Festuca psammophila.[30] The only fully specific species is the sea buckthorn *Hippophaë rhamnoides*, whose natural national range is almost exclusively limited to cliffs.[31] During stabilization, such a cliff begins to grow with sand grass or species typical of pine forest (Empetro nigri-Pinetum) with pine in a layer of shrubs enter it immediately, and then on a stabilized substrate – trees. On cliffs with a mixed geological structure, there are patches of the above-mentioned communities. In addition, peat or organogenic formations (gytija), in the form of an outcrop on the cliff wall, show groundwater outflows, where there are species associated with highly wet substrate: rush and reed.[32]

[27] Ewelina Mruk, Tomasz A. Łabuz, Environmental protection of coastal dunes on the Polish coast – areas, forms and effects, Lublin, 2020

[28] Subotowicz W. 1984. Cliffsides. [in:] B. Augustowski (ed.), Pobrzeże Pomorskie. Ossolineum, Gdańsk, pp. 121–149.

[29] Tomasz Łabuz "Ways to protect the sea shores and their impact on the natural environment of the Polish Baltic coast. Report", WWF, 2013

[30] Tomasz Łabuz "Ways to protect the sea shores and their impact on the natural environment of the Polish Baltic coast. Report", WWF, 2013

[31] Cliffs on the Baltic coast, Habitat and species protection guides, Marine and coastal habitats, coastal and inland salt marshes and dunes, Volume I, GDOŚ, 2016

[32] Tomasz Łabuz "Ways to protect the sea shores and their impact on the natural environment of the Polish Baltic coast. Report", WWF, 2013

**Resources and natural values of the low, organic coast**

On the low coast of organic origin, aquatic communities of rushes develop. These communities occupy very different habitats from relatively deep standing to slow flowing waters. They occur along the banks of rivers leading to the sea, on the banks of coastal lakes and bays and floodplains. The most common on the Polish coast is the reed with the cane (*Phragmitetum australis*), which builds the so-called reed field. Cane growing on the shore inhibit the erosion processes caused by the ripple of water, and as a result of the death of subsequent generations of plants and the increase in the height of the substrate, they cause the development of the shore. This community is a place of nesting and protection of numerous species of waterfowl.[33]

**The world of animals on the coast**

The Polish coast is an area of many animal species. In addition to typical mammals, including wild boars (fed), there are raccoon dogs, deer, roe deer and elk. After several years of absence, the foxes and hares returned to the dunes, and the wolf traces were also found (mainly in the Słowiński National Park). It also happens that beavers visit the beaches. On the other hand, seals can be found on the beaches, especially away from human settlements. The place most numerous and most frequently visited by seals are sandy bars at the mouth of the Vistula Przekop.[34]

For water and marsh birds, the key areas are concentrated in the land part of northern Poland along with the Baltic coastal waters. In the coastal belt and on the lakes nest and feed such species as: mute swan, seagulls (black-headed, herring), as well as terns, ducks.[35]

The Polish coast is an attractive food base during flights for many birds, among others, for such species as: *Calidris alpina*, *Actitis hypoleucos*, *Calidris ferruginea*, *Calidris canutus*, *Arenaria Interpress*, *Pluvialis* squatarola, *Charadrius hiaticula*. There are also numerous seagulls or terns, such as the unique *Sterna sandvicensis*.[36]

Small birds also feed on the beaches; they are also protected: *Anthus campestris* and *Motacilla alba*. Others, characteristic of wetlands, only nest in the Beka Reserve (Puck Bay) or in the Karsiborska Kępa Reserve (Back Delta of the Brama Świny).[37] The intensive recreational use of coastal areas by people is a leading factor in the loss of habitats of birds nesting on coastal beaches.[38]

The counting of wintering birds in our country has been carried out regularly for several decades, but in the absence of central coordination, they have been carried out with different effectiveness and to different extent in different regions. In 2010, as part of the pilot study, the counting of birds hibernating along 140 km of the coast was carried out. Over 24,000 individuals of 23 species were observed. The most common on the tested strip of the coast were: Great crested grebe, Common merganser, Long-tailed duck, Common goldeneye, European herring gull. The most numerous were

[33] Tomasz Łabuz "Ways to protect the sea shores and their impact on the natural environment of the Polish Baltic coast. Report", WWF, 2013
[34] Tomasz Łabuz "Ways to protect the sea shores and their impact on the natural environment of the Polish Baltic coast. Report", WWF, 2013
[35] Tomasz Łabuz "Ways to protect the sea shores and their impact on the natural environment of the Polish Baltic coast. Report", WWF, 2013
[36] Tomasz Łabuz "Ways to protect the sea shores and their impact on the natural environment of the Polish Baltic coast. Report", WWF, 2013
[37] Tomasz Łabuz "Ways to protect the sea shores and their impact on the natural environment of the Polish Baltic coast. Report", WWF, 2013
[38] Update of the preliminary assessment of the status of marine water environment, Warsaw 2018

European herring gull (35% of the cluster), goldeneye (16%) and mallard (11%).[39] Since 2016, transitional waters, i.e. reservoirs that are partially saline but are heavily influenced by freshwater, have been separated from the Wintering Water Birds Monitoring programme. In 2019, 31 facilities were inspected, on which 234,613 birds of species ecologically linked to water reservoirs were found. This group included the five most numerous species, including Tufted duck, Greater scaup and goldeneye, the number of which exceeded 20,000 individuals.[40]

The Monitoring of Wintering Sea Birds, launched in 2010, is to be primarily a source of data on changes in the number of sea birds wintering in the Polish Baltic zone. In 2019, during the counting, 50,790 aquatic birds from 27 species and 233 individuals whose species affiliation was not determined were found. This gives a total of 51,023 waterbirds. The two most numerous species of seabirds,Velvet scoter and long-tailed duck, accounted for a total of 95.1% of birds found in the transect belt and 93.1% of all observed birds. The level of 1% share in the grouping of birds registered during the counting was exceeded by the marquetry and the European herring gull, the remaining species were much less numerous.[41]

On the dunes and in the vicinity of the cliffs, there are reptiles – all protected, including the *Lacerta agilis*, *Vipera berus* and the *Anguis fragilis*. The coast is also the habitat of numerous insects and crustaceans. Among the insects there are, among others: Cicindela hybrida and *the* largest European spiders in their family: *Arctosa cinerea* and *Alopecosa fabrilis*, reaching 2-5 cm in size. *Talitrus saltator* lives on clean, rarely used beaches. Most of these insects, concentrated in numerous populations, can only be found outside tourist areas.[42]

[39] "Preliminary assessment of the status of marine waters environment of the Polish Baltic Sea zone. Report to the European Commission ", Material based on the work entitled: "Development of a preliminary environmental assessment of the Polish economic zone of the Baltic Sea in accordance with the provisions of the Maritime Strategy Framework Directive", team led by Włodzimierz Krzymiński, GIOŚ

[40] Assessment of the status of the environment of the Polish maritime areas of the Baltic Sea on the basis of monitoring data from 2019 against the background of the decade 2009-2018". GIOŚ, Warsaw, 2020, and., : "Assessment of the status of the environment of the Polish maritime areas of the Baltic Sea on the basis of monitoring data from 2018 against the background of the decade 2008-2017". GIOŚ, Warsaw, 2019

[41] Assessment of the status of the environment of the Polish maritime areas of the Baltic Sea on the basis of monitoring data from 2019 against the background of the decade 2009-2018". GIOŚ, Warsaw, 2020, and., : "Assessment of the status of the environment of the Polish maritime areas of the Baltic Sea on the basis of monitoring data from 2018 against the background of the decade 2008-2017". GIOŚ, Warsaw, 2019

[42] Tomasz Łabuz "Ways to protect the sea shores and their impact on the natural environment of the Polish Baltic coast. Report", WWF, 2013

## 5.2.2 Marine Biodiversity

The sea water zone is a world of animated nature, where individual elements have an impact on each other. The food web in the Baltic Sea consists of a small number of species and trophic levels (**Błąd! Nie można odnaleźć źródła odwołania.**).

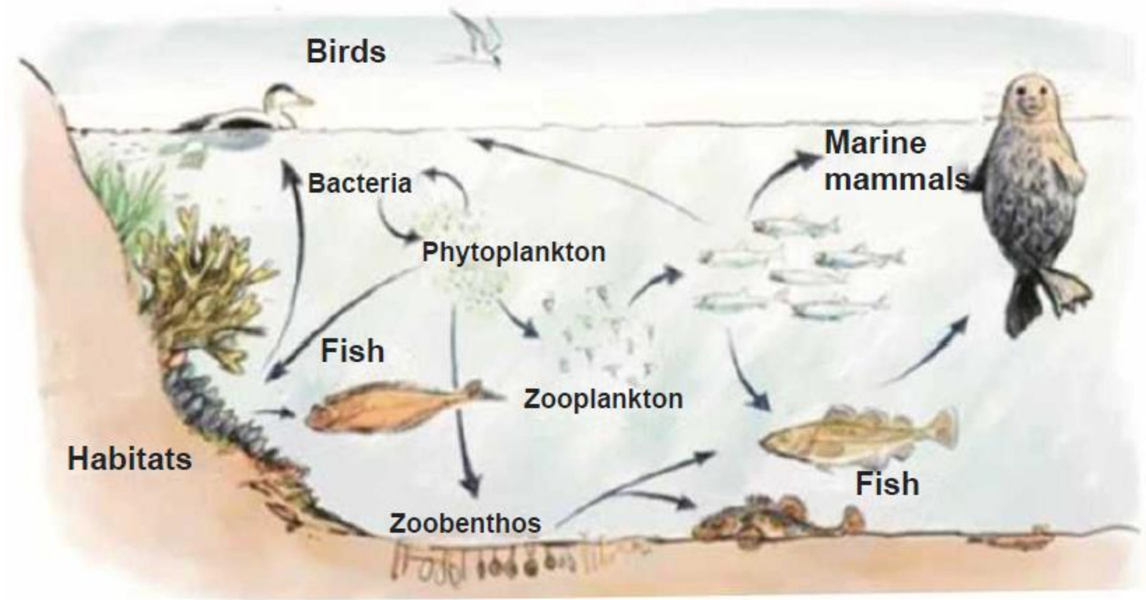



**Fig. 10 Functioning of the trophic chain in the Baltic Sea**

*Source: http://www.helcom.fi/Lists/Publications/BSEP122.pdf*

The Baltic Sea is one of the largest saltwater reservoirs in the world, and its location in the Boreal climate zone determines the type of organisms living in it. The Baltic Sea is characterized by a specific distribution of salinity growing from the Gulf of Finland and the Bothnian (salinity 2) towards the Danish Straits (salinity 16-20). This distribution of salinity has a significant impact on the biodiversity of the Baltic Sea.

Transitional waters – lagoons, bays, river estuaries and partly coastal waters within the reach of terrestrial waters – are very diverse and species-rich habitats, while other coastal waters and the active zone belt are the poorest marine habitats. Most of the species found in this strip of coastline are forms with high environmental tolerance, inhabiting both the Gulf of Pomerania, the open sea and the Gulf of Gdańsk.[43]

In Poland, GIOŚ publishes the results of the monitoring in the form of reports entitled “Assessment of the status of the environment of the Polish maritime areas of the Baltic Sea”. The results of monitoring carried out in the open sea waters are presented in these reports. Natural issues relate to the tested indicators in the field of: phytoplankton, zooplankton, macrophytes and zoobenthos. Full monitoring of marine waters, meeting the requirements of the Marine Strategy Framework Directive, the scope of which is specified in the "Marine Waters Monitoring Programme", developed by GIOŚ, has been carried out since 2014. This document proposes basic indicators and test parameters for 11 features

[43] "Preliminary assessment of the status of marine waters environment of the Polish Baltic Sea zone. Report to the European Commission ", Material based on the work entitled: "Development of a preliminary environmental assessment of the Polish economic zone of the Baltic Sea in accordance with the provisions of the Maritime Strategy ", a team led by Włodzimierz Krzymiński, GIOŚ.

(in MSFD terminology, indicators) listed in Article153 (1) (1) of the Water Law. An update was published in 2020.

Taking into account the above information, the most important results of the monitoring conducted so far are presented below, based on the recently published monitoring data of GIOŚ[44]:

- **The status of the marine environment of Polish marine areas** – examined in terms of ichthyofauna on the basis of the basic indicator - the open-water fish size index (based on 2019 data) is inadequate (subGES).
- **Phytoplankton** – the analysis of the presented graphs shows that in individual regions of the Polish southern Baltic zone, the total biomass of phytoplankton in the summer months in 2019 was lower than the average from the decade (with the exception of the Puck Lagoon, the central part of the Gulf of Gdańsk and the eastern part of the central coast). The larger biomass values appearing in the series are related to the episodic phytoplankton blooms, which distort the decade-average values and should, in principle, be removed when calculating the averages, as outliers. The only region that is characterized by a significant increase in biomass over the last 7 years is the Puck Lagoon.
- **Zooplankton**[45]– The analysis of the mean size index (MeanSize) indicates a much greater variation of zooplankton in individual regions of the Polish Baltic zone. In 2019, a total of 27 zooplankton taxa were found. The most diverse in terms of the number of species were deep-sea stations – in the Gdańsk Deep and the Gulf of Gdańsk, where 19 taxa were recorded. The site on which the smallest number of taxa was found was the site from the area of the Vistula Lagoon - 12. The average annual number and biomass of zooplankton at the stations from the Vistula Lagoon and the Puck Lagoon showed a sharp increase in relation to the previous years. The last such large increase in the number and biomass of zooplankton was recorded in 2016. Changes in the average size of zooplankton calculated from the MeanSize indicator at the Vistula Lagoon station of the central Gulf of Gdańsk show a positive trend, i.e. a systematic improvement in the state of zooplankton. Based on the threshold value, the Gdańsk Basin Water site demonstrates good environmental status (GES).
- **Macrophytes** – In 2019, a similar number of species was recorded on individual measurement transects as in 2018. The calculated macrophyte state index, based on the ratio of the biomass of multiannual species to the total biomass of macrophyte, the average values determined from two measurement seasons, indicates the status of the ecological marine environment. The results from 2019 show a deterioration in the status within the coastal waters of the Gdańsk Basin from good to moderate, on the profile of Jama Kuźnicka. On the profile of Klif Orłowski, the status, as in 2018, was moderate, but the value of the indicator was much lower. The deterioration from very good to good also occurred in the area of the Słupsk Bank – open waters of the Bornholm Basin. In the area of the Glazowisko Rowy – the coastal waters of the Bornholm Basin, there was a decrease

[44] "Assessment of the status of the environment of the Polish maritime areas of the Baltic Sea on the basis of monitoring data from 2019 against the background of the decade 2009-2018". GIOŚ, Warsaw, 2020, and., : "Assessment of the status of the environment of the Polish maritime areas of the Baltic Sea on the basis of monitoring data from 2018 against the background of the decade 2008-2017". GIOŚ, Warsaw, 2019,

[45] For the purpose of monitoring, the status of zooplankton is presented using two indicators: the biomass of phytoplankton, namely the percentage of biomass of phytoplankton in the total biomass of meso-zooplankton (CB%) for annual averages, and the mean size of zooplankton (MeanSize), expressed as the ratio of total biomass to total abundance, also for annual averages.

in the indicator, and the condition, as in 2018, remained in the "good" class. Within the surface water body Dziwna-Świna in the area of the Gulf of Pomerania, which has been monitored since 2018, the condition has deteriorated from weak to bad. The main reason for this situation were abundant greenery in June. In addition, very strong storms in September caused damage and tearing of vegetation from the stones in this measurement period and underestimation of the assessment, which was based only on samples from June.

- **Zoobentos** – The overall state of macrozoobenthos in the Polish coastal waters of the Gdańsk Basin did not improve in 2019 compared to 2018, showing a poor status. The state of the bottom fauna in the open waters of the Gdańsk Basin, and more precisely in its deep water part, was determined as poor in accordance with the WFD (class V) principles, i.e. inadequate – subGES – according to the MSFD. In 2019, the state of macrozoobenthos for the open waters of the eastern Gotland Basin remained at the same level as in 2018. In 2018, for the first time, no representatives were recorded in the multi-year period, therefore, the state of macro-obenthos was determined to be poor, within the meaning of the WFD and the MSFD. The overall state of macrozoobenthos in the open waters of the Bornholm Basin has been classified as moderate according to RDW rules, and below good (subGES) according to MSFD rules. The final result is influenced by the inclusion in the assessment of stations from the Bornholm DepTH (it is the only one outlying from the monitoring stations of the open waters of the Bornholm Basin, where zoobenthos in the multiannual period 2009-2019 showed a poor status or at most reached the lower limit of the poor status), which reduces the final classification by one assessment class. In none of the monitored sub-bodies of water did the state of macrozoobenthos reach the target value of MSFD – good condition.

In Poland, in the years 2015-2018, the following project was carried out: "*Pilot implementation of monitoring of marine species and habitats in 2015-2018*". The aim of the project was to assess the conservation status of the monitored habitats and animal species. In the marine Baltic region, 75% of the surveyed sites of animal species were found to have a poor status (U2), and 25% were found to have an unknown status (XX). In the biogeographical continental region, where fish and lamprey were monitored, one site was characterised by a specific condition (FV), which accounts for only 3% of all sites. For 20% of positions, unsatisfactory (U1) was found, while bad (U2) for 72% of positions. In the case of two positions, the security status was assessed as XX (unknown status), which equals 5% of all monitored positions.[46] Among the mammals in Polish waters there are three species of seal: grey seal (*Halichoerus* influpus), common seal (*Phoca vitulina*), ringed seal (*Pusa hispida*) and one species of dolphin: porpoise (*Phocoena phocoena*).

In the case of the grey seal, in addition to the pressure from fishing, it should be noted that its position in the Vistula Mouth is an unstable habitat located on sandy bars. Due to significant fluctuations in the water level, the amount of space available for seals is not constant due to the washout during natural hydrodynamic processes. This place is monitored regularly (since 2010) by WWF Polska and the Maritime Station of the University of Gdańsk (SMIOUG).

Monitoring of porpoise as part of the State Environmental Monitoring (PMŚ) started in POM in 2016, hence its results are not the basis for parametric assessment for the years 2011-2016. The Baltic porpoise subpopulation has been identified as critically threatened with extinction and placed on the HELCOM Red List (HELCOM 2013b). The status of preservation of the porpoise population in the

[46] Monitoring of Marine Species and Habitats in 2016-2018, Biblioteka Monitoringu Środowiska, Warsaw 2018

assessment prepared for the Habitats Directive for 2007-2012 was assessed as bad by all Baltic countries.

**Species at risk**

According to HELCOM data[47], there are a total of 59 species in the Baltic that are considered endangered or whose population is declining. Among them are all mammals occurring in the sea. The largest part consists of fish and lamprey species (a total of 23 species). The southern part of the Baltic Sea and the Gulf of Gdansk are one of those regions where the number of endangered species is the highest. The largest number of endangered species within Polish waters are fish species, and in the second place birds.

**Biodiversity**

The Baltic Sea ecosystem is heavily degraded mainly by the introduction of pollution from 85 million people living in the catchment area. The Ecosystem Health of the Baltic Sea 2003–2007 report[48] indicates that the Baltic Sea, compared to other waters, is characterized by a low degree of biodiversity. The functioning of the ecosystem and ecological interactions based on a relatively small number of species make it vulnerable to external pressures.

The Fig. 11 shows the distribution of the biodiversity indicator within the Baltic Sea. The results show that the southern and central parts of the Baltic Sea (areas marked in red) are characterised by a poor state of biodiversity. Blue means very good, green – good, yellow – moderate, orange – poor, red – bad. To sum up, 82% of coastal areas had unfavourable status between 2003 and 2007 and only 18% had good or high status.

The unsatisfactory state of Baltic biodiversity is also confirmed by the results second Helcom holistic assessment. The resultant maps of works carried out within the HELCOM HOLAS II Project aiming to conduct a holistic assessment of the state of the Baltic Sea environment covering the period 2011-2016 and based on regionally agreed core indicators, are presented below (Fig. 12). Status is shown in five categories based on integrated biological quality ratios (BQR). Values of at least 0.6 correspond to good status.

[47] HELCOM 2009 Biodiversity in the Baltic Sea – An integrated thematic assessment on biodiversity and nature conservation in the Baltic Sea: Executive Summary. Balt. Sea Environ. Proc. No. 116A

[48] HELCOM, 2010. Ecosystem Health of the Baltic Sea 2003–2007: Helcom Initial Holistic Assessment. Balt. Sea Environ. Proc. No. 122.

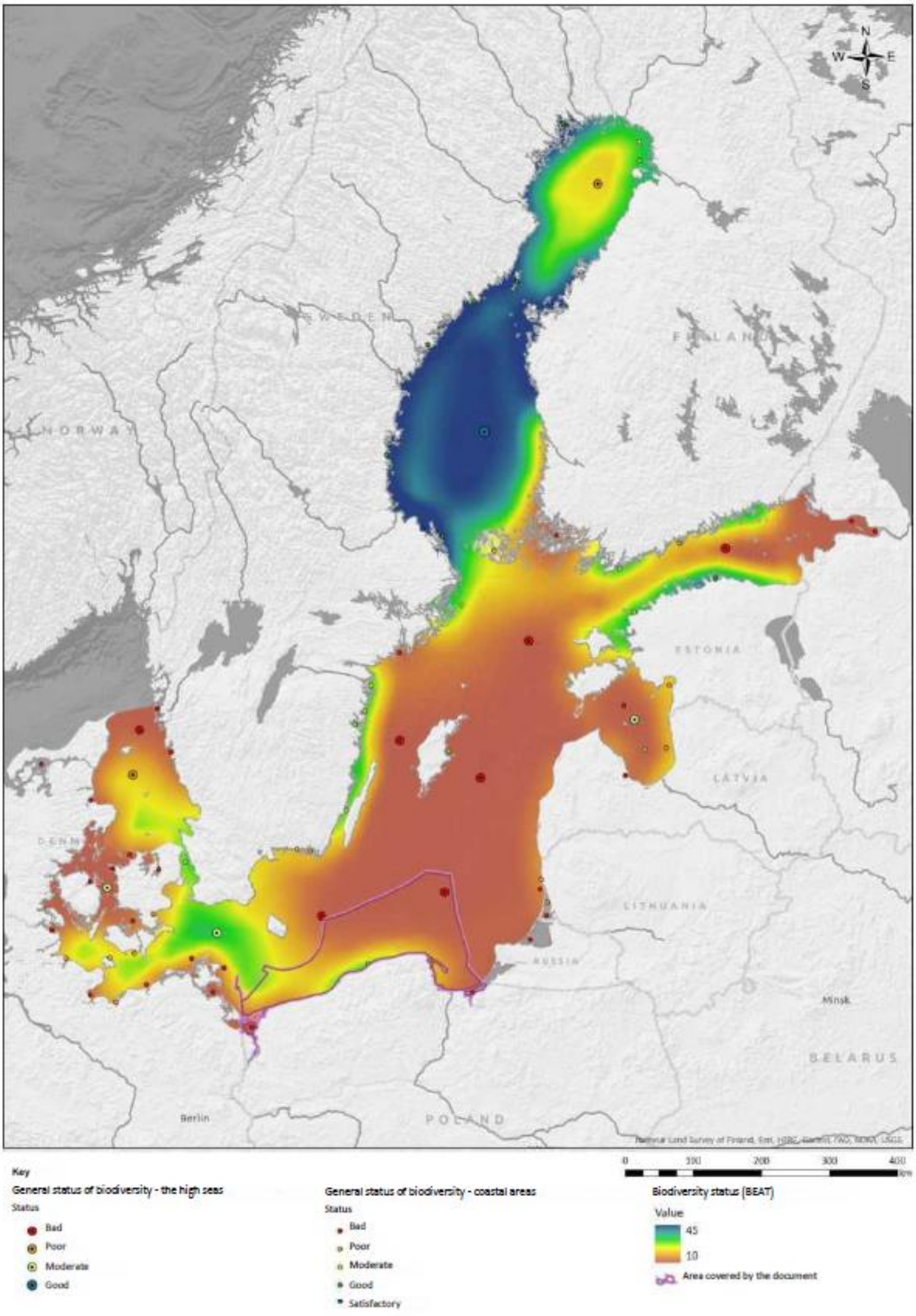
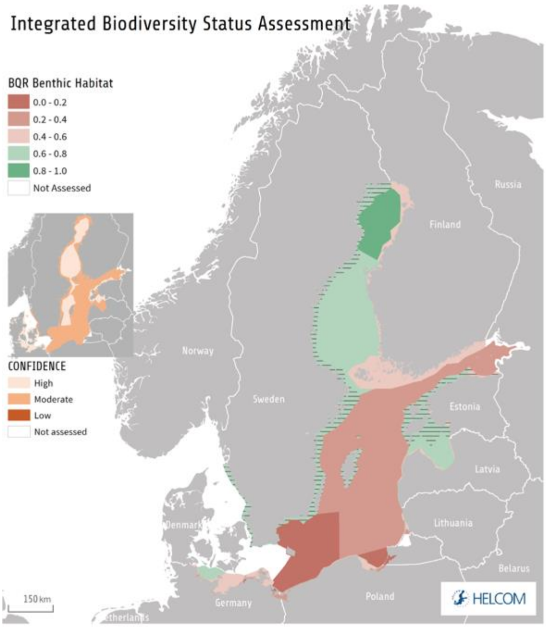
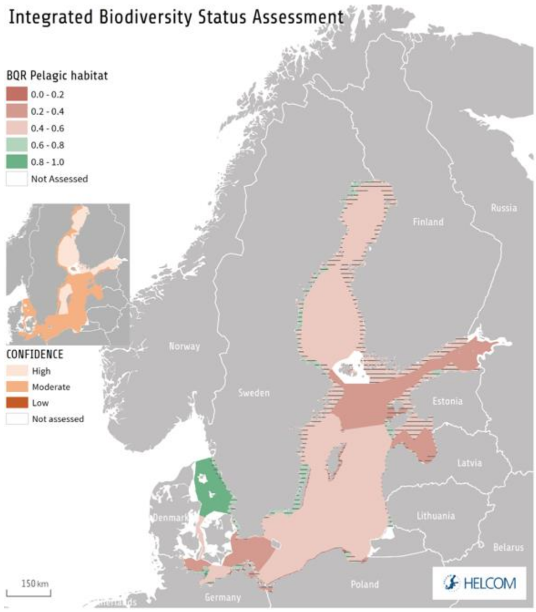



**Fig. 11 The status of biodiversity in the Baltic Sea**

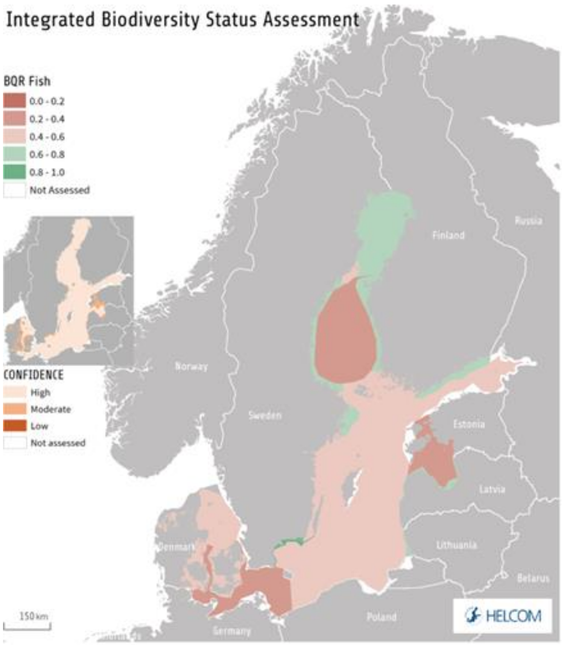
*Source: own study based on HELCOM, 2010.Biodiversity in the Baltic Sea. Balt. Sea Environ. Proc. No. 116.*



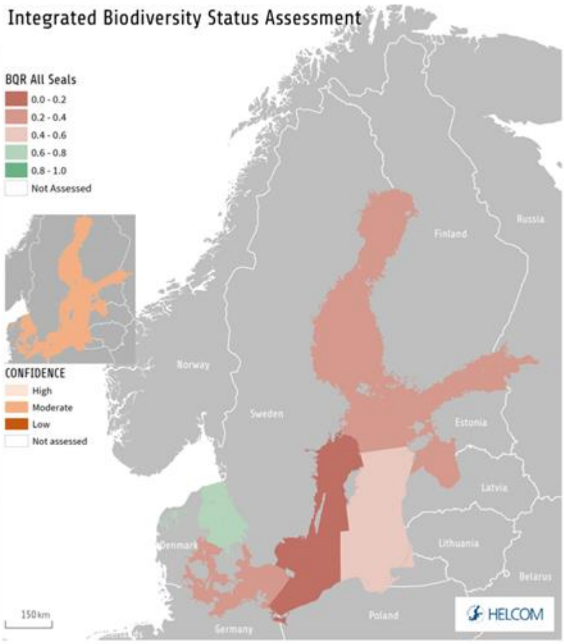

**Integrated biodiversity status assessment for benthic habitats**




**Integrated biodiversity status assessment for pelagic habitats**




**Integrated biodiversity status assessment for fish**




**Integrated biodiversity status assessment for seals**

**Fig. 12 Integrated biodiversity in the Baltic Sea out within the HELCOM HOLAS II Project**

*Source: [http://stateofthebalticsea.helcom.fi/](http://stateofthebalticsea.helcom.fi/) (HELCOM (2018): State of the Baltic Sea – Second HELCOM holistic assessment 2011-2016. Baltic Sea Environment Proceedings 155)*

### 5.2.3 Protected sites

**Natura 2000 sites**

Human activity and its pressure on the natural environment are a well-known phenomenon. The two main factors considered negative anthropogenic impacts and adverse impacts on marine ecosystems and their components listed in BSEP 124A – Helcom are:

- contamination with nutrients and hazardous substances,
- fishing.

Other anthropogenic measures included: shipping, seabed mining, as well as marine installations leading to disruption of species and habitats and general degradation of marine ecosystems.

In order to restore biodiversity and maintain an adequate level of resources in the marine environment, several conventions and policy frameworks have been introduced since 1974, which call for the implementation of a number of different management tools and measures, including the designation of marine protected areas.[49]

Helsinki Convention for the Protection of the Baltic Sea (OJ 2000 No. 28, item 346, as amended) aims at reducing pollution of the Baltic Sea introduced through rivers, discharges from the outlets of channels and pipelines, pollution from the operation of ships, as well as from atmospheric air.

The Convention establishes, inter alia, the Baltic Sea Environment Protection Commission (HELCOM) with the aim of:

- monitoring the implementation of the Convention,
- preparing recommendations on the protection of the marine environment,
- establishing the budget and assuming such other functions as may be appropriate in the framework of this Convention.

As well as:

HELOM Baltic Sea Action Plan, adopted by the Helsinki Commission, a programme aimed at restoring the good environmental status of the Baltic Sea by 2021. The Baltic Sea Action Plan was updated in 2013 during the HELCOM Ministerial meeting. The programme shall set out the following priorities:

- eutrophication (excess of biogenes in water, which affects the growth of algae),
- hazardous substances,
- protection of biodiversity and nature,
- maritime activity.

The related documents will be:

- Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for Community action in the field of marine environmental policy (Marine Strategy Framework Directive) (OJ L 164, 25.6.2008, p. 19–40),[50]
- Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 establishing a framework for maritime spatial planning (OJ L 257, 28.8.2014, pp. 135–145),

[49] Baltic Sea Environment Proceedings No. 124A Towards an ecologically coherent network of well-managed Marine Protected Areas
[50] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=LEGISSUM:l28089&from=EN

- Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions — Future EU Maritime Policy: A European vision for the oceans and seas (COM(2006) 275 final, 07.06.2006).[51]

Habitats protected in Polish marine Natura 2000 sites include:

- 1110 Sandy underwater beds permanently covered with water of low depth,
- 1130 Estuaries,
- 1150 Coastal lagoons,
- 1160 Large, shallow bays,
- 1170 Reefs,
- 1210 Annual vegetation of drift lines.

In addition, other habitats are protected in the coastal zone, such as cliffs, various types of dunes or coastal salt marshes. From marine species are protected: river and sea lamprey, twait shad, grey seal and porpoise.[52]

In special protection areas (SPAs), protection is mainly provided for ducks, terns, gulls, grebes and ducks. These habitats provide favorable living conditions throughout life. They are satisfied with, among others, the Bay of Puck (from Hel to Gdańsk) and the Vistula Mouth[53]. The above-mentioned habitats are described below[54]:

- 1110 – sandy underwater shoals

These are longitudinal, often rounded, shallows of irregular shape. Habitat 1110 is characterized by a constant occurrence underwater and frequent surroundings of deep waters, which usually do not exceed 20 m. Most of it consists of sandy sediments, but there are also sediments with higher grain size, such as boulders, as well as smaller ones, such as silt.

Most often, there is no bottom vegetation, with the exception of algae growing on single stones lying on the sand. However, groups of demersal invertebrates with high species diversity are characteristic. In Polish maritime areas, these criteria are met by Odrzana Ławica and the vast majority of Ławica Słupska.[55]

- 1160 – large and shallow bays

Entering land and separated from the open sea and sheltered from the impact of ripples, freshwater bodies (as opposed to estuaries). Plant and animal communities are characterised by high biodiversity. An important distinguishing feature is the presence of seagrass communities *of*Zosteretea and *Potametea*. Characteristic species of vascular plants are: *Zostera marina* and other species; *Ruppia spp*., *Potamogeton spp*., benthic algae. The internal Bay of Puck corresponds to these criteria.[56]

[51] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=LEGISSUM:l28089&from=EN
[52] https://seaplanspace.ug.edu.pl/wp-content/uploads/2019/11/SEAPLANSPACE-morkie-obszary-chronione.pdfMorskie teren Natura 2000, GDOŚ
[53] https://seaplanspace.ug.edu.pl/wp-content/uploads/2019/11/SEAPLANSPACE-morkie-obszary-chronione.pdf
[54] https://natura2000.gdos.gov.pl/tom-1
[55] https://natura2000.gdos.gov.pl/files/artykuly/52912/1110_Piaszczyste_lawice_podmorskie.pdf
[56] http://morskiesiedliska.gios.gov.pl/pl/o-programie/19-siedliska-powierzchnie-monitoringowe/48-piaszczyste-lawice-podmorskie-1110

- 1170 – rocky and stony seabed reefs

Submerged and elevated above the surrounding seabed rocky subsoil in the sublittoral zone. Reefs favour the zonal distribution of plants and animals, as well as high biodiversity. Taking into account the nature of the substrate and the presence of "shoals" of bivalve molluscs, the role of the reef is played by the north-western part of the Słupsk Bar with a bottom built of boulders and stones with rich plant communities.

The area of the habitat includes the north-western part of the Słupsk Bar, where there is a bottom covered with compact stone paving and boulders, and a bottom covered with stones. The depth of the habitat is 8-17 m.[57]

- 1130 – estuaries

The lower part of the river course bounded by the boundary of saltwaters and subject to the action of the tides. The seawater is diluted in the estuary with fresh water from the onshore run-off. The mixing of fresh and marine waters and the reduced water flow rate promote the deposition of fine-grained sediment fractions, which often leads to the formation of sandy shoals. If tidal currents are more influential than river waters, a delta is formed at the mouth of the river. The estuaries of the Baltic rivers are defined as a subtype of the estuary due to the lack of tides, while the sea waters approach up the river (similarly to the tidal seas), but caused by wind energy (so-called backwaters). In Poland, the most complex estuaries are the Odra and the Vistula. Lakes (Dąbie, Drużno), tributaries (Szkarpawa), as well as lakes by the sea, the Gulf of Pomerania and the Gulf of Gdansk are also included as their components. This is due to the definition of the estuary, which assumes as the main feature the mixing of marine and fresh waters, originating from the land drainage. Hence, the estuary defined in this way combines many forms of habitats differing in diagnostic features, threats and recommended management and protection methods. In the classification of the Baltic Sea habitats, an estuary was defined as a type of landscape combining different habitats. Since lagoons, coastal lakes and shallow bays have been included in the Natura 2000 classification as other habitats and, for practical reasons, in particular management and conservation, it seems justified to include in the estuaries only the final stretches of rivers under the influence of the Baltic waters.[58]

These criteria are met by the estuary section of the Vistula (the przekop Wisły, Wisła Śmiała, Wisła Martwa and the Szkarpawa Vistula Lagoon), the Odra Estuary (the Świna Strait, the Dziwna River) and the estuaries of smaller coastal rivers (Rega, Parsęta, Wieprza, Słupia, Łeba, Piaśnica, Czarna Woda, Reda, the Zagórska Struga Canal, Piaśnica).

- 1150 – lagoons

The coastal part of the sea (bay) was formed as a result of cutting off from the open sea. Coastal shallow saltwater reservoirs of variable salinity and volume, completely or partially separated from the sea.[59]

Salinity may vary from brackish to salty, depending on the intensity of precipitation and river water inflow, evaporation, seawater inflows.

In the Baltic Sea region, the classification of coastal areas is complicated. It is difficult to clearly distinguish lagoons from shallow, large bays. All these waters meet the criteria of estuaries at the same

[57] https://natura2000.gdos.gov.pl/files/artykuly/52912/1170_Skaliste_i_kamieniste_dno_morskie_rafy.pdf
[58] http://natura2000.gdos.gov.pl/tom-1
[59] https://natura2000.gdos.gov.pl/tom-1

time. In the work on the list of Baltic Sea habitats (HELCOM) and the implementation of Natura 2000, the size of the flow of river waters and the exchange with marine waters were adopted as criteria. In accordance with these definitions, along the Polish coast, lagoons can be classified as: Wiślany and Szczeciński, as well as seaside lakes.

- 1210 – Annual vegetation of drift lines

Halophilic and nitrophilic communities of annual plants on beach embankments formed of organic material. Beach embankments are created as a result of the accumulation of waves and currents, depositing the material transported by them on the beach; in this case, they are organic remains of marine plants (Bladder wrack, eelgrass, etc.), and near the estuaries – also pieces of wood and other plants brought by the rivers. The organic debris zone lies between the summer and winter shorelines.[60]

"Marine Natura 2000 areas" are those that are at least partially located in marine waters, within the meaning of the Marine Areas Act of the Republic of Poland and maritime administration (Dz. U. z 2020 r. poz. 2135, z 2021 r. poz. 234). Currently, 18 marine Natura 2000 sites have been established. It consists of 8 bird areas (PLB), 9 habitat areas (PLH) and one area of Ławica Słupska (PLC), which is within the same boundaries a bird and habitat area.[61]

**Table 15 Marine Natura 2000 sites**

| Name of the area | Code | % Maritime Area Participation |
|---|---|---|
| **Ławica Słupska** | PLC 990001 | 100 |
| **Odra River Mouth and Szczecin Lagoon** | PLH 320018 | 82 |
| **Wolin and Usedom** | PLH 320019 | 18 |
| **A refuge in the Gulf of Pomerania** | PLH 990002 | 100 |
| **Ostoja Słowińska** | PLH 220023 | 35 |
| **Puck Bay and Hel Peninsula** | PLH 220032 | 83 |
| **Cliffs and Stone Reefs Orlova** | PLH 220105 | 60 |
| **A refuge in the Vistula Estuary** | PLH 220044 | 42 |
| **Vistula Lagoon and Vistula Spit** | PLH 280007 | 74 |
| **Wisłoujście Fortress** | PLH 220030 | 34 |
| **Szczecin Lagoon** | PLB 320009 | 8 |
| **Swina Delta** | PLB 320002 | 45 |
| **Kamieński and Dziwna Lagoons** | PLB 320011 | 35 |
| **Gulf of Pomerania** | PLB 990003 | 100 |
| **Coastal waters of the Baltic Sea** | PLB 990002 | 100 |
| **Bay of Puck** | PLB 220005 | 99 |

[60] http://natura2000.gdos.gov.pl/tom-1
[61] "Marine Natura 2000 sites", GDOŚ.

| Name of the area | Code | % Maritime Area Participation |
|---|---|---|
| **Vistula River Mouth** | PLB 220004 | 51 |
| **Vistula Lagoon** | PLB 280010 | 94 |

In addition, there are several Natura 2000 sites adjacent to the Polish coast or including transitional waters. All the above-mentioned Natura 2000 sites that are under analysis in this strategic assessment are described in Annex 3 to the Forecast.

In Poland since 2010 there are 9 BSPA areas in Poland - currently HELCOM MPA[62]:

- PLH320019 Wolin and Usedom (area overlapping with the Wolin National Park, BSPA ID 86),
- PLH220023 Słowińska Ostoja (area overlapping with Słowiński National Park, BSPA ID 85),
- PLB220005 Bay of Puck (area overlapping with the Seaside Landscape Park, BSPA ID 84),
- PLH280007 Vistula Lagoon and Vistula Spit (area overlapping with the Vistula Spit Landscape Park, BSPA ID 83),
- PLH320018 Odra River Mouth and Szczecin Lagoon,
- PLB990003 Gulf of Pomerania,
- PLB990002 Coastal Baltic waters,
- PLC990001 Słupsk Bar,
- PLB220004 Vistula Mouth.

One of the most important sources of threats occurring in the marine Natura 2000 areas include, among others, fishing, as a negative impact on the species and the bottom of marine waters; navigation contributing to excessive noise, pollution, marine collisions, as well as the introduction of species of foreign origin. In addition, growing tourism and recreation, water eutrophication, aggregate extraction and exploration and extraction of oil and gas, wind farm installations, military operations and coastal urbanisation are all contributing to the deterioration of these areas.[63]

[62] https://seaplanspace.ug.edu.pl/wp-content/uploads/2019/11/SEAPLANSPACE-morkie-obszary-chronione.pdf
[63] "Marine Natura 2000 sites", GDOŚ.

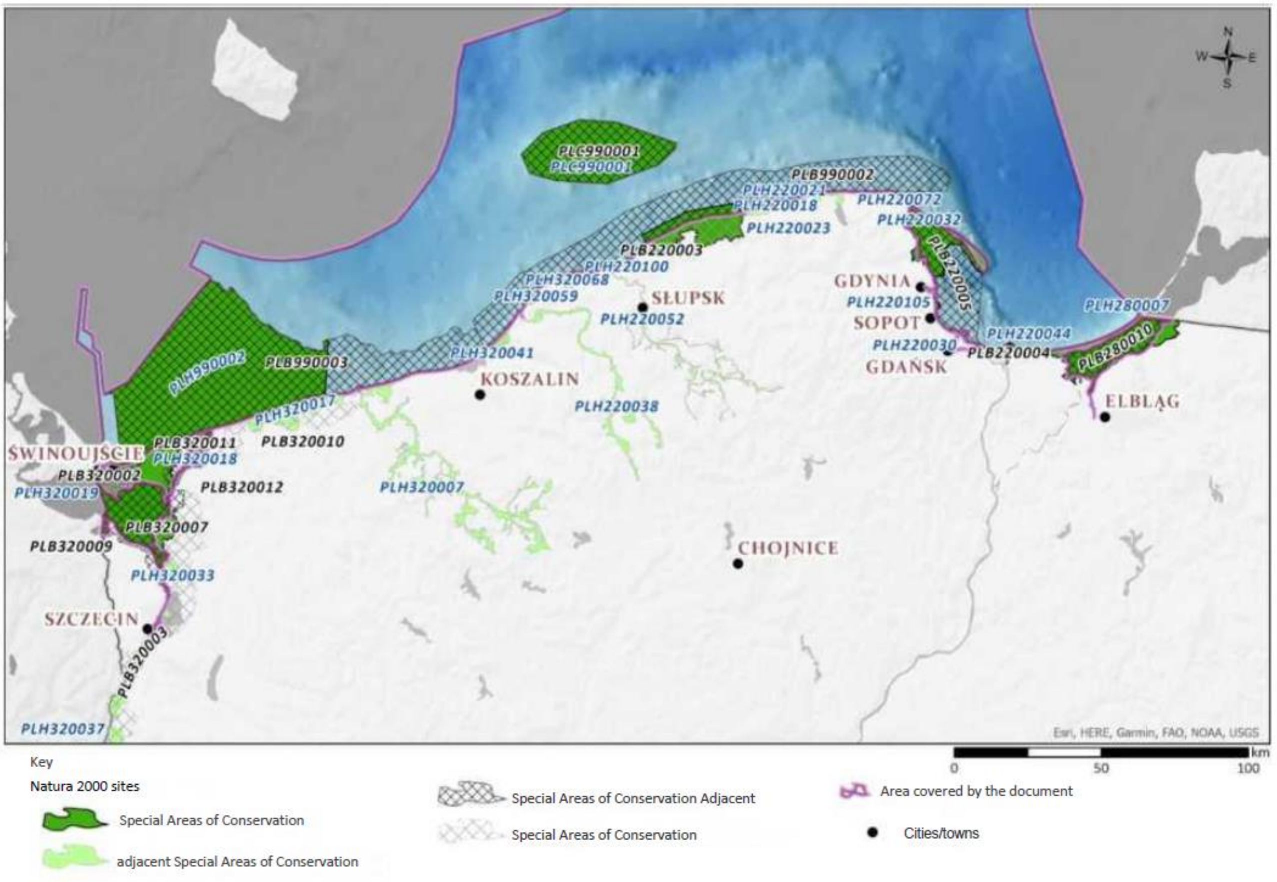



**Fig. 13 Natura 2000 marine sites and Natura 2000 sites adjacent to the boundaries of the study**

*Source: Own study based on GDOŚ data*

**Other forms of nature conservation**

Other forms of nature protection occurring within the scope of the analysis of this strategic assessment are presented in the tables below. These are areas that occur on land, the boundary of which runs along the coast or includes areas and surroundings of transitional waters.

In accordance with the nature conservation Act of 16 April 2004 (i.e. Journal of Laws of 2020, item 1378, as amended), the forms of nature protection occurring in the analyzed area adopt the following definition:

**Nature and landscape complexes (ZPK)** are fragments of the natural and cultural landscape that deserve protection due to their visual or aesthetic qualities (Article 43).

There are 3 natural and landscape complexes in the area covered by the forecast: Dębina, Helski Cypel, Usedom Peat bogs.

- ZPK Dębina – protected area since 2002, established pursuant to Regulation No. 14/2002 of the West Pomeranian Voivode of 9 July 2002 on the recognition of the area located in the city of Szczecin as a natural and landscape complex, its task is to protect the ecosystem, which is of particular importance for rare plant species present therein and acts as a breeding ground for birds of prey threatened with extinction. The area of ZPK is 780 ha.
- ZPK Helski Cypel - a team appointed pursuant to the resolution of the City Council of Hel No. XXVI/155/08 of 29 October 2008 (Journal of Laws (Official Journal of Lubuskie Province. z 2008 r. No. 136, item 3453) in order to protect valuable fragments of the traditional coastal landscape with preserved complexes of military architecture and high natural values, such as dune habitats and the coastal forest *Empetro nigri - Pinetum*. The area is 293 ha.
- ZPK Usedom Peat bogs – an area covered by protection since 2003, established pursuant to Regulation No. 7/2003 of the West Pomeranian Voivode of 10 May 2003 on the recognition of the area as a natural and landscape complex under the name "Usedom Peat bogs", in order to protect the natural and aesthetic values of a part of the Usedom Spit forests characterized by high biodiversity, unique mosaic habitats consisting of: the occurrence of a specific variety of soils related to marsh processes (low peat) and alluvial and elusive (age-differentiated dune embankments), old deciduous forests, including over 150-year-old oak stands and numerous sites of protected plant and animal species (Journal Of West Pomeranian province of 2003. No. 39, item 611).

**Documentation** stations are non-separable on the surface or separable, scientifically and didactically important, places of occurrence of geological formations, accumulations of fossils or mineral formations, caves or subsurface shelters with silt and fragments of exploited or inactive surface and underground excavations (Article 41.1.),

- Oksywski Cliff – a position protected under the order of voivode of Pomorskie No. 162/99 of 16 November 1999 on the recognition of certain areas in the Pomorskie province as documentary sites of inanimate nature, an area of 10 ha.

**The nature reserve** includes areas preserved in a natural or unchanged state, ecosystems, natural refuges and habitats, as well as plant habitats, animal and fungal habitats, and inanimate formations and components of nature, characterised by particular natural, scientific, cultural or landscape values (Article 13.1),

The analyzed area includes 14 established under the following Regulations:

- Helskie Dunes - Regulation of the Pomeranian Voivode of 5 December 2006 on the establishment of the "Helskie Dunes" reserve (Journal of Laws of 2005, No. 113, item 954 and no. 130, item 1087).
- Ujście Nogatu - Regulation No. 325 of the Governor of the Warmia and Mazury Province of 13 December 2001 on recognition as a nature reserve "Ujście Nogatu" ( Official Gazette 2001 r. No. 142, item 2040).

Ordinances:

- Kępa Redłowska - Ordinance of the voivode of Pomeranian province of July 29, 1938 on the protection of nature creations in the area of Kępa Redłowska in Gdynia (Journal of 1938 No. 23, item 271),
- Ptasi Raj - Ordinance of the Minister of Forestry and Wood Industry of 5 November 1959 on the establishment of the "Ptasi Raj" nature reserve (Monitor Polski of 1959. No. 97, item 525).,
- Mierzeja Sarbska - Ordinance of the Minister of Forestry and Wood Industry of 10 November 1976 on the establishment of the "Mierzeja Sarbska" landscape reserve (Monitor Polski No. 42, item 206),
- Białodrzew Kopicki - Ordinance of the Minister of Forestry and Wood Industry of 11 April 1985 on recognizing "Białodrzew Kopicki" (Monitor Polski of 1985. No. 7, item 60),
- Beka - Ordinance of the Minister of Environment and Natural Resources dated 17 November 1988 on recognizing the nature reserve “Beka” (Polish Monitor No. 32, item 292) and the Order of the Regional Director for Environmental Protection in Gdańsk dated 26 April 2018 on the nature reserve “Beka” (Journal Laws of 2018, item 2025),
- Mewia Łacha - Ordinance of the Minister of Environment, Natural Resources and Forestry of 9 October 1991 on recognition as a nature reserve of "Mewia Łacha" (Monitor Polski z 1991 r., No. 38, item 273),
- Słone Łąki - Ordinance of the Pomeranian Voivode of 30 November 1999 on the establishment of the "Słone Łąki" reserve (Journal Of Pomeranian province No. 131, item 1129),
- Mechelińskie Łąki - Order of the Governor of the Pomeranian province of 23 November 2000 on the establishment of the reserve "Mechelińskie Łąki" (Journal of Laws No. 109, item 714).
- Gulf of Elbląg - Regulation of the Minister of Environment, Natural Resources and Forestry of 9 October 1991 on recognition as nature reserves "Gulf of Elbląg" (M. P. of 1991. No. 38, item 273).

The main objectives of the protection of the above-mentioned reserves include, among others, the preservation of a unique landscape, specific natural processes occurring in their areas at the interface of land and sea, the preservation of rich and diverse fauna of water-mud birds and their habitats, as well as resting places for fleeting birds, including coastal complexes of lakes, swamps and dunes, the protection of existing grassland, heathland and forest ecosystems.

The **national park** includes an area with special natural, scientific, social, cultural and educational values, with an area of not less than 1000 ha, in which all nature and landscape values are protected (Article 8.1.),

There are 2 National Parks in the area covered by the forecast: Słowiński National Park and Wolin National Park.

- Słowiński National Park – the area of 32744 ha, including approx. 21572 ha, belongs to the mainland, and 11171 to the coastal waters of the Baltic Sea, protected under the Regulation of the Council of Ministers of 23 September 1966 on the establishment of the Słowiński National Park (Journal of Laws of 1966 r. No. 42, item 254). The park area is under strict protection, which mainly consists in the absolute cessation of any human interference in the state of the ecosystem and its natural components, as well as the course of natural processes. In 1977, the area of the Park was included in the UNESCO program "Man and the Biosphere" and thus included in the global network of biosphere reserves. The next stage in the implementation of protection was the inclusion in 1995 in the list of protected areas under the Ramsar Convention - on wetlands of international importance.
  The land part of the Park is protected under the International Protection of Birds – Słowińska Uprising (PL019), approved according to the adopted criteria regarding the species composition and the number of the avifauna. The marine areas of Słowiński Park include three areas of the Natura 2000 network: Ostoja Słowińska (PLH 220023), Pobrzeże Słowińskie (PLB 220003) and Coastal Baltic waters (PLB 990002).
  The area of the buffer zone of the Słowiński National Park is 30220 ha.
- Woliński National Park – area of 10937 ha, including forest ecosystems: 4648 ha, water: 4681 ha and non-forest land 1607 ha. The area covered by strict protection covers an area of 498 ha. The park was protected in 1960 by the Regulation of the Council of Ministers of 3 March 1960 on the establishment of the Wolin National Park.
  The park is located within the boundaries of the Świna Delta (PL001) – the International Bird Sanctuary. Particular advantages in this area include the archipelago of islands in the reverse delta of Świna, taking into account the surrounding waters of the Szczecin Lagoon, a section of the cliff coast and the coastal belt of the Baltic Sea.
  Marine areas of the Wolin National Park are represented by the areas of the Natura 2000 Network, including: A refuge in the Gulf of Pomerania PLH 990002 and Świna Delta PLB320002, which extend beyond the border of the Park.
  The area of the buffer zone of the Wolin National Park is 3368 ha.

The **landscape park** covers an area protected due to natural, historical and cultural values and landscape qualities in order to preserve, promote these values in sustainable development conditions (Article 16.1.),

There are three landscape parks within the limits of the document: Seaside Landscape Park, Elbląg Upland Landscape Park and Vistula Spit Landscape Park.

- Seaside Landscape Park – an area of 18804 ha, including 7452 ha of land and 11352 ha of waters of the Gulf of Puck, protected under Resolution No IX/49/78 of the Provincial National Council in Gdańsk of 5 January 1978. (Journal WRN in Gdańsk 1978 r. No. 1, item 3). Resolution No. 142/VII/11 of the Pomeranian province Council of 27 April 2011 on the Seaside Landscape Park is currently in force. The terrestrial area of the Park contains fragments of Kępa Swarzewska and Pucka, the primeval depressions of Plutnica and Redy to the town of Mechelinki, and there are 13 reserves within the area. The maritime part lies within the boundaries of the International Bird Sanctuary – Puck Bay (code: PL024), as well as Natura 2000 sites, including: Puck Bay and Hel Peninsula (PLH 220032) and Puck Bay (PLB 220005).
- Landscape Park of the Elbląg Upland – an area of 13417 ha, created pursuant to Resolution No. VI/51/85 of the Provincial National Council in Elbląg of April 26, 1985 on the creation of landscape parks and protected landscape areas. Its purpose is to preserve the natural, historical, cultural and landscape values of the protected area.
- Vistula Spit Landscape Park – an area of 4410 ha, established in 1985 by virtue of Resolution No. VI/51/85 WRN in Elbląg of April 26, 1985 on the creation of landscape parks and a protected landscape area in the Elbląg province. Currently, resolution No. 261/XXIV/16 of the POMERANIAN province ASSEMBLY of 25 July 2016 on the amendment of the resolution of the Pomeranian province Assembly on the "Vistula Spit" Landscape Park is in force. The aim of the park was to protect the eastern part of the Vistula Spit with its characteristic features of the sculpture and a diverse habitat: from pine forests, alder rushes to acrylic phytocenoses.

**The protected landscape area** includes areas protected due to the distinctive landscape with diverse ecosystems, valuable due to the possibility of meeting the needs related to tourism and leisure or performed as ecological corridors (Art. 23. 1.)

The analyzed area includes 11 landscape conservation areas (Table 16), established pursuant to the following Resolutions:

- Koszalin Seaside Belt - Resolution No. X/46/75 of the Provincial National Council in Koszalin of 17 November 1975 on the protected landscape zones "Koszalin Seaside Belt" (Journal (Official Journal of WRN 1975 No. 9 item 49),
- Coastal Belt west of Ustka and Coastal Belt west of Ustka (province Zachodniopomorskie) - Resolution No. X/42/81 of the Provincial National Council in Słupsk of 8 December 1981 on the establishment of the "Słupia Valley" Landscape Park and protected landscape areas "Coastal Belt to the West of Ustka" and "Coastal Belt to the West of Ustka (province of Zachodniopomorskie), (Journal of Laws 1981 No. 9, item 23),
- Szkarpawa and Tugi River - Resolution No. VI/51/85 of the Provincial National Council in Elbląg of 26 April 1985 on the creation of landscape parks and landscape protected areas in the province of Elbląski River of Szkarpawa and Tuga (Official Journal Urz. z 1985 r. No. 10, item 60)

- Bauda River - Resolution No. VI/51/85 of the Provincial National Council in Elbląg of April 26, 1985 on the creation of landscape parks and landscape areas protected in the Elbląg province "Bauda River" (Journal Laws 1985 No. 10, item 60),
- Coastal Belt to the East of Ustka - Resolution No. X/42/81 of the Provincial National Council in Słupsk of 8 December 1981 on the establishment of the "Słupia Valley" Landscape Park and protected landscape areas "Coastal Belt to the East of Ustka" (Journal of Laws 1981 No. 9, item 23),
- Nogat River - Resolution No. VI/51/85 of the Provincial National Council in Elbląg of April 26, 1985 on the creation of landscape parks and landscape protected area in the Elbląg province for the area of "Nogat River" (Journal Laws 1985 No. 10, item 60),
- Koszalin Seaside Belt - Resolution No. X/46/75 of the Provincial National Council in Koszalin of 17 November 1975 on protected landscape zones for the area "Koszalin Seaside Belt" (Journal (Official Journal of WRN in Koszalin No. 9, item 49),
- Old Prussian Coast - Resolution No. VI/51/85 of the province National Council in Elbląg of April 26, 1985 on the creation of landscape parks and landscape areas protected in the Elbląg province for the area of "Old Prussian Coast" (Journal Laws 1985 No. 10, item 60),
- Elbląg Upland – East - Resolution No. VI/51/85 of the Provincial National Council in Elbląg of April 26, 1985 on the creation of landscape parks and landscape areas protected in the Elbląg province for the area of "Elbląg Upland – East" (Journal Laws 1985 No. 10, item 60),

Regulations:

- Seaside - Regulation No. 5/94 of 8 November 1994 on the designation of landscape conservation areas, the determination of boundaries of landscape parks and the designation of buffer strips around them and the introduction of prohibitions and restrictions applicable therein for the area "Seaside" (Journal Laws 1998 No. 59, item 294),
- Sobieszewska Islands - Regulation No. 11/98 of the Gdańsk Voivode of September 3, 1998 amending Regulation No. 5/94 of November 8, 1994 on the designation of protected landscape areas, determining the boundaries of landscape parks and creating buffer zones around them and introducing prohibitions and restrictions applicable therein for the "Sobieszewska Islands" area (Journal Of Laws of 1998. No. 59, item 294).

**Table 16 Other forms of nature protection within the area of the study.**

| Item | Name of the natural and landscape complex |
|---|---|
| 1 | Dębina |
| 2 | Helski Cypel |
| 3 | Usedom peat bogs |
| **Item** | **Documentation station name** |
| 1 | Oksywski Cliff |
| **Item** | **Reserve name** |
| 1 | Kępa Redłowska |
| 2 | Bird Paradise |
| 3 | Mierzeja Sarbska |

| | |
|---|---|
| **4** | Białodrzew Kopicki |
| **5** | Beka |
| **6** | Mewia Łacha |
| **7** | Słone Łąki |
| **8** | Mechelińskie Łąki |
| **9** | Nogat Mouth |
| **10** | Gulf of Elbląg |
| **11** | Beka - buffer |
| **12** | Salt Meadows - buffer |
| **13** | Mechelin Meadows - buffer |
| **14** | Helskie Dunes - buffer |
| **Item** | **National park name** |
| **1** | Wolin National Park |
| **2** | Wolin National Park - buffer zone |
| **3** | Słowiński National Park |
| **4** | Słowiński National Park - buffer zone |
| **Item** | **Landscape park name** |
| **1** | Seaside Landscape Park. |
| **2** | Coastal Landscape Park - buffer zone |
| **3** | Elbląg Upland Landscape Park. |
| **4** | Elbląg Upland Landscape Park - buffer zone |
| **5** | The Vistula Spit Landscape Park. |
| **6** | Vistula Spit Landscape Park - buffer zone |
| **Item** | **Name of the Protected landscape area** |
| **1** | Coastal belt west of Ustka (Zachodniopomorskie province) |
| **2** | Szkarpawa and Tugi River |
| **3** | Bauda River |
| **4** | Seaside |
| **5** | Coastal belt east of Ustka |
| **6** | Sobieszewska Islands |
| **7** | Nogat River (Pomorskie province) |
| **8** | Koszalin Seaside Belt |
| **9** | Old Prussian Coast |

| | |
|---|---|
| **10** | Coastal Belt West of Ustka |
| **11** | Elbląg Upland - East |

Słowiński National Park is also a UNESCO biosphere reserve and a water-marsh area designated under the Ramsar Convention.

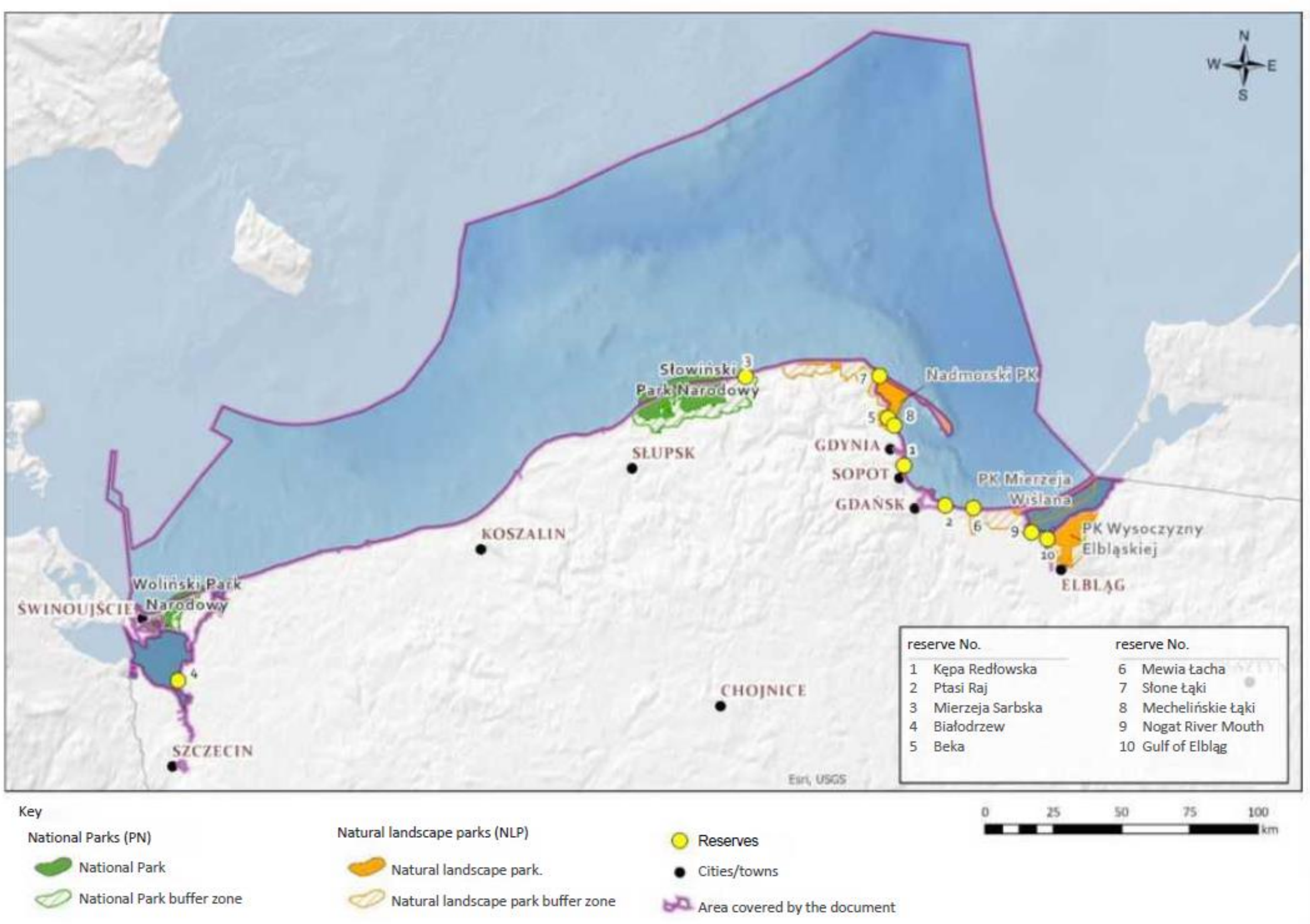



**Fig. 14 Forms of nature conservation (national parks, landscape parks and reserves) in the POM area**

*Source: Own study based on GDOŚ data*

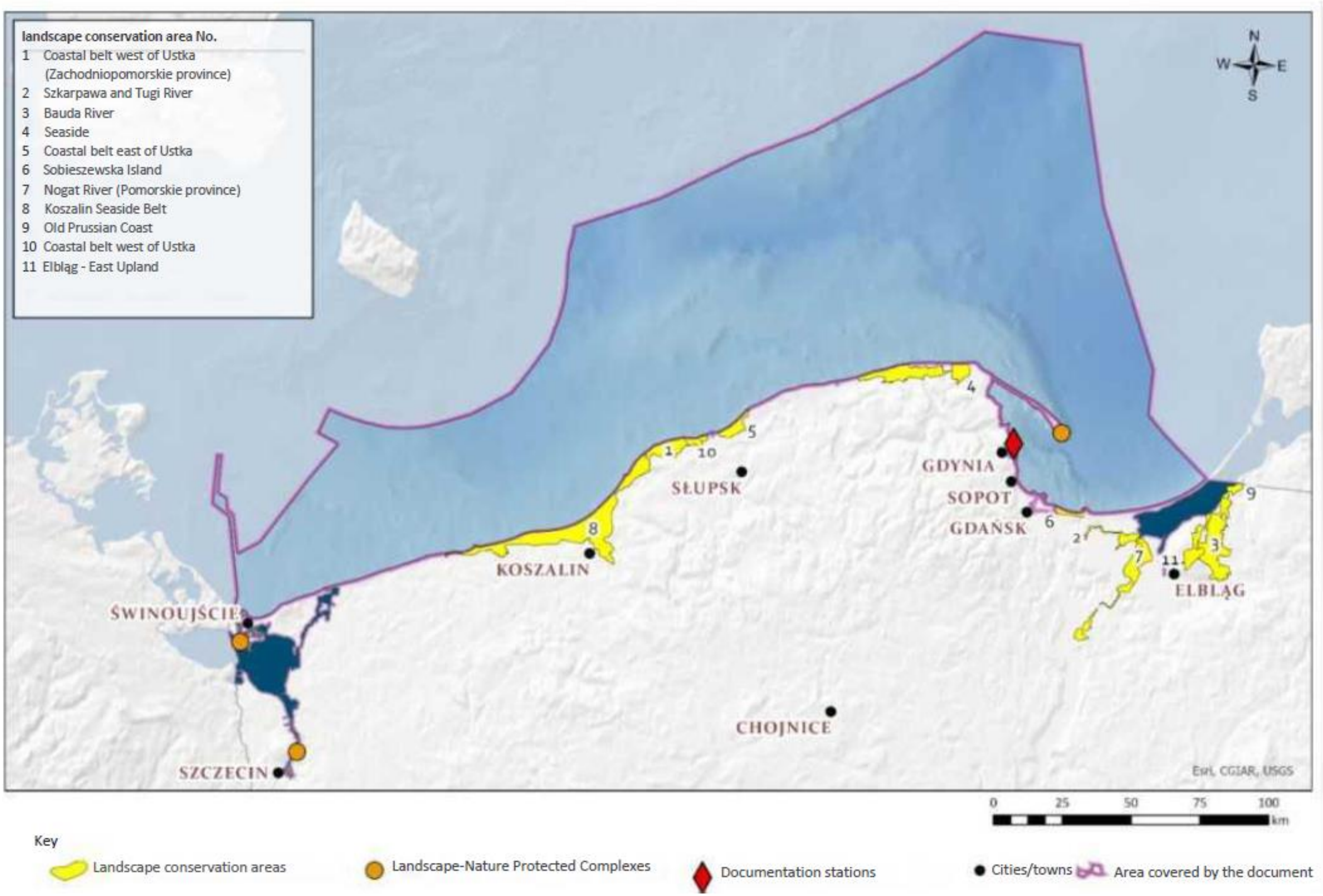



**Fig. 15 Forms of nature protection (landscape protection areas, natural and landscape complexes and documentation sites) in the analysed area**

*Source: Own study based on GDO data*

## 5.3 Surface waters

### 5.3.1 Hydrography

#### 5.3.1.1 Legal position of maritime areas and their division

The legal position of the maritime areas of the Republic of Poland and their division is determined by the Act of 21 March 1991 on Maritime Areas of the Republic of Poland and Maritime Administration (i.e. Journal of Laws of 2021, item 234). Pursuant to Article 2 of the Act:

1. The maritime areas of the Republic of Poland are:
    - internal marine waters,
    - territorial sea,
    - adjacent zone,
    - exclusive economic zone,

hereinafter referred to as "Polish maritime areas" - POM

2. The internal marine waters and the territorial sea are part of the territory of the Republic of Poland.
3. The territorial sovereignty of the Republic of Poland over internal sea waters and the territorial sea extends to the waters, airspace over these waters and to the seabed of internal waters and the territorial sea, as well as to the interior of the ground below them.

Marine internal waters are, in accordance with Article 4 of the Act:

4. the part of the Nowowarpieskie Lake and the part of the Szczecin Lagoon with Świna and Dziwna and the Kamień Lagoon, located east of the national border between the Republic of Poland and the Federal Republic of Germany, and the Odra river between the Szczecin Lagoon and the waters of the port of Szczecin;
5. the part of the Gulf of Gdańsk enclosed by the baselines of the territorial sea;
6. the part of the Vistula Lagoon located south-west of the state border between the Republic of Poland and the Russian Federation on that Lagoon;
7. the waters of ports identified from the sea by a line connecting the outermost fixed port facilities forming an integral part of the port system;
8. the waters between the sea shore line established in accordance with the Law of 20 July 2017. – Water law, and the baselines of the territorial sea.

According to Article 5 (1) of the Act, the territorial sea of the Republic of Poland is an area of marine waters with a width of 12 nautical miles (22 224 m), calculated from the baselines of that sea.

The Act, in Article 13a (1), established a zone adjacent to the territorial sea of the Republic of Poland, the external border of which is no more than 24 nautical miles from the baseline.

The Act established the exclusive economic zone of the Republic of Poland. It is situated outside the territorial sea and adjoins it. It includes the waters, the bottom of the sea and the interior of the earth underneath. The borders of the exclusive economic zone are defined by international agreements.

Internal marine waters shall comprise:

- transitional waters, which, in accordance with Article 25 of the Water Law Act, constitute surface waters located in estuaries or near estuaries, which, due to the proximity of salt waters, show partial salinity, remaining within the range of significant influences of fresh waters, and internal marine waters of the Gulf of Gdańsk.

- coastal waters which, in accordance with Article 26 (1) of the Water Law Act, comprise the area of surface waters from the coastline the external boundary of which is delimited by a distance of one nautical mile from the sea side, counting from the baselines referred to in Article 5 (2) of the Law of 21 March 1991 on the maritime areas of the Republic of Poland and the maritime administration, excluding the internal sea waters of the Gulf of Gdańsk and the territorial sea adjacent thereto. If the range of transitional waters is greater than the coastal zone, the outer limit of that range shall be the outer limit of the coastal waters.

The extent and division of Polish maritime areas is presented in the figure below.

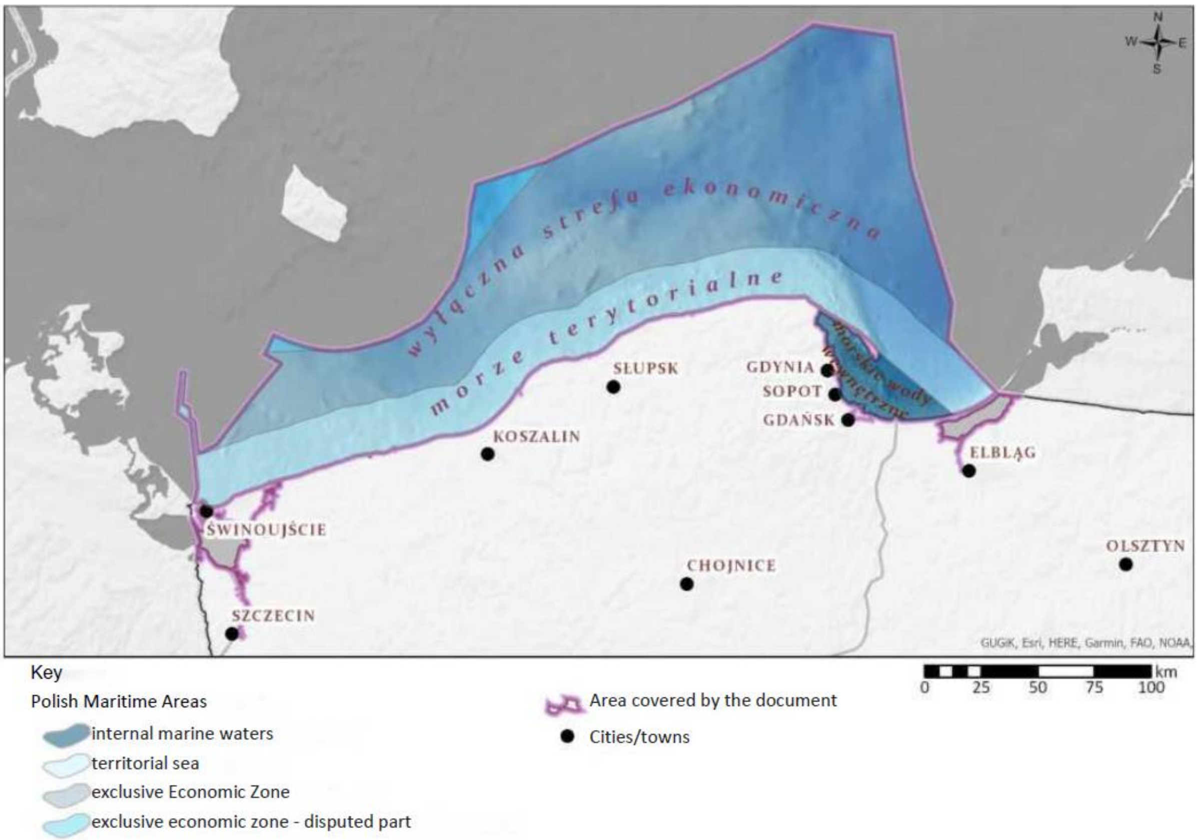



**Fig. 16 Extent and division of Polish maritime areas**

*Source: Own study based on data Update of the preliminary assessment of the status of the marine waters environment*

The internal marine waters and the territorial sea constitute a legally integral part of the territory of Poland. The exclusive economic zone, which is located outside the territorial sea and adjacent to this sea, is not included in the territory of the country, but Poland is entitled in this zone:

- sovereign rights to identify, manage and exploit the natural resources, both living and mineral, of the seabed and the interior of the earth beneath it and the waters overlying it, and to protect those resources and sovereign rights in respect of other economic endeavours in the zone;
- authority in the field of a) construction and use of artificial islands, constructions and other devices, b) scientific research, c) protection and preservation of the marine environment,
- and other powers provided for in international law.

### 5.3.1.2 Sea shore of the Polish Baltic Sea

Within the sea shore, three forms can be distinguished: dune banks, cliff banks and low-lying (flat) banks.

The dune banks cover approx. 75% of the Polish sea shore. Dune banks are characterized by a variety of forms and types, variation in dune height, width and sculpture of the beach, degree of vegetation overgrowth. Dune banks are usually formed by dune systems (sequences), less often by single dune sequences. In the case of a typically dune shore, dunes occurring on the land edge of the beach, provide protection against the impact of storm waves and accumulate sand that can power the beaches (shore) during their washout.

The cliff banks cover about 20% of the length of the open Polish sea shore. The cliff sections of the sea shore are usually alternately with the dune banks. On the open sea, cliffs meet on the sections Cetniewo – Jastrzębia Góra, Rowy – Ustka, Jarosławiec – Niechorze – Dziwnówek and Wolin island and on the western shores of the Gulf of Gdańsk. Locations of the largest cliffs are the island of Wolin, the bank east of Ustka, the vicinity of Jastrzębia Góra and Rozewia, as well as locally in several other coastal towns, e.g. in the vicinity of Niechorze – Trzęsacz – Dziwnówek or Sarbinowo – Ustronie Morskie – Kołobrzeg.

The low (flat) banks are located in the delta area of rivers and in the lagoon area. With regard to the open sea, they occur locally in the vicinity of lowland areas. However, larger sections of the flat bank can be indicated in the lagoons (Szczecin Lagoon and Vistula Lagoon) and in the bays cut into the land (Puck Bay). The low-lying banks also occur in the back of the dune banks, such as some sections along the Hel Peninsula or in the area between Karwia and the Piaśnica river, as well as in many places along the spit banks. The coastline, partially closed to the influence of open sea factors (coastline of bays, estuaries, floods) is 413 km.

In the scope of sea shore protection, the Act of 28 March 2003 on the establishment of a multiannual programme According to the assumptions (journal of Laws 2016, item 675). The programme provides for the construction, development and maintenance of a flood protection system for coastal areas, ensuring the stabilisation of the coastline and preventing the disappearance of beaches, as well as measures aimed at the rescue of the sea shores, including their monitoring.

The following is a brief description of the areas within the range of marine waters impact:

**Vistula Lagoon**

The Vistula Lagoon covers a total area of 838 km$^2$ (of which there are 301.7 km$^2$ of its area within the borders of Poland). The border with the Russian Federation (Kaliningrad Oblast) runs through the area of the Lagoon. The lagoon is separated from the sea by the Vistula Spit, and its average depth is approx. 3 m. Through the Pilawa Strait, the Vistula Lagoon is connected to the Gulf of Gdańsk. The Vistula Lagoon drains an area of 23,856 km$^2$, of which 14,757 km$^2$ is located in Poland. The remaining dewatered areas are located in Russia and Lithuania. The largest river flowing to the Lagoon is Pregoła located in the Kaliningrad Oblast. The tributaries of Pregoła, Łyna and Węgorapa collect water from the territory of Poland, from the lakes of the Masurian Lake District.

**Gulf of Gdańsk**

It is a large body of water in the south-eastern part of the Baltic Sea with an area of approximately 6,300 km$^2$, which extends geographically within the borders of Poland and Russia. The open sea border is delineated by a line connecting Cape Rozewie with Cape Taran on the Sambia Peninsula. The western part is limited on the one hand by the Hel Peninsula, on the other by the section of the Coast to Swibno. The inner part of this basin is the Bay of Puck. The border runs from the Hel to the Oxksywski Cape. On the other hand, the most northeastern part of the Gulf of Puck is a much shallower basin, where the waves tend to be less intense than in the Gulf of Puck. The dividing line is the Rybitwia Mielizna - a sandy bar stretching from Kuźnica to Rewa. The coastline of the Gulf of Gdańsk is gentle, levelled, built of flat and sandy beaches or steep hills. The waters of the Gulf of Gdansk are fed by the Vistula River - the catchment area of the Gulf of Gdansk is approx. 220 thousand $km^2$.

**Hel Peninsula**

The Hel Peninsula covers a measuring area of 35 km and a width of approx. 100-200 m in the area of the peninsula's base in Władysławów or in the area of Kuźnica, to nearly 3 km in the vicinity of Hel. The border with the waters of the open sea, the Gulf of Puck and the Gulf of Gdansk. The continuous peninsula was formed in the 17th and 18th centuries from the merger of the existing islands. Hel Spit does not have a surface hydrological network, apart from local periodic wetlands.

**Gulf of Pomerania**

The Gulf of Pomerania with an area of approx. 6000 $km^2$ is located in the south-western part of the Baltic Sea off the coasts of Poland and Germany. The bay stretches from the island of Rügen in the west to Jarosławiec in the east. The depths in the Gulf of Pomerania do not exceed 15 meters. The Gulf of Pomerania is connected by the Straits of Piana, Świna and Dziwna with the Szczecin Lagoon. The Gulf of Pomerania, which is part of the Odra estuary, is an area characterized by variable hydrochemical conditions caused by the interaction of inland and marine waters. The bay is connected with Szczecin by a waterway for sea vessels with a length of approx. 100 km, which runs through Świna, the Szczecin Lagoon and the Oder.

**Szczecin Lagoon**

The Szczecin Lagoon is a reservoir located in Poland and Germany. The state border between Germany and Poland runs from the north to the south and divides the Szczecin Lagoon into two parts: the western one – the German one (the Little Lagoon) and the eastern one – the Polish one (the Great Lagoon). Most of the area (410 $km^2$ of the total area of 687 km2) is located within the borders of Poland. The outflow of water takes place through three straits: Pig and Strange, which go to the Gulf of Pomerania and the foam falling into the Gulf of Greifswald. The islands of Usedom and Wolin are separated from the waters of the Baltic Sea in the Gulf of Pomerania. The main tributary of the Szczecin Lagoon is the Odra river, the catchment area of which accounts for 1/3 of the area of Poland (approximately 119,000 $km^2$). The Szczecin Lagoon acts as a buffer reservoir protecting the waters of the Pomeranian Gulf against the impact of pollutants brought from the Odra basin. On the Polish part of the Lagoon, there is a continuously deepened waterway leading from Świnoujście to Szczecin with a length of approx. 20 km.

## 5.3.2 Identification of surface water bodies covered by the Forecast

### 5.3.2.1 Territorial sea, adjacent zone and exclusive economic zone

In the work of the HELCOM CORESET BD2/2011 project, a regional harmonisation was carried out regarding the separation of common larger assessment areas - sub-bodies of water – in the Baltic Sea. This division of assessment units was used in the preliminary assessment of the status of marine waters environment of the Polish Baltic Sea Zone. Within the Polish Maritime Areas (POM) there were 8 separate areas (in parentheses the number of the sub-body is given):

- (27) Eastern Baltic Open Waters
- (33) Open waters of the Gulf of Gdańsk
- (35) Polish coastal waters of the Gulf of Gdańsk
- (36) Open waters of the Bornholm Basin
- (38) Polish coastal waters of the Bornholm Basin
- (62) Polish coastal waters of the Eastern Baltic Sea
- (35A) Polish part of the Vistula Lagoon
- (38A) Polish part of the Szczecin Lagoon

Subsequently, for the purposes of a unified approach to assessment, the HELCOM Monitoring and Assessment Strategy (HELCOM MAS) adopted a modified division of the Baltic Sea into sub-bodies, i.e. marine regional units (MRUs) subject to assessment. <u>This division, described below, was used in the update of the preliminary assessment of the environmental status of marine waters</u>.

The waters of the Baltic Sea are divided into 17 sub-bodies, of which POM refers to (sub-body code in brackets):

- Basen Bornholmski / Bornholm Basin (SEA-007),
- Eastern Gotland Basin (SEA-009),
- Basen Gdański / Gdansk Basin (SEA-008),

An additional 40 coastal waters have been designated for pom (area code in brackets):

- Polskie wody przybrzeżne wschodniego Basenu Gotlandzkiego / Eastern Gotland Basin Polish Coastal waters (22)
- Polskie wody przybrzeżne Basenu Gdańskiego / Gdansk Basin Polish Coastal waters (24)
- Polskie wody przybrzeżne Basenu Bornholmskiego Bornholm / Bornholm Basin Polish Coastal waters (26)

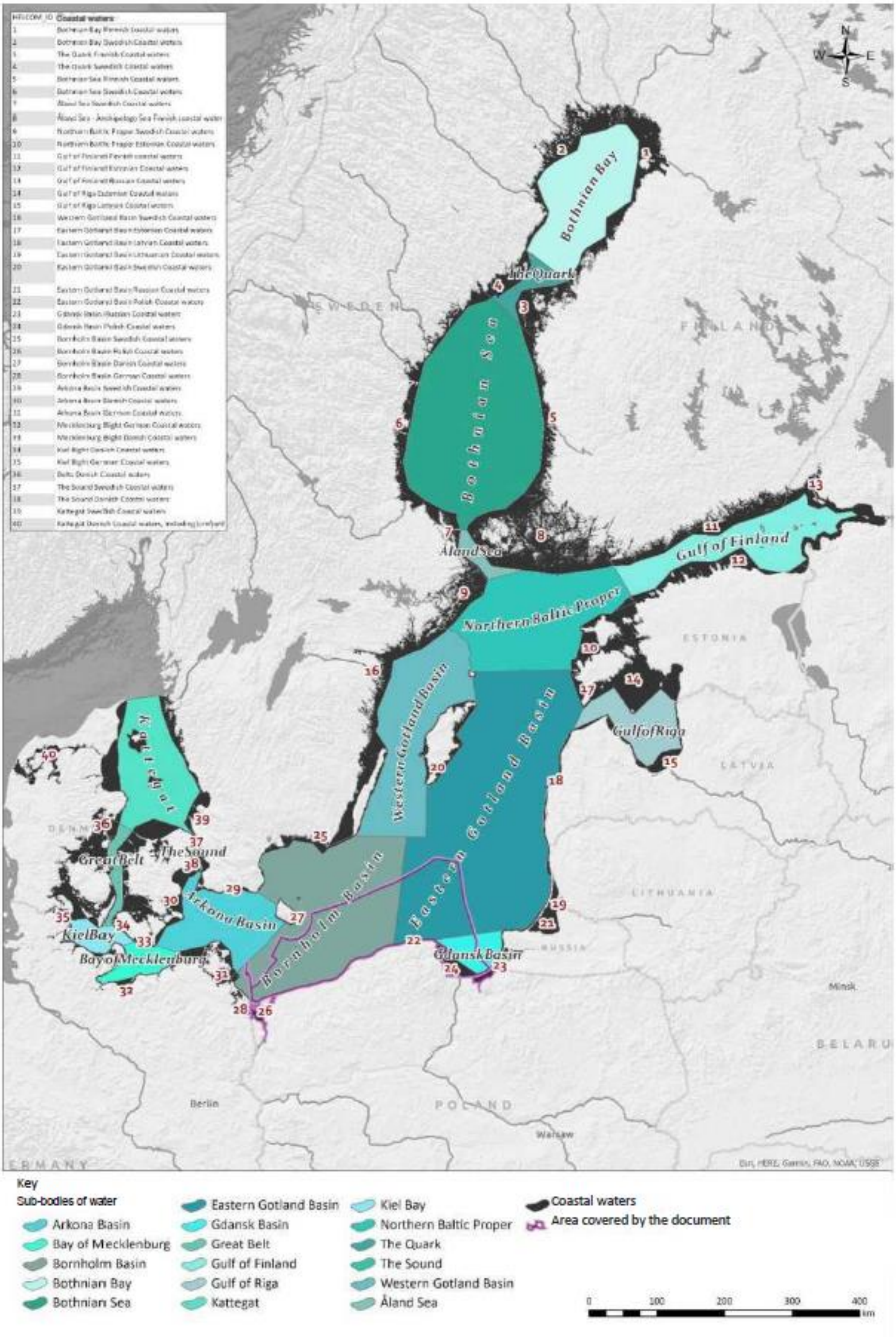



**Fig. 17 Baltic Sea sub-bodies of waters**

*Source: own study based on HELCOM*

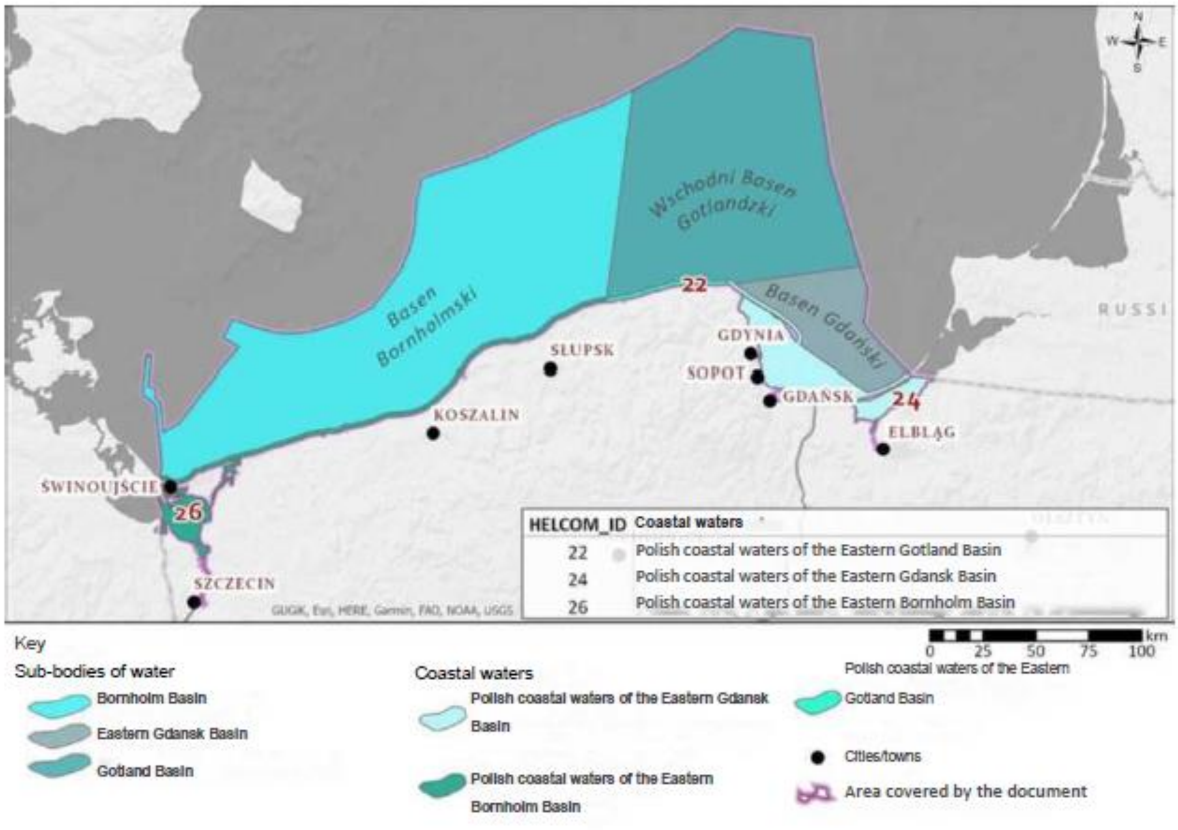



**Fig. 18 Sub-bodies of water in POM**

Source: Own study based on HELCOM

### 5.3.2.2 Internal marine waters (coastal and transitional SWB)

In accordance with the project II uRBMP within Polish internal marine waters, the following number of coastal and transitional water bodies was identified:

- in the Lower Vistula water region there are 4 transitional and 2 coastal water bodies.
- in the water region of Lower Odra and the Western Przymorze, there are 3 transitional and 2 coastal water bodies.

The tables below summarise the basic information on the identified transitional and coastal water bodies.

**Table 17 List of basic information on transitional SWBs**

| Item | water body name | uSWB code[1] | uSWB type for 2022-2027* | Status of uSWB for the years 2022 - 2027 | area [km²] | River basin | Water Region |
|---|---|---|---|---|---|---|---|
| **1** | Outer Puck Bay | TW20003WB5 | Zat I | NAT | 285.93 | Vistula | Lower Vistula |

| Item | water body name | uSWB code[1] | uSWB type for 2022-2027* | Status of uSWB for the years 2022 - 2027 | area [km$^2$] | River basin | Water Region |
|---|---|---|---|---|---|---|---|
| **2** | Puck Lagoon | TW20002WB4 | Annex II | NAT | 111.13 | Vistula | Lower Vistula |
| **3** | Inner Gulf of Gdańsk | TW20004WB6 | Zat II | NAT | 1194.8 | Vistula | Lower Vistula |
| **4** | Vistula Lagoon | TW20001WB1 | Zal I | NAT | 301.74 | Vistula | Lower Vistula |
| **5** | Szczecin Lagoon | TW60001WB2 | Zal I | NAT | 407.28 | the Odra | Lower Odra and the Western Przymorze |
| **6** | Kamieński Lagoon | TW60001WB3 | Zal I | NAT | 43.6 | the Odra | Lower Odra and the Western Przymorze |
| **7** | Mouth of the Vistula River | TW20005WB7 | NAT | PrzU | 64.24 | Vistula | Lower Vistula |

*Source: Own study based on materials from II uRBMP*

[1] ZAL I - Floodplain I with a mud and sandy substrate; ZAL II - Floodplain II with a sandy and mud substrate; Zat I - Bay I with a clay and mud substrate; Zat II - Bay II with a sandy substrate periodically stratified; PrzU - Estuary with a sandy substrate

**Table 18 Summary of basic information on coastal water bodies**

| Item | water body name | Code of water body | Type of water body1 | Status for 2022 – 2027* | area [km2] | River basin | Water Region |
|---|---|---|---|---|---|---|---|
| **1** | Hel Peninsula | CW20001WB1 | PbM | NAT | 81.16 | Vistula | Lower Vistula |
| **2** | Polish coastal waters of the Gotland Basin | CW20001WB2 | PbO | NAT | 187.44 | Vistula | Lower Vistula |
| **3** | Polish coastal waters of the Bornholm Basin | CW60001WB3 | PbO | NAT | 221.63 | the Odra | Lower Odra and the Western Przymorze |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **4** | Coastal waters of the Gulf of Pomerania | CW60001WB4 | PbO | NAT | 138.9 | the Odra | Lower Odra and the Western Przymorze |

*Source: Own study based on materials from II uRBMP*

[1] PbM - spit; PbO - Open Coast

### 5.3.3 Identification of protected and protective areas indicated in Article 317 (4) of the Water Law

Article 317 (4) of the Water Law lists the following protected areas[64]:

- water bodies intended for water intake for the purposes of providing water for human consumption, as referred to in Article 71,
- water bodies intended for leisure purposes, including swimming,
- areas sensitive to eutrophication caused by contaminants coming from domestic sources,
- areas intended for the conservation of habitats or species, as referred to in the Nature Conservation Act of 16 April 2004, for which the preservation or improvement of water condition is an important factor in their conservation,
- areas designated for the protection of species of aquatic animals of economic importance.

**Water bodies intended for water intake for the purposes of providing water for human consumption, as referred to in Article 71 of the Water Law Act**

In accordance with the list of surface water bodies intended for water abstraction for the purposes of providing water for human consumption attached to Annex II of the uRBMP, in the analysed area (the Lower Odra and West Pomerania water region and the Lower Vistula water region) there are such water bodies. However, these waters are not threatened by the effects of marine measures and are therefore omitted in this description. **It should be emphasized that coastal and transitional water bodies are not water bodies intended for water intake for the purposes of providing water for human consumption.**

**Water bodies for leisure purposes, including swimming**

Waters intended for recreational purposes are determined on the basis of the provisions of Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC (Journal (Official Journal of EC L 64 of 04.03.2006, p. 37 as amended). This directive was transposed into Polish legislation by the Water Law. The act of national law regulating the requirements for bathing water quality is the Regulation of the Minister of Health of 17 January 2019 on the supervision of water quality in a bathing water and a place occasionally used for bathing (Journal of Laws of 2019, item 255) The provisions relating to the sanitary conditions in the swimming pool have been adopted as an environmental objective.

In accordance with the Water Law, bathing water is understood as a separate and marked fragment of surface water designated by the municipal council, used by a large number of bathers, provided that no permanent bathing ban has been issued in relation to this bathing water; the bathing water is not: a swimming pool, swimming pool or spa, a closed water reservoir subject to treatment or use for

[64] Protected areas within the meaning of Article 16 (32) of the Water Law of 20 July 2017

therapeutic purposes, an artificial, closed water reservoir, separated from surface water and groundwater.

The commune council determines, by way of a resolution constituting an act of local law, annually by May 20, a list of bathing sites in the commune or in Polish maritime areas adjacent to the commune. The records of bathing sites and their updating are kept by the mayor, mayor or city president.

Within the area covered by the Forecast, river, lake as well as coastal and transitional water bodies intended for leisure purposes, including swimming were identified. The tables below show the data on these water bodies.

**Table 19 River, coastal and transitional uWB for leisure purposes, including bathing within the area covered by the Forecast**

| Item | uWB name | uSWB Code | River basin | Water Region |
|---|---|---|---|---|
| | | **Coastal SWB** | | |
| **1** | Polish coastal waters of the Gotland Basin | PLCW20001WB2 | Vistula | Lower Vistula |
| **2** | Hel Peninsula | PLCW20001WB1 | Vistula | Lower Vistula |
| **3** | Polish coastal waters of the Bornholm Basin | PLCW60001WB3 | the Odra | Lower Odra and the Western Przymorze |
| **4** | Coastal waters of the Gulf of Pomerania | PLCW60001WB4 | the Odra | Lower Odra and the Western Przymorze |
| | | **Transitional SWB** | | |
| **5** | Mouth of the Vistula River | PLTW20005WB7 | Vistula | Lower Vistula |
| **6** | Puck Lagoon | PLTW20002WB4 | Vistula | Lower Vistula |
| **7** | Inner Gulf of Gdańsk | PLTW20004WB6 | Vistula | Lower Vistula |
| **8** | Outer Puck Bay | PLTW20003WB5 | Vistula | Lower Vistula |
| **9** | Szczecin Lagoon | PLTW60001WB2 | the Odra | Lower Odra and the Western Przymorze |
| | | **Lake SWB** | | |
| **10** | Bachotek | PLLW20189 | Vistula | Lower Vistula |
| **11** | Bartężek | PLLW20100 | Vistula | Lower Vistula |
| **12** | Borzechowskie Wielkie | PLLW20695 | Vistula | Lower Vistula |
| **13** | Cekcyńskie Wielkie | PLLW20395 | Vistula | Lower Vistula |
| **14** | Charzykowskie | PLLW20290 | Vistula | Lower Vistula |
| **15** | Chełmżyńskie | PLLW20451 | Vistula | Lower Vistula |
| **16** | Dąbrowskie | PLLW20726 | Vistula | Lower Vistula |
| **17** | Dobrogoszcz | PLLW20649 | Vistula | Lower Vistula |
| **18** | Drwęckie | PLLW20081 | Vistula | Lower Vistula |

| Item | uWB name | uSWB Code | River basin | Water Region |
|---|---|---|---|---|
| **19** | Dymno | PLLW20265 | Vistula | Lower Vistula |
| **20** | Garczyno | PLLW20481 | Vistula | Lower Vistula |
| **21** | Jeleń | PLLW20991 | Vistula | Lower Vistula |
| **22** | Jeziorak | PLLW20116 | Vistula | Lower Vistula |
| **23** | Kamionkowskie | PLLW20242 | Vistula | Lower Vistula |
| **24** | Karsińskie | PLLW20310 | Vistula | Lower Vistula |
| **25** | Horse | PLLW20277 | Vistula | Lower Vistula |
| **26** | Lidzbarskie | PLLW20149 | Vistula | Lower Vistula |
| **27** | Lubowidzkie | PLLW21040 | Vistula | Lower Vistula |
| **28** | Narie | PLLW30352 | Vistula | Lower Vistula |
| **29** | Niskie Brodno | PLLW20197 | Vistula | Lower Vistula |
| **30** | Przywidzkie Wielkie | PLLW20679 | Vistula | Lower Vistula |
| **31** | Raduńskie Górne | PLLW20713 | Vistula | Lower Vistula |
| **32** | Rudnickie Wielkie | PLLW20562 | Vistula | Lower Vistula |
| **33** | Sępoleńskie | PLLW20417 | Vistula | Lower Vistula |
| **34** | Szczytno Wielkie | PLLW20268 | Vistula | Lower Vistula |
| **35** | Wdzydze Pn. | PLLW20500 | Vistula | Lower Vistula |
| **36** | Wielewskie | PLLW20508 | Vistula | Lower Vistula |
| **37** | Zbiczno | PLLW20188 | Vistula | Lower Vistula |
| **38** | Żarnowieckie | PLLW21049 | Vistula | Lower Vistula |
| **39** | Barlineckie | PLLW11025 | the Odra | Lower Odra and the Western Przymorze |
| **40** | Dąbie | PLLW90329 | the Odra | Lower Odra and the Western Przymorze |
| **41** | Dłużec | PLLW11014 | the Odra | Lower Odra and the Western Przymorze |
| **42** | Kluki | PLLW11061 | the Odra | Lower Odra and the Western Przymorze |
| **43** | Miedwie | PLLW11034 | the Odra | Lower Odra and the Western Przymorze |
| **44** | Morzycko | PLLW10983 | the Odra | Lower Odra and the Western Przymorze |
| **45** | Myśliborskie | PLLW10946 | the Odra | Lower Odra and the Western Przymorze |

| Item | uWB name | uSWB Code | River basin | Water Region |
|---|---|---|---|---|
| **46** | Pełcz | PLLW11081 | the Odra | Lower Odra and the Western Przymorze |
| **47** | Strzeszowskie | PLLW11008 | the Odra | Lower Odra and the Western Przymorze |
| | | **River and reservoir SWBs** | | |
| **48** | Biały Rów | PLRW200018524729 | Vistula | Lower Vistula |
| **49** | Brda from res. Mylof to res. Koronowo | PLRW200011292799 | Vistula | Lower Vistula |
| **50** | Brynica to Pissa | PLRW20001528743 | Vistula | Lower Vistula |
| **51** | Drwęca to Lake Drwęckie | PLRW2000102819 | Vistula | Lower Vistula |
| **52** | Kamionka from Lake Mochel to Estuary | PLRW200016292699 | Vistula | Lower Vistula |
| **53** | Trynka Canal | PLRW2000102956 | Vistula | Lower Vistula |
| **54** | Kotomierzyca | PLRW20001029295929 | Vistula | Lower Vistula |
| **55** | Radunia from Strzelenka to the Radun Canal | PLRW200011486879 | Vistula | Lower Vistula |
| **56** | Rudniczanka to Lake Rudnickie Wielkie | PLRW2000102952453 | Vistula | Lower Vistula |
| **57** | Ryszka | PLRW200010294719299 | Vistula | Lower Vistula |
| **58** | Słupia from Kamieniec to Otocznica | PLRW20001147297 | Vistula | Lower Vistula |
| **59** | Trynka | PLRW200010293889 | Vistula | Lower Vistula |
| **60** | Wda to Lake Wdzydze | PLRW2000202943799 | Vistula | Lower Vistula |
| **61** | Wda from Brzezianka to res. Żur | PLRW2000112947199 | Vistula | Lower Vistula |
| **62** | Wda from Gródek to estuary | PLRW20001129499 | Vistula | Lower Vistula |
| **63** | Wierzyca to Lake Zagnanie | PLRW200010298173 | Vistula | Lower Vistula |
| **64** | Dzierżęcinka | PLRW600009456149 | the Odra | Lower Odra and the Western Przymorze |
| **65** | Gunica from the sources to Rów Wołczkowski | PLRW60001519987 | the Odra | Lower Odra and the Western Przymorze |

| Item | uWB name | uSWB Code | River basin | Water Region |
|---|---|---|---|---|
| **66** | Cedynia Canal | PLRW600010191729 | the Odra | Lower Odra and the Western Przymorze |
| **67** | Kosa | PLRW600018191292 | the Odra | Lower Odra and the Western Przymorze |
| **68** | Niemica | PLRW6000233534699 | the Odra | Lower Odra and the Western Przymorze |
| **69** | Odra from Bukowa to estuary | PLRW6000121999 | the Odra | Lower Odra and the Western Przymorze |
| **70** | Rega from Rejowice to Molostowa | PLRW60001142799 | the Odra | Lower Odra and the Western Przymorze |
| **71** | Tywa from the Tywice tributary with the Tywice tributary to the mouth | PLRW600016193299 | the Odra | Lower Odra and the Western Przymorze |

*Source: Own study based on materials from II uRBMP*

**Areas sensitive to eutrophication caused by contaminants coming from domestic sources**

In accordance with the provisions of the Treaty of Accession of the Republic of Poland to the European Union, the entire area of Poland was considered to be sensitive to eutrophication caused by contaminants coming from domestic sources.

**Areas exposed to contamination by nitrogen compounds from agricultural sources**

The issue of water protection against pollution caused by nitrates of agricultural origin was regulated by Directive 91/676/EEC, the so-called Nitrates Directive. Areas particularly exposed to pollution by nitrogen compounds from agricultural sources (UN) are areas from which runoffs to surface water and/or groundwater considered as sensitive water (containing or likely to contain more than 50 mg/l of nitrates) occur, unless action is taken as described in the Directive and runoffs to eutrophic waters or such waters are assessed as likely to become eutrophic if action is taken. Currently, the provisions of this Directive are implemented in national law by the Act of 20 July 2017. - Water law by making Article 104 (1) mandatory the application, throughout the country, of the Programme of measures to reduce the pollution of waters by nitrates from agricultural sources and to prevent further pollution, the so-called Programme of measures. The Programme of measures adopted by the Regulation of the Council of Ministers of 5 June 2018 on the adoption of the "Programme of measures aimed at reducing the pollution of waters by nitrates from agricultural sources and preventing further pollution" (Journal of Laws 1339) was in force until 14 February 2020. From 15 February 2020, the new Regulation of the Council of Ministers of 12 February 2020 on the adoption of the "Programme of measures aimed at reducing water pollution by nitrates from agricultural sources and preventing further pollution" (Journal of Laws of 2018, item 243).

The action programme shall oblige all farmers who carry out agricultural production, including the special departments of agricultural production, and measures which store livestock manure or fertilisers used to manage it in accordance with the requirements set out therein.

**Areas intended for the conservation of habitats or species, as referred to in the Nature Conservation Act of 16 April 2004, for which the preservation or improvement of water condition is an important factor in their conservation**

Article 6.1 of the Water Framework Directive and Article 317 (4) (4) of the Water Law require protected areas intended for the protection of habitats or species to have a legal basis in nature protection legislation. The legal basis resulting in specific delimitation of the area can be attributed only to forms of nature protection. Therefore, the "protected areas" included in the list are the forms of nature protection listed in Article 6 (1) of the Nature Conservation Act of 16 April 2004 (i.e. Laws of 2020, item 1378)

The environmental objective, according to the study "Setting environmental objectives for water bodies with the development of a register of lists of protected areas", is to "achieve compliance with all standards and objectives" for each protected area. 'Standards and objectives' in this case means the conservation objectives set out in the act constituting a given form of nature protection, which may be specified in a planning act (conservation plan, conservation tasks or protection tasks plan) established for a given form of nature protection. In relation to Natura 2000 sites, 'standards and objectives' means, in accordance with the proposed European Commission document Links between the Water Framework Directive (WFD 2000/60/EC) and Nature Directives (Birds Directive 79/409/EEC and Habitats Directive 92/43/EEC); Frequently Asked Questions – such water conditions as are necessary to achieve the appropriate level of protection for protection objects.

Areas intended for the protection of habitats or species, as laid down in the Nature Conservation Act, for the protection of which the maintenance or improvement of water condition is an important protection factor include, in particular, the SWB specified in Annex 3 to the Forecast.

### 5.3.4 Assessment of water status and risk of non-achieving the environmental objectives

#### 5.3.4.1 Territorial sea, adjacent zone and exclusive economic zone

**Basic features of the Polish Baltic Sea Zone**

The information presented in this chapter was prepared on the basis of the "Update of the preliminary assessment of the status of marine waters environment" (adopted for submission to the European Commission by RM on 18.01.2019[65]). The update of the preliminary assessment contains information on the basic features and properties of the marine environment of the The basic characteristics and properties of the ROOM are described below.

**Salinity**

The analysis of the annual and seasonal distribution of water salinity was carried out for sub-bodies for which data collected under the PMŚ were available.

The salinity of water in the surface layer of the sea in 2016 in separate pom waters is presented in the figure below.

[65] Resolution No. 8 of the Council of Ministers of 18 January 2019 on the consent to the submission to the European Commission of the preliminary assessment of the state of the marine waters environment together with the draft update of the set of properties typical of the good state of the marine waters environment (M.P. of 2019, item 230).

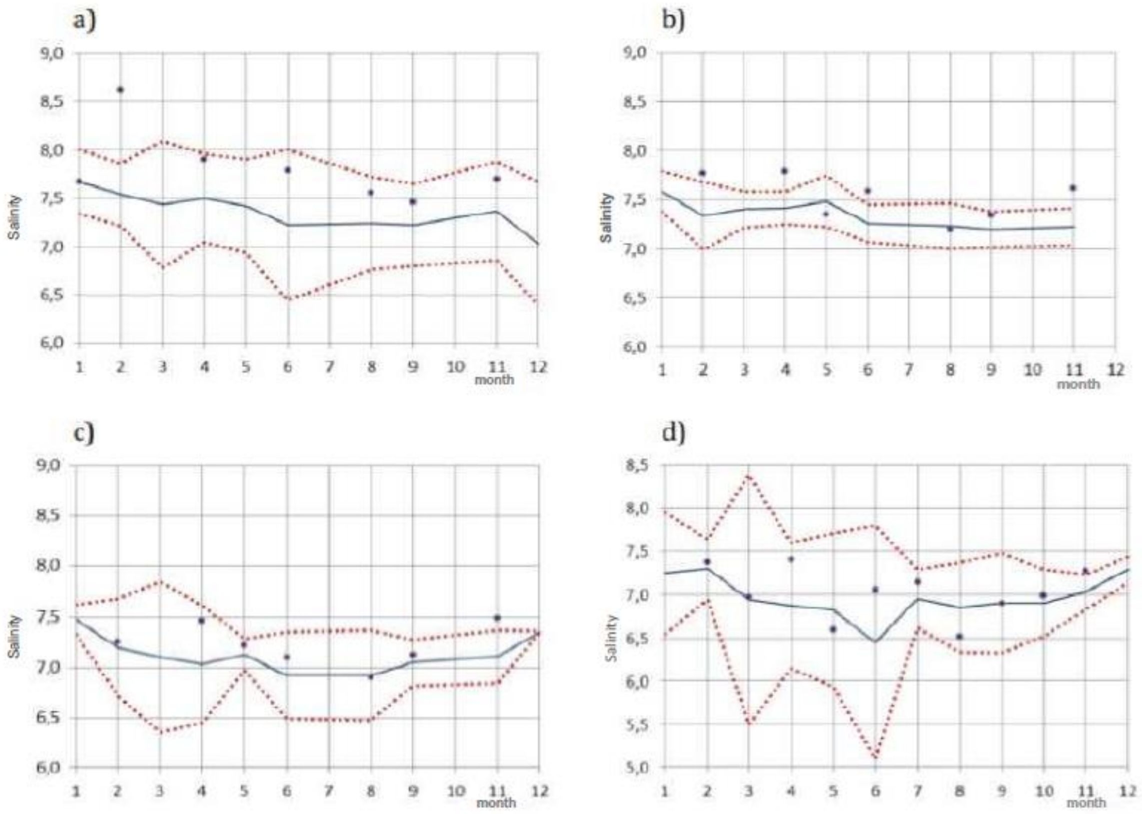



**Fig. 19 Salinity of water in the surface layer of the sea in 2016 in separate areas of the Polish maritime area: a) Bornholm Basin, b) Eastern Gotland Basin, c) Gdańsk Basin, d) Polish coastal waters of the Gdańsk Basin; continuous line – average 2006-2015; dashed line – average ± standard deviation 2006-2015; points – 2016 (note – different scaling of salinity values)**

*Source: Update of the preliminary assessment of the status of the marine environment*

The average salinity of water in the surface layer of the Bornholm Basin (graph a) above) throughout 2016, apart from February, was higher by about 0.5 than the average salinity from the period 2006-2015, with a decreasing trend until September. At the same time, in all months, the minimum salinity values were higher than the minimum values in the multi-year period. In August, the biggest difference was 3,936.

In the waters of the eastern Gotland Basin (graph b) above), part of the deviation was smaller without a clear direction of change, which was also marked by smaller differences in the minimum values for which the average value was 0.447.

In the Gdańsk Basin (chart c) above), salinity in spring and in late summer and autumn 2016 was higher than in the multi-year period. In the coastal waters of this basin (chart d) above), it fluctuated during the year, and significantly decreased in August.

The salinity of the seabed waters of the deep water zone of the southern Baltic Sea in the period 2011-2016 was shaped by a weak influx of saltwater from the North Sea. The largest increase in salinity (18,881) was found in the waters of the Bornholm Deep in April, followed by a gradual decrease until September. See**Błąd! Nie można odnaleźć źródła odwołania.**.

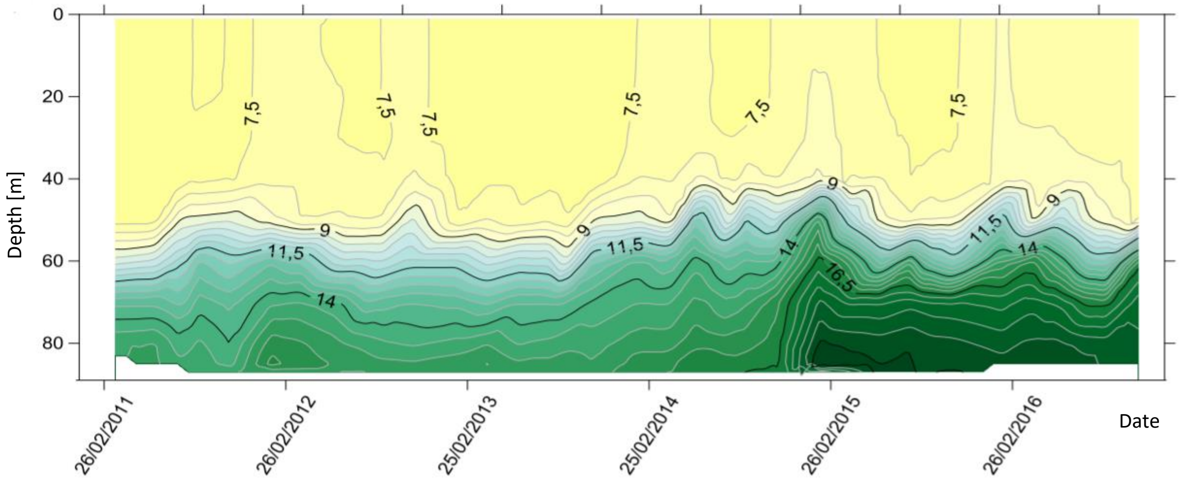



**Fig. 20 Salinity [78'PSS] depending on the depth in the waters of the Bornholm Basin - Bornholm Depths - in the multiannual period 2011-2016**

*Source: Update of the preliminary assessment of the status of marine environment*

In the seabed waters of the eastern Gotland Basin, salinity increased from the beginning of the year to May 2016, after which it remained at a similar level until August. The short-term decline was followed by a renewed increase in November. See**Błąd! Nie można odnaleźć źródła odwołania.**.

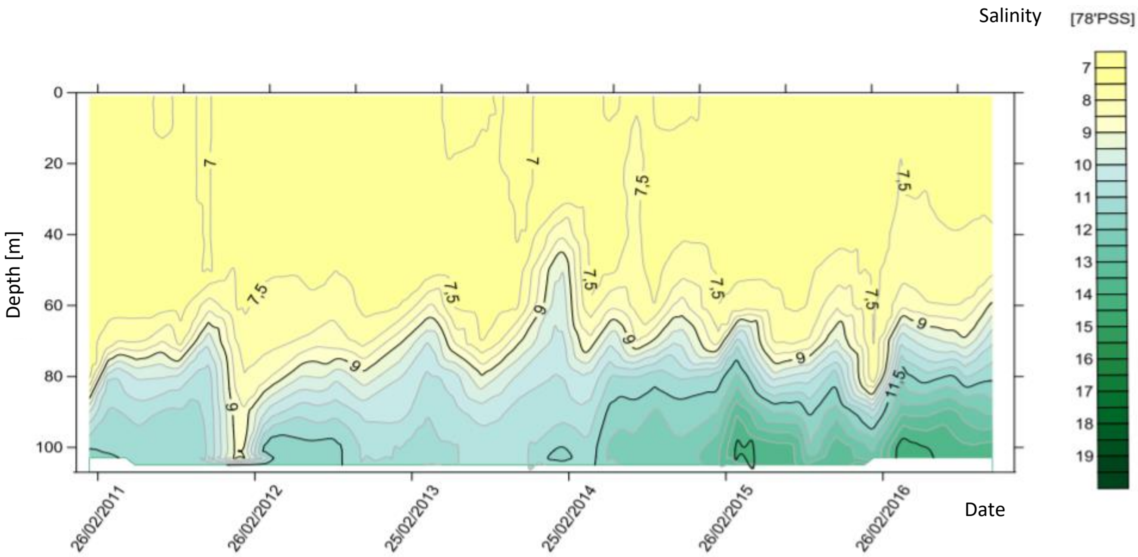



**Fig. 21 Salinity [78'PSS] depending on the depth in the waters of the eastern Gotland Basin in the multiannual period 2011-2016**

*Source: Update of the preliminary assessment of the status of marine environment*

In the Gdańsk Deep, the largest salinity (14,318) of the bottom waters in 2016 occurred at the beginning of April, after which it remained at a lower level until November (13,726). See**Błąd! Nie można odnaleźć źródła odwołania.**.

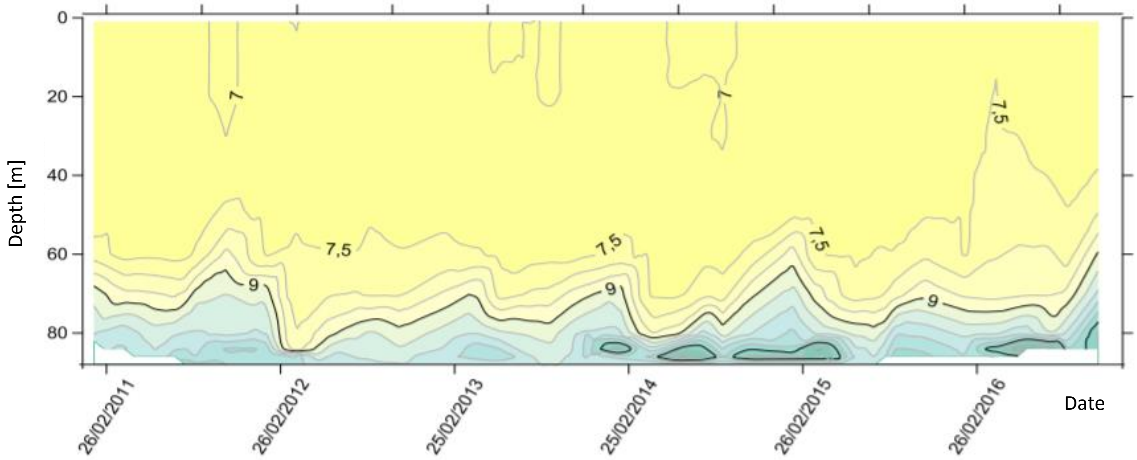



**Fig. 22 Salinity [78'PSS] depending on the depth in the waters of the Gulf of Gdańsk - Gdańsk Deep - in the multiannual period 2011-2016**

*Source: Update of the preliminary assessment of the status of marine environment*

### Seawater reaction

The measurement data used to analyse changes in the pH of seawater were collected in 2006-2016 during research trips carried out in the Polish Exclusive Economic Zone (EEZ) with a frequency of 6 times a year. The list of extreme and average pH values in separate pom waters is presented in the table below.

**Table 20 Summary of extreme and average pH values in separate pom areas**

| Water body | Minimum | | Maximum | | Average | |
|---|---|---|---|---|---|---|
| | 2015 | 2016 | 2015 | 2016 | 2015 | 2016 |
| **Gdansk basin** | 7.16 | 7.04 | 8.85 | 9.22 | 8.12 | 8.12 |
| **Eastern Gotland Basin** | 7.28 | 7.20 | 8.63 | 9.00 | 8.30 | 8.20 |
| **Bornholm basin** | 7.42 | 7.14 | 8.76 | 9.23 | 8.12 | 8.18 |

*Source: Update of the preliminary assessment of the status of marine environment*

The pH indicator is used to assess the scale of the problem of potential acidification of the waters of the global ocean, mainly due to increased carbon dioxide input from the atmosphere. Monitoring the pH of the marine environment is the basis for capturing the trends of temporal and spatial changes, resulting both from human activity (mainly the combustion of fossil fuels) as well as natural factors (geological, hydrodynamic, climatic/meteorological) and related possible changes in the functioning of marine ecosystems.

In the entire area of research and at the level of separated waters, there was a weak tendency for the growing reaction of sea water against the background of the last 10 years. The trend is illustrated by the graph below.

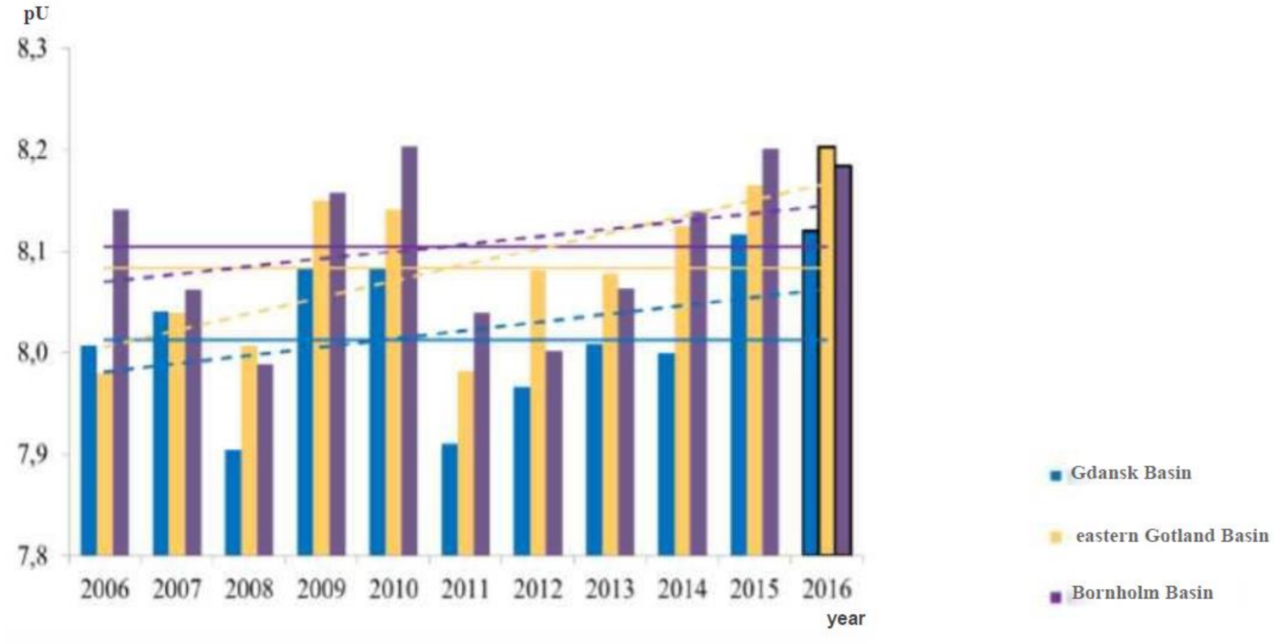



**Fig. 23** **Average annual pH values in the entire water column in 2006-2016 in separate pom areas; continuous line – average 2006–2015, dashed line – trend of changes (source of data PMŚ)**

*Source: Update of the preliminary assessment of the status of marine environment*

Similar temporal variability in pH was also observed in the sub-surface layer, which is a direct receptor of possible changes in the atmosphere.

**Marine currents**

Surface currents in the Baltic Sea are mainly generated by wind and modified by bottom topography and shore morphology. The modification of currents takes place mainly in the shallow-water coastal zone, where a homogeneous flow structure from the surface to the bottom is often observed. The highest current speeds were recorded for the area north of the Hel Peninsula, where the intensification of currents as a result of the shoreline system promotes the formation of upwelling and shoreline downwelling. Although it is the most dynamic fragment of Polish marine waters, the average vector velocity and flow stability is low there.

The general characteristics of the distribution of currents for the period 2006-2015 presented in the form of current roses determined for individual Baltic squares are shown in the figure below.

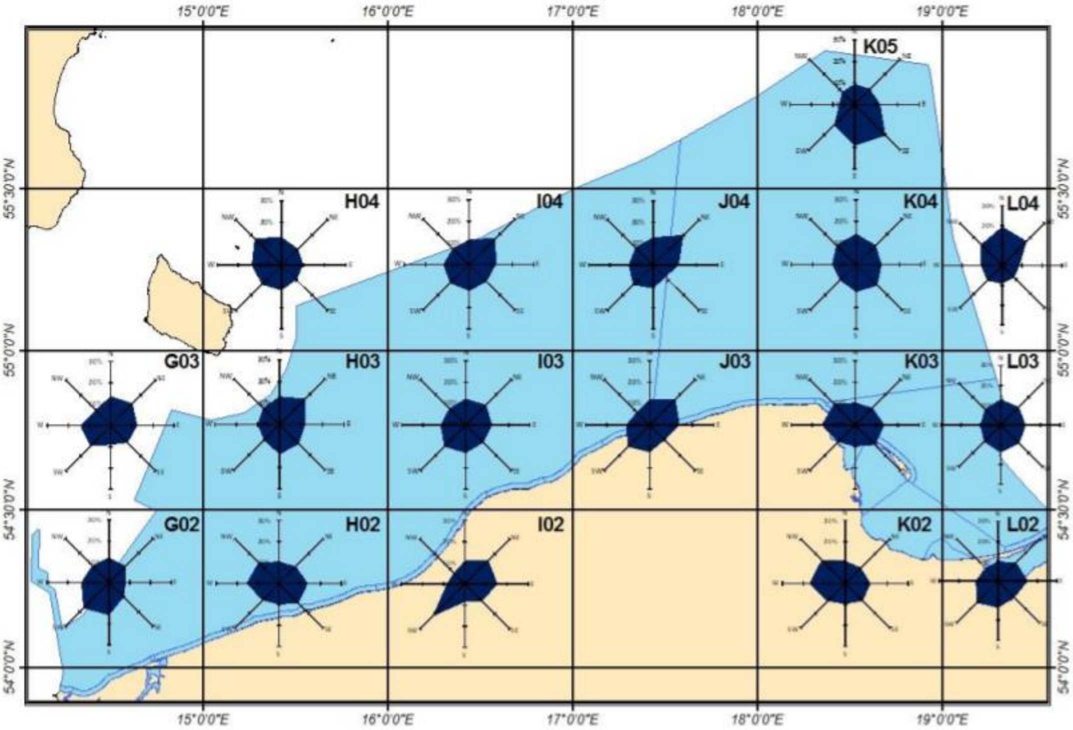



**Fig. 24 Roses of currents in squares in the subsurface layer 7.5-12.5 m based on measurements from 2006-2015**

*Source: Update of the preliminary assessment of the status of marine environment*

The directions of subsurface currents in the Polish coastal zone were located in a narrow range along the north-east-south-west axis. In the K02 square, in the coastal zone of the Gulf of Gdańsk, south-western and north-eastern shore currents were mostly recorded, while in the L02 square, in most cases, they were currents directed to the shore. In the Gulf of Pomerania, the northern direction and along the coastline prevailed.

**Water Replacement**

The high inflow of freshwater and the difficult and irregular inflow of seawater, the Baltic Sea is particularly prone to pollution and eutrophication.

The exchange of waters in the sub-bodies of water is subject to two different processes: the influx of waters in the bottom layer from irregular inflows of salt waters through the Kattegat from the North Sea and the constant flow of river waters affecting surface waters. Deep-water regeneration can only take place as a result of extreme inflows into the Baltic Sea. In the period from 2011 to 2015, one of the largest infusions into the Baltic Sea occurred (in 2014), as well as other, less significant, moderate and medium ones. In 2016, there were no very large infusions, only average in February and weak at the turn of November, December and December.

## Identification of the primary environmental objective for marine waters

A detailed identification of the environmental objectives for marine waters is included in the document "Draft Update of the set of environmental objectives for marine waters" commissioned by the KZGW. The draft set of environmental objectives was approved by the Regulation of the Minister of Infrastructure of 25 February 2021. (Journal of Laws 2021, item 569). MSFD requires achieving or maintaining good environmental status of the marine environment, including environmental objectives, for all characteristics by 2020. In turn, the Baltic Marine Environment Protection

Commission (HELCOM), through the development of the Baltic Sea Action Plan, assumed the achievement of the GES by 2021. The objectives are listed and described Table 7 in Chapter 2.2.

### Assessment of the state of marine waters on the basis of the "Preliminary assessment of the status of marine waters environment of the Polish Baltic Sea Zone"

The information contained in this chapter was prepared on the basis of the "Update of the preliminary assessment of the status of marine waters environment of the Polish Baltic Sea Zone". The update of the preliminary assessment includes the classification and assessment of the state of the entire marine environment of Polish maritime areas.

The current update of the assessment covers the period from 01.01.2011 to 31.12.2016.

The method for assessing the characteristics of the state of preparation for pom for this study was in many respects consistent with the method proposed in the second HELCOM holistic assessment and also referred to the technical guidance provided in the working version of the guide to Article 8 of the MSFD[66], which was developed in parallel to the work on the new Commission Decision (EU) laying down the criteria and methodological standards regarding good environmental status of marine waters and laying down specifications and harmonised methods for monitoring and evaluation, and repealing Decision 2010/477/EU[67].

With regard to the previous preliminary assessment of the status of marine waters environment of the Polish Baltic Sea Zone (GIOŚ 2014), the basic difference in the method of assessing the features is the "integrated assessment of biodiversity" referring at the same time to features 1, 4 and 6. In this way, the consistency of the assessment methodology in the Baltic Sea region was maintained in cooperation between Poland (Chief Inspector of Environment Protection) and the Helsinki Commission (HELCOM). The evaluation used data from the implementation of the State Environmental Monitoring Program in the period from 01.01.2011 to 31.12.2016.

Taking into account the provisions of Commission Decision (EU) 2017/848 of 17 May 2017 (laying down the criteria and methodological standards regarding good environmental status of marine waters and the specifications and uniform methods for monitoring and assessment, and repealing Decision 2010/477/EU), 5 ecosystem elements were assessed in the update of the initial assessment of marine waters:

- groups of bird species,
- group of marine mammal species,
- groups of fish species,
- benthic habitats,
- pelagic habitats

and ecosystems, including food chains.

The final result of the assessment of "biodiversity", as opposed to the preliminary environmental assessment (GIOŚ 2014), is not to present the assessment broken down by individual characteristics describing the state of the environment in the POM, but to indicate separate assessments for each

[66] Guidance for assessments under Article 8 of the Marine Strategy Framework Directive on Integration of assessment results, February 2017 (DG Environment, Document ref: R.2733)

Commission [67] Decision (EU) 2017/848 of 17 May 2017 laying down the criteria and methodological standards regarding good environmental status of marine waters and the specifications and uniform methods for monitoring and evaluation, and repealing Decision 2010/477/EU ecosystem element, without the need for further integration between these assessments and the establishment of a single value for the assessment of "biodiversity" at the highest level.

Conducting assessments for 5 ecosystem elements simultaneously meets the requirement to apply the characteristics for determining good environmental status set out in Annex I to Directive 2008/56/EC:

- D1 – biodiversity,
- D4 – food chains,
- D6 – integrity of the seabed.

Decision 2017/848 established the breakdown of the indicators to be included in the assessment of the status of the marine environment into two groups. Article 153 (1) (1) of the Water Law provides for all 11 features of good environmental status of marine waters. In accordance with Decision 2017/484, the features of pressure include: D2, D3, D5, D6, D7, D8, D9, D10 and D11, while the status features include: D1, D4 and D6 concerning ecosystem elements: mammals, fish, birds, pelagic habitats, benthic habitats (the convention of symbols has been maintained for the features and criteria following the English version of Directive 2008/56/EC, i.e. D for the feature, C for the criterion).

<u>Assessment area</u>

In accordance with Directive 2008/56/EC and Decision 2017/848 in the Baltic Sea, the areas of assessment according to the hierarchical division developed by Helcom (HELCOM Monitoring and Assessment Strategy (MAS) 2013, update of Annex 4 -2017) in the 4-stage scale have been separated:

1. no division: the entire Baltic Sea area is assessed,
2. subdivision into 17 sub-bodies within the Baltic Sea,
3. subdivision into 17 open-sea sub-bodies and 40 coastal waters,
4. division into 17 open sea sub-bodies and into bodies of transitional and coastal waters (water body according to the Water Framework Directive 2000/60/EC – WFD)

As part of the 'integrated biodiversity assessment', individual ecosystem elements (birds, marine mammals, fish, benthic and pelagic habitats) are assessed at different scales of the division of the Baltic Sea into sub-bodies designated by HELCOM MAS. The selection of the appropriate assessment areas shall be based on the need to characterise the status of the species, groups of species, habitats or ecosystems as closely as possible in relation to the smallest possible territorial unit. The division of pom into assessment areas used in the assessment of the status of marine mammals, benthic and pelagic habitats in the Polish Baltic zone is shown in the figure below.

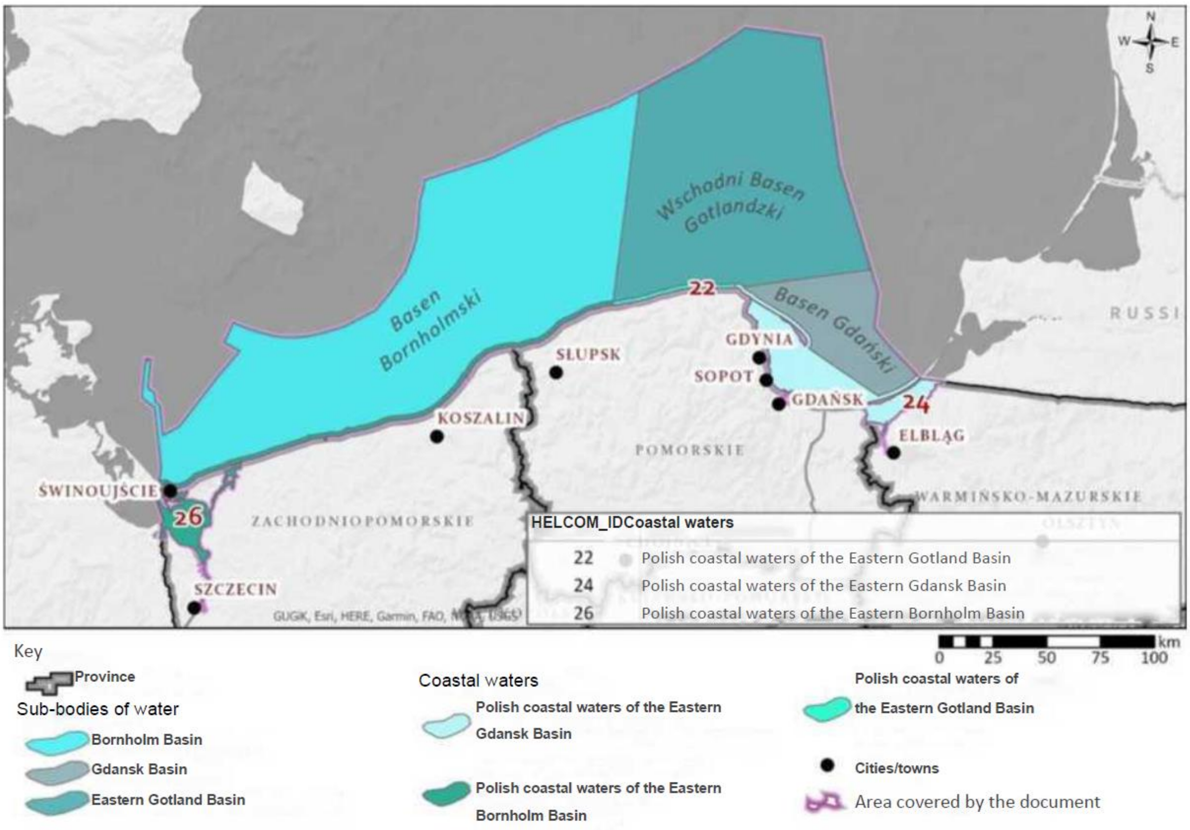



**Fig. 25 Division of pom into assessment areas.**

*Source: Own study based on HELCOM*

A summary of the assessments contained in the Update of the preliminary assessment of the status of the marine water environment for individual sub-bodies is presented in the table below. Assessments are presented separately for:

- ecosystem elements (D4, D1 and D6)
- pressure characteristics (D2, D3, D5, D6 (part), D7, D8, D9, D10, D11).

For each of the sub-bodies, the arithmetic mean of the sum of component ratings expressed in the scale: good (1) or bad (0) was determined. The summary does not apply to pom as a whole, as in some cases the same assessments are presented for sub-bodies.

For the sake of clarity of the summary, the results of the evaluation of fish (D3) and harmful substances (D9) carried out for the boundaries of the ICES zones are assigned in the cited evaluation to the relevant pools according to the HELCOM MASS distribution (2017 update).

<u>Assessments for ecosystem elements</u>

**Table 21 Environmental assessment for D4 – Trophic chains**

| **Trophic groups** | **Ecosystem elements** | **Indicator** | **Bornholm basin** | **Eastern Gotland Basin** | **Gdansk basin** |
|---|---|---|---|---|---|
| **Trophic group A** | Phytoplankton (primary producers) | Dia/Dino | GES | GES | GES |
| | Makrozoobentos | B | subGES | subGES | subGES |
| | Demersal fish | LFI | subGES | subGES | subGES |
| **Trophic group B** | Phytoplankton (primary producers) | Dia/Dino | GES | GES | GES |
| | Makrozoobentos | B | subGES | subGES | subGES |
| | Benthic Birds | Group of breeding birds | Group of breeding birds | Group of breeding birds | Group of breeding birds |
| | | Group of wintering birds | Group of wintering birds | Group of wintering birds | Group of wintering birds |
| **Group C, trophic** | Phytoplankton (primary producers) | Dia/Dino | GES | GES | GES |
| | Zooplankton (secondary producers) | MSTS | | | GES |
| | Plankton-eating fish | | | | |
| | Grey seals | Abundance and abundance trend | subGES | | |
| | | Occurence | | | |
| | | Reproduction status | | | |

Dia/Dino - Diatom/Dinoflagellate ratio
B - Multimetric macrosobenthos index
LFI - Large Fish Index
MSTS - MSTS Index (size structure and total zooplankton resources)

*Source: Update of the preliminary assessment of the status of marine environment*

**Table 22 Environmental status assessment for the status features: D1 Biodiversity - integrated assessment of biodiversity**

| **Water body** | **Ecosystem elements – feature D1** | | | | |
|---|---|---|---|---|---|
| | Mammals | Wintering Birds | Breeding Birds | Fish | Pelagic habitats |
| **POM** | | | | | |
| **Polish waters of the Bornholm Basin** | | | | | |
| **Polish waters of the eastern Gotland Basin** | | | | | |
| **Polish waters of the Gdańsk Basin** | | | | | |
| **Polish coastal waters of the Bornholm Basin** | | | | | |
| **Polish coastal waters of the eastern Gotland Basin** | | | | | |
| **Polish coastal waters of the Gdańsk Basin** | | | | | |

*Source: Update of the preliminary assessment of the status of marine environment*

**Table 23 Environmental status assessment for the status features: D6 Seabed Integrity – Integrated Biodiversity Assessment**

| **Water body** | **Ecosystem elements – feature D6** |
|---|---|
| | Benthic habitats |
| **POM** | |
| **Polish waters of the Bornholm Basin** | |
| **Polish waters of the eastern Gotland Basin** | |
| **Polish waters of the Gdańsk Basin** | |
| **Polish coastal waters of the Bornholm Basin** | |
| **Polish coastal waters of the eastern Gotland Basin** | |
| **Polish coastal waters of the Gdańsk Basin** | |

*Source: Update of the preliminary assessment of the status of marine environment*

The summary of the assessment in the quoted study indicates that the comparison for the features D1 and D6 shows that the state of ecosystem elements is the best in the waters of the eastern Gotland

Basin and its Polish coastal waters. Good assessment of birds and diverse pelagic and benthic habitats have a great impact on the result, but also poor assessment of mammals and fish, which is determined by poor assessment according to one of the criteria.

Assessments for Pressure Features

Assessment of the status of the environment for the features of pressure: D2, D3, D5, D6 (part), D7, D8, D9, D10, D11 are shown in the tables below.

**Table 24 Assessment of the status of the environment for the features of pressure: D2 alien species,**

| Water body | Pressure characteristics |
|---|---|
| | D2 alien species, |
| **POM** | |
| **Polish waters of the Bornholm Basin** | |
| **Polish waters of the eastern Gotland Basin** | |
| **Polish waters of the Gdańsk Basin** | |
| **Polish coastal waters of the Bornholm Basin** | |
| **Polish coastal waters of the eastern Gotland Basin** | |
| **Polish coastal waters of the Gdańsk Basin** | |

*Source: Update of the preliminary assessment of the status of marine environment*

**Table 25 Assessment of the status of the environment for the features of pressure: D3 Commercial fish and crustaceans**

| Water body | Pressure characteristics | |
|---|---|---|
| | D3 Commercial fish and crustaceans | |
| | sprat | herring |
| **POM** | | |
| **Polish waters of the Bornholm Basin** | | |
| **Polish waters of the eastern Gotland Basin** | | |
| **Polish waters of the Gdańsk Basin** | | |
| **Polish coastal waters of the Bornholm Basin** | | |
| **Polish coastal waters of the eastern Gotland Basin** | | |
| **Polish coastal waters of the Gdańsk Basin** | | |

*Source: Update of the preliminary assessment of the status of marine environment*

**Table 26 Assessment of the status of the environment for the features of pressure: D5 Eutrophication,**

| Water body | Pressure characteristics |
|---|---|
| | D5 Eutrophication, |
| **POM** | |

| | |
|---|---|
| **Polish waters of the Bornholm Basin** | |
| **Polish waters of the eastern Gotland Basin** | |
| **Polish waters of the Gdańsk Basin** | |
| **Polish coastal waters of the Bornholm Basin** | |
| **Polish coastal waters of the eastern Gotland Basin** | |
| **Polish coastal waters of the Gdańsk Basin** | |

*Source: Update of the preliminary assessment of the status of marine environment*

**Table 27 Assessment of the status of the environment for the features of pressure: D6 Seabed integrity**

| **Water body** | **Pressure characteristics** |
|---|---|
| | D6 Seabed integrity |
| **POM** | |
| **Polish waters of the Bornholm Basin** | |
| **Polish waters of the eastern Gotland Basin** | |
| **Polish waters of the Gdańsk Basin** | |
| **Polish coastal waters of the Bornholm Basin** | |
| **Polish coastal waters of the eastern Gotland Basin** | |
| **Polish coastal waters of the Gdańsk Basin** | |

*Source: Update of the preliminary assessment of the status of marine environment*

**Table 28 Assessment of the status of the environment for the features of pressure: D7 Permanent change in hydrographic conditions**

| **Water body** | **Pressure characteristics** |
|---|---|
| | D7 Permanent change in hydrographic conditions |
| **POM** | |
| **Polish waters of the Bornholm Basin** | |
| **Polish waters of the eastern Gotland Basin** | |
| **Polish waters of the Gdańsk Basin** | |
| **Polish coastal waters of the Bornholm Basin** | |
| **Polish coastal waters of the eastern Gotland Basin** | |
| **Polish coastal waters of the Gdańsk Basin** | |

*Source: Update of the preliminary assessment of the status of marine environment*

**Table 29 Assessment of the status of the environment for the features of pressure: D8 The concentration of the pollutants maintained at a level that does not give rise to pollution-specific effects**

| **Water body** | **Pressure characteristics** |
|---|---|
| | D8 The concentration of the pollutants maintained at a level |

| | |
|---|---|
| | that does not give rise to pollution-specific effects |
| **POM** | |
| **Polish waters of the Bornholm Basin** | |
| **Polish waters of the eastern Gotland Basin** | |
| **Polish waters of the Gdańsk Basin** | |
| **Polish coastal waters of the Bornholm Basin** | |
| **Polish coastal waters of the eastern Gotland Basin** | |
| **Polish coastal waters of the Gdańsk Basin** | |

*Source: Update of the preliminary assessment of the status of marine environment*

**Table 30 Environmental assessment for pressure characteristics:D9 The level of contaminants in fish and seafood intended for human consumption shall not exceed the levels laid down in Community legislation or other relevant standards.**

| **Water body** | **Pressure characteristics** |
|---|---|
| | D9 The level of contaminants in fish and seafood intended for human consumption shall not exceed the levels laid down in Community legislation or other relevant standards. |
| **POM** | |
| **Polish waters of the Bornholm Basin** | |
| **Polish waters of the eastern Gotland Basin** | |
| **Polish waters of the Gdańsk Basin** | |
| **Polish coastal waters of the Bornholm Basin** | |
| **Polish coastal waters of the eastern Gotland Basin** | |
| **Polish coastal waters of the Gdańsk Basin** | |

*Source: Update of the preliminary assessment of the status of marine environment*

**Table 31 Assessment of the status of the environment for the features of pressure: D10 Properties and quantities of marine litter do not cause harm to coastal and marine environments**

| **Water body** | **Pressure characteristics** |
|---|---|
| | D10 Properties and quantities of marine litter do not cause harm to coastal and marine environments |
| **POM** | |
| **Polish waters of the Bornholm Basin** | |

| | |
|---|---|
| **Polish waters of the eastern Gotland Basin** | |
| **Polish waters of the Gdańsk Basin** | |
| **Polish coastal waters of the Bornholm Basin** | |
| **Polish coastal waters of the eastern Gotland Basin** | |
| **Polish coastal waters of the Gdańsk Basin** | |

*Source: Update of the preliminary assessment of the status of marine environment*

**Table 32 Assessment of the status of the environment for the features of pressure: D11 Underwater noise**

| **Water body** | **Pressure characteristics** |
|---|---|
| | D11 Underwater noise |
| **POM** | |
| **Polish waters of the Bornholm Basin** | |
| **Polish waters of the eastern Gotland Basin** | |
| **Polish waters of the Gdańsk Basin** | |
| **Polish coastal waters of the Bornholm Basin** | |
| **Polish coastal waters of the eastern Gotland Basin** | |
| **Polish coastal waters of the Gdańsk Basin** | |

*Source: Update of the preliminary assessment of the status of marine environment*

In the summary of the assessment, the cited study indicates that in the assessment of the features of pressure, the worst results were achieved by alien species (D2), eutrophication (D5) and the sprat stock in all the sub-bodies considered. At the same time, the Polish coastal waters of the Bornholm and Gdańsk Basins have a poor assessment in relation to all the features of pressure. Some influence on such a result is caused by poor condition of hydromorphological elements, mainly due to strongly altered SWBs

### 5.3.5 Information on the risk of flooding

Flooding is one of the extreme hydrometeorological events. It can be either natural, when it is the result of, for example, sudden precipitation or thaws, or anthropogenic, related to, for example, the failure of the hydrotechnical infrastructure. In accordance with Article 16 (43) of the Water Law, flooding is defined as' the temporary coverage by water of an area which is not normally covered by water, in particular caused by flooding of natural watercourses, water bodies, canals and the sea, excluding the coverage by water of an area caused by flooding of sewerage systems'. This is a definition in accordance with the provisions of the Flood Directive.

Flood analyses should distinguish between two concepts – flood risk and risk. Flood risk is the probability of a flood of a given size, together with information on which areas will be flooded (i.e. flood zones). On the other hand, flood risk, according to the Flood Directive, is a combination of the probability of flooding (i.e. the risk) and the potential negative consequences for human health, the environment, cultural heritage and business activity related to flooding – in other words, the flood risk is the resultant of the probability of flooding and potential losses caused by it.

According to the EU classification,[68] we specify the following types of floods by source:

- River flooding – related to the rising of river waters, streams, mountain streams, canals, lakes, including floods resulting from the melting of snow,
- Precipitation – related to flooding with water directly from rainfall or snow melt, may include urban storm floods or excess water in extra-urban areas,
- Flooding from groundwater – associated with flooding of the ground as a result of raising the water level above the ground level, may include the rise of groundwater and groundwater resulting from high level of surface water,
- **Flooding from the sea** – related to the flooding of the area by sea waters, including estuarine sections of rivers and coastal lakes,
- Flood from water and sewage and hydrotechnical equipment – related to flooding of the area by water from water and sewage infrastructure or as a result of failure of this infrastructure, including:[69] floods from sewage systems and water supply and sewage treatment equipment, artificial navigation channels, stacking structures (e.g. water reservoirs and dams),
- Flooding from another source.

### Initial Flood Risk Assessment

In the framework of the review and update of the preliminary assessment of flood risks from the sea, including internal marine waters, a total of 1 104.5 km of coastal rivers and stretches of coastline have been identified as flood risk areas (ONNP), of which:

- 503.0 km are estuary (to the Baltic Sea) stretches of rivers,
- 499.5 km are sections of Przymorze,
- 102.0 km are floodplain sections,
- The Szczecin Lagoon and the Dziwna Strait, which do not have a chainage[70].

As part of the review and update of the preliminary flood risk assessment, the ranges of historical floods and probable floods were determined. Areas at risk from expected climate change have also been identified. On the basis of these analyses, areas exposed to the risk of flooding (ONNP) from the sea, including internal marine waters, were selected. The following figures show the products obtained under aWORP.

[68]Source: Updated methodology for Initial Flood Risk Assessment, June 2018

[69] in accordance with art. 16 p. 43 of the Water Law, flooding is defined as the *temporary covering by water of an area that is not normally covered with water, in particular caused by the flooding of water in natural watercourses, water reservoirs, canals and from the sea, <u>excluding the covering by water of the area caused by the flooding of water in sewage systems</u>*

[70]Source: Report on the review and update of the preliminary flood risk assessment, 2018

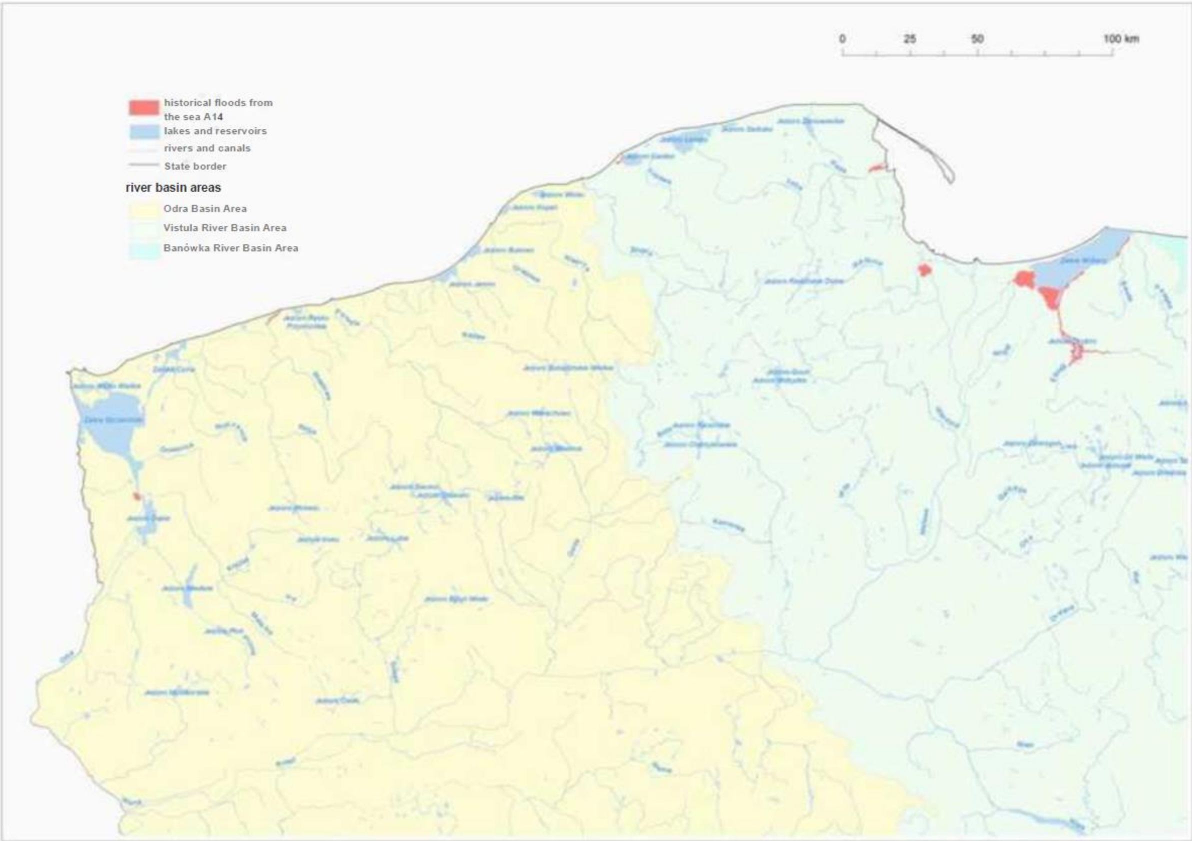



**Fig. 26 Historical floods from the sea side**

*Source: Report on the review and update of the preliminary flood risk assessment, 2018*

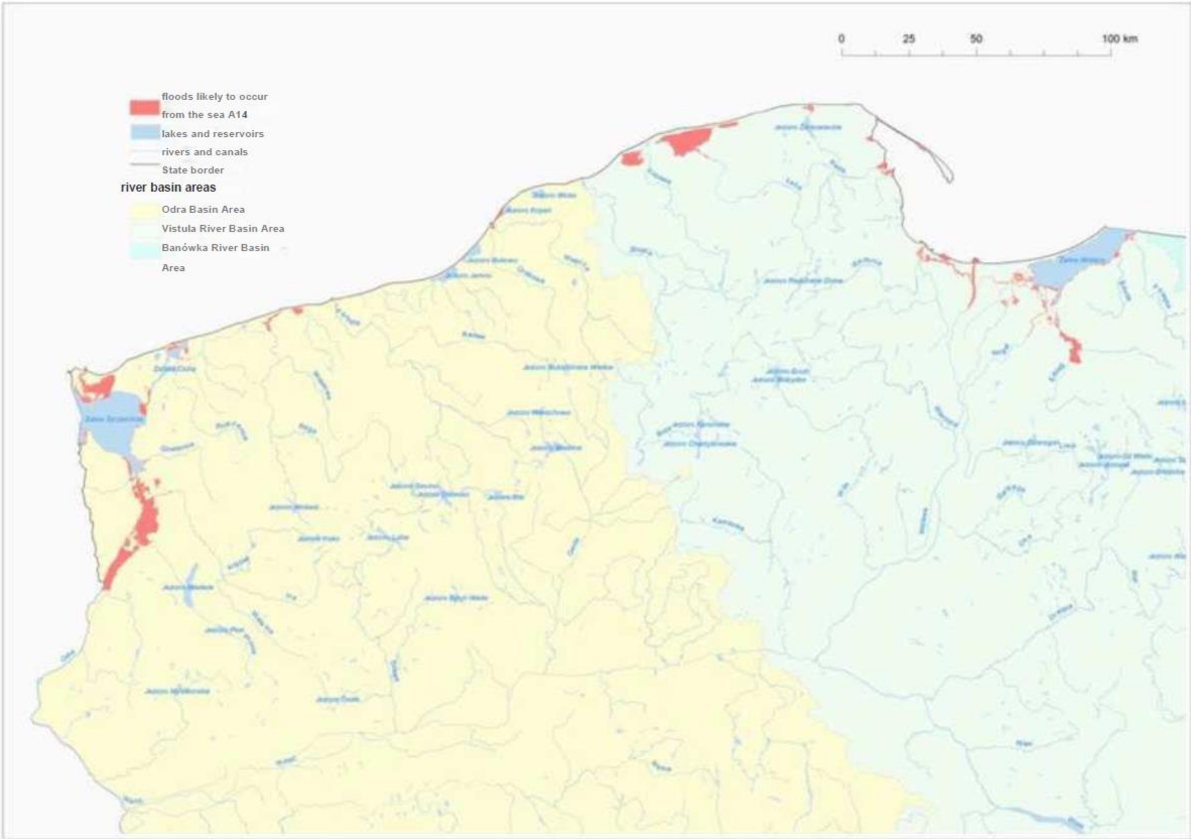



**Fig. 27 The reach of floods probable on the sea side (p=1%)**

*Source: Report on the review and update of the preliminary flood risk assessment, 2018*

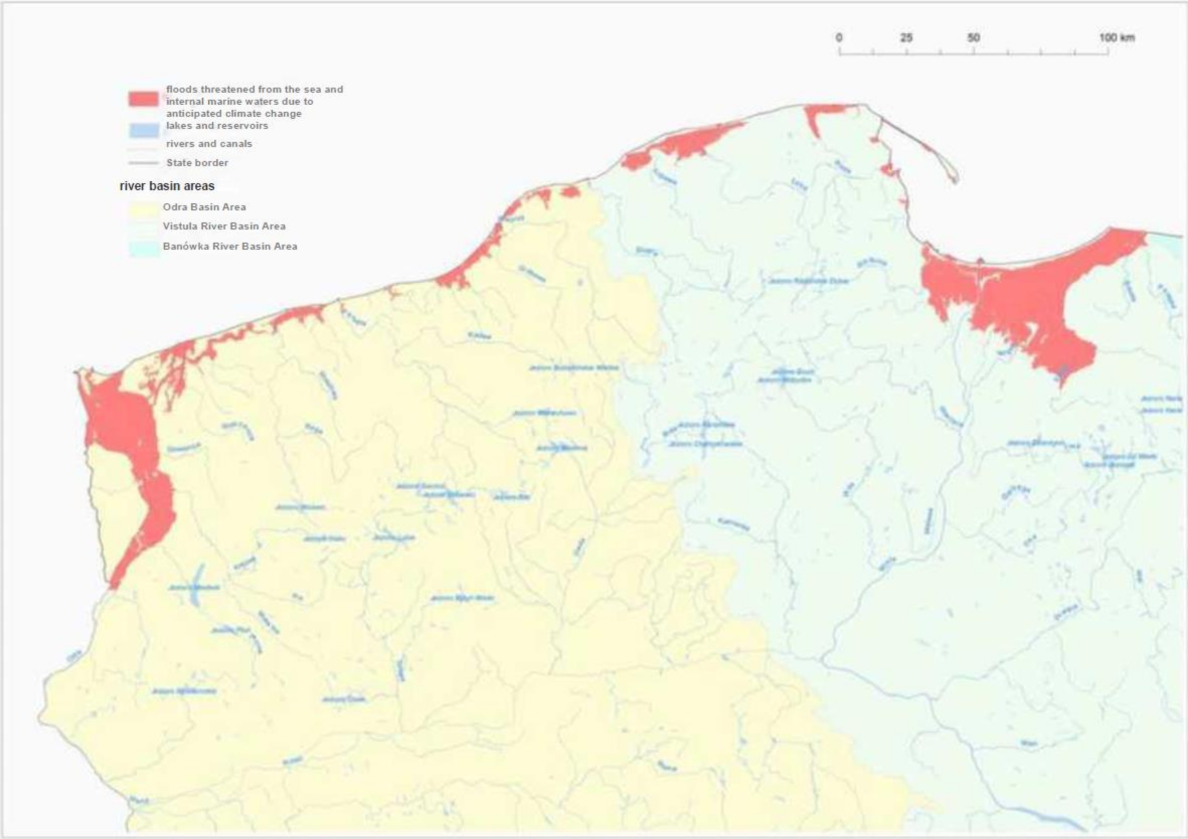



**Fig. 28 Identified areas at risk from the sea and internal marine waters as a result of foreseeable climate change**

*Source: Report on the review and update of the preliminary flood risk assessment, 2018*

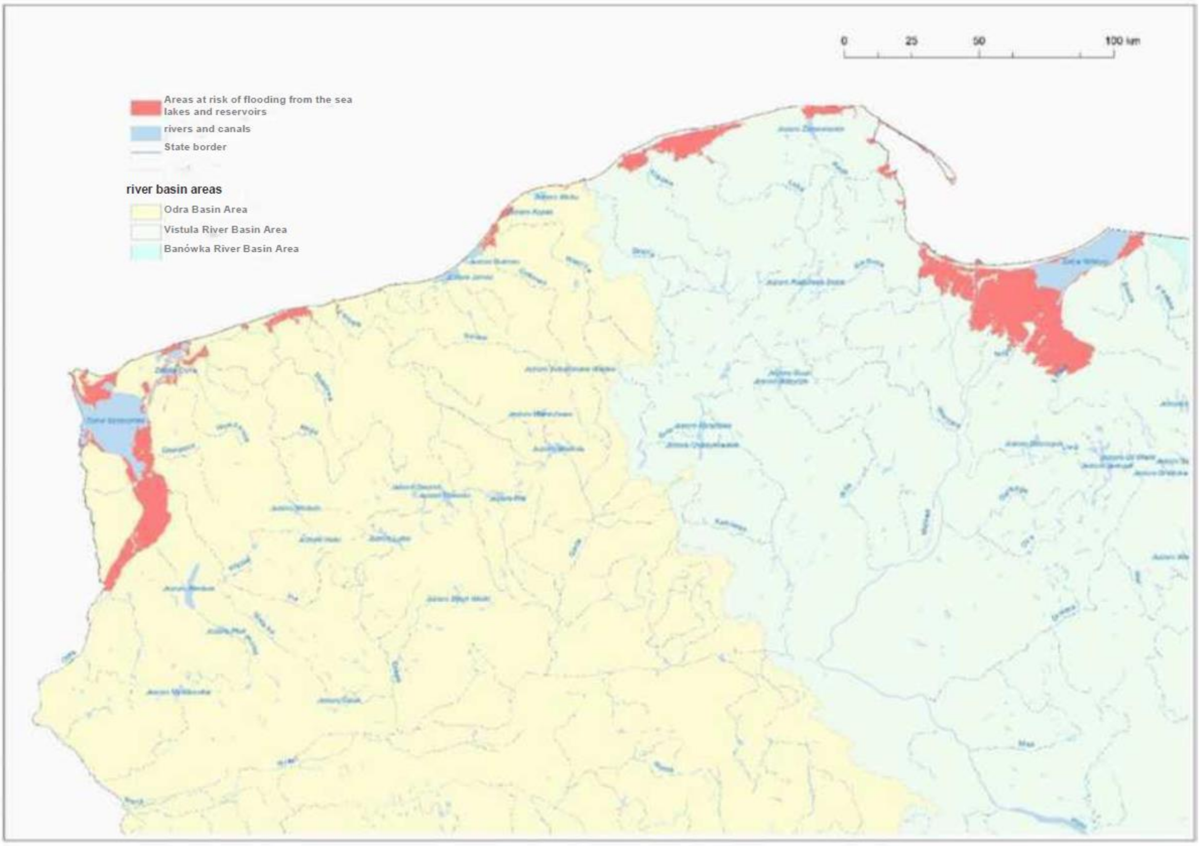



**Fig. 29 ONNP for floods from the sea, including internal marine waters**

*Source: Report on the review and update of the preliminary flood risk assessment, 2018*

## Flood hazard maps and flood risk maps

According to the provisions of the Flood Directive, ONNP selected as part of the preliminary flood risk assessment and its updating, are the basis for the development of flood hazard maps and flood risk maps for these areas. Under the aMRPiMZP, updates and new MZP and MRP were developed for floods on the sea side, together for approx. 1.2 thousand km of coastal areas and estuarine sections of rivers. For comparison, MZP and MRP from the sea side, including internal sea waters, in the first planning cycle (2010-2015), for 270.5 km of the Baltic Sea coast, 264 km of the Szczecin Lagoon and the Vistula Lagoon coast and 395.5 km of estuary sections of rivers, canals, straits under the influence of the sea, i.e. for sections with a total length of 930 km, were made for 270.5 km of the Baltic Sea coast.

Under the aMRPiMZP, floods from the sea were taken into account in two scenarios:

- natural erosion,
- destruction of flood embankments or storm protection embankments.

MZP and MRP show in detail the range zones of potential floods from the sea side with the mechanism of natural rising for the probability of p=1% (i.e. once per 100 years) and p=0.2% (i.e. once per 500 years). The variant of breaking the flood embankments or storm protection embankments is developed based on the probability p=1%. The indicated maps are available at: http://mapy.isok.gov.pl/.

## 5.4 Groundwater

Groundwater is the most vulnerable and the largest source of fresh water in Europe and is the main source of drinking water supply. Groundwater from land areas flows towards the sea in places where the hydraulic gradient is above sea level. This is, among others, the cause of pollution of marine waters by groundwater, which carries a load of pollutants from the land area. In maritime areas, groundwater research is part of the documentation of raw material deposits (e.g.: oil, natural gas) and in the case of research on the location of structures and offshore installations (e.g.: pipelines).

Groundwater bodies as defined in the Water Framework Directive, groundwater bodies (GWB) comprise those bodies of groundwater which are present in aquifers with porosity and permeability enabling significant abstraction in the supply of water to the population or flow of significant intensity for the formation of the desired surface water status and terrestrial ecosystems. GWBs have been determined taking into account the types and extent of aquifers, the relationship of groundwater with terrestrial ecosystems and surface water, the possibility of water intake, and in relation to the nature and extent of anthropogenic transformation of chemical and dynamics of groundwater. The aPWOM project area is directly bordered by 17 GWB areas, which are shown on the map **Błąd! Nie można odnaleźć źródła odwołania.** below. However, the report Table 33 contains detailed information on each of the GWB.

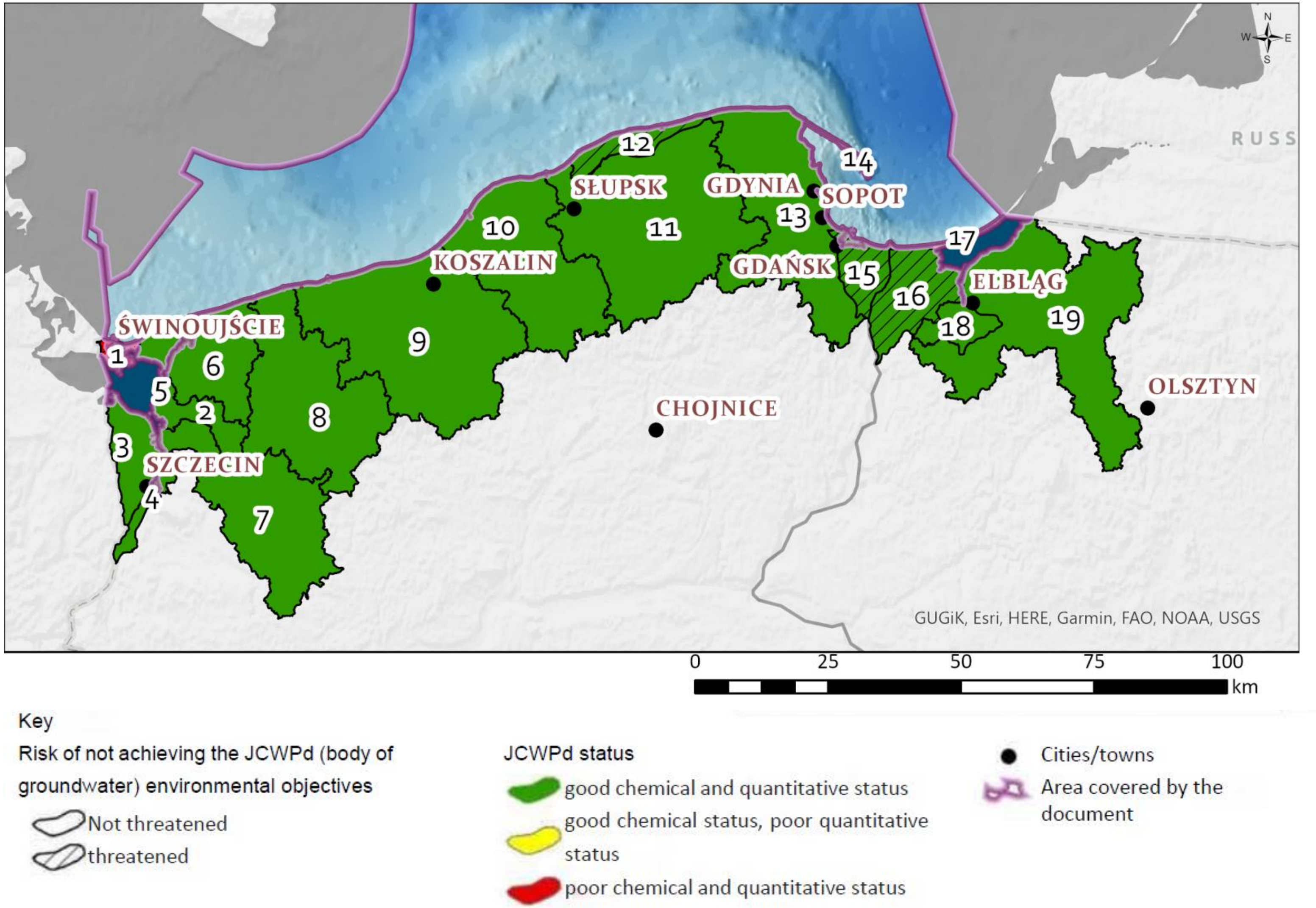



**Fig. 30 Assessment of the state of GWB with the risk of not achieving the environmental objectives (the numbers on the map correspond to the numbering of GWB in Table 32)**

*Source: Own study based on uRBMP.*

The list and basic information about GWB are presented in the table below.

**Table 33 Basic information about GWB bordering the Polish coast**

| GWB no. | Code of water body | Water Region | GPU Stratigraphy | Water type | Quantitative status | Quality status | Threat |
|---|---|---|---|---|---|---|---|
| **1** | PLGW60001 | Lower Odra and Western Pomerania | Q | Porous, | poor | poor | yes |
| **2** | PLGW60002 | Lower Odra and Western Pomerania | Q, Cr, PN | Porous, porous and cavity | good | good | NO |
| **3** | PLGW60003 | Lower Odra and Western Pomerania | Q, Cr | Porous, cavity | good | good | NO |
| **4** | PLGW60004 | Lower Odra and Western Pomerania | Q, Cr | Porous, cavity | good | good | NO |
| **5** | PLGW60005 | Lower Odra and Western Pomerania | Q | Porous | good | good | NO |
| **6** | PLGW60006 | Lower Odra and Western Pomerania | Q, Cr, J | Porous, porous and cavity | good | good | NO |
| **8** | PLGW60008 | Lower Odra and Western Pomerania | Q, Cr, J | Porous, karst and cavity, porous and cavity | good | good | NO |
| **9** | PLGW60009 | Lower Odra and Western Pomerania | Q, Cr, J | Porous, porous-cavity, | good | good | NO |
| **10** | PLGW600010 | Lower Odra and Western Pomerania | Q, Ng, Pg, Cr | Porous, cavity-karst, | good | good | NO |

| GWB no. | Code of water body | Water Region | GPU Stratigraphy | Water type | Quantitative status | Quality status | Threat |
|---|---|---|---|---|---|---|---|
| **11** | PLGW200011 | Lower Vistula | Q, M, Ol, Cr | Porous, porous-cavity, | good | good | NO |
| **12** | PLGW200012 | Lower Vistula | Q, Qm-M-Ol | Porous | good | good | yes |
| **13** | PLGW200013 | Lower Vistula | Q, M, Ol, Cr | Porous | good | good | NO |
| **14** | PLGW200014 | Lower Vistula | Q pl-h, Q-K, | Porous | good | good | yes |
| **15** | PLGW200015 | Lower Vistula | Q pl-h, M, Ol, Cr | Porous, porous-cavity, | good | good | yes |
| **16** | PLGW200016 | Lower Vistula | Q pl-h, Q(pl-Ng-Pg-K), Cr | Porous, porous-cavity, cavity | good | good | yes |
| **17** | PLGW200017 | Lower Vistula | Q pl-h | Porous | good | poor | yes |
| **18** | PLGW200018 | Lower Vistula | Q pl-h, Q-Pg-Cr | Porous, porous and cavity | good | good | NO |
| **19** | PLGW200019 | Lower Vistula | Q, Ng, Pg | Porous | good | good | NO |

*Source: Own development on the basis of uRBMP and GWB information sheets*

GPU - Main Utility Level, Q – Quaternary, Ng – Neogene, Pg – Paleogene,Cr – Cretaceous, J – Jurassic, M – Miocene, Ol – Oligocene; Ol-M-Qm: Oligocene-Miocene-Early Pleistocene (intermoraine)

**Main Groundwater Reservoirs (GZWP)**

The main bodies of groundwater are water-rich geological structures, which are or may be in the future a strategic resource of groundwater for the supply of the population and basic branches of the economy, requiring high quality water. In accordance with the contractual criteria of separation, due to the high quality of water, wealth and potential productivity, GZWP constitute the most valuable fragments of hydrostructural units and aquifer systems, requiring special protection of the chemical and quantitative status of groundwater and control of resource management, while maintaining priority for collective water supply for consumption and meeting the necessary economic needs. In close proximity to the coast there are several main bodies of groundwater, these are:

- 102 Wolin Island – GZWP with an area of 112.7 km$^2$, located on the border of the Zachodniopomorskie province in the direct catchment area of the Baltic Sea.
- 110 Pradolina Kaszuba and the Reda River – GZWP with an area of 124.3 km. In terms of hydrography, it belongs to the Redy and Zagórska Struga catchment areas. It was designated in the aquifer structures of the Redy-Łeby Valley within the quaternary aquifer.

- GZWP No. 111 Subniecka Gdańska - GZWP with an area of 1864 $km^2$ is located in the northern part of the Pomeranian province within several different morphological units. In the area of the Kaszubskie Lake District, the area of the area rises to 260 m a.s.l., in the coastal zone it lowers to sea level, while in Żuławy Wiślane it includes depressed areas.

The following figure shows the location of the GZWP.

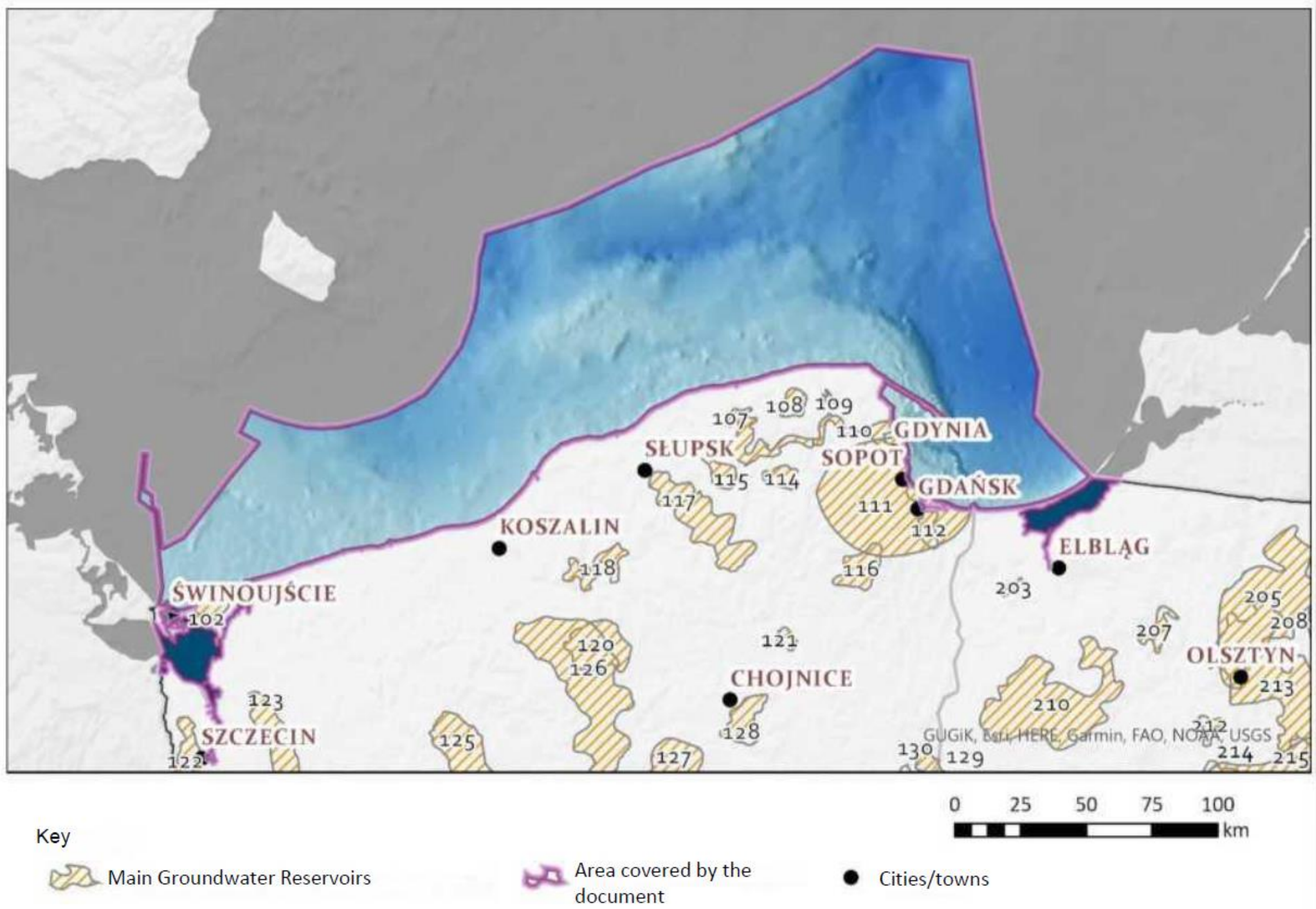



**Fig. 31 GZWP location**

*Source: Own elaboration based on data from PIG.*

The marine coastal zone is the boundary between two hydrochemical environments. On the sea side there are saltwater with bottom sediments, while on the land side there are fresh groundwater that may occur in the aquifer of the coastal zone. The sea coast area is the contact zone of these two different environments. In natural conditions, undisturbed, there is a balance between these environments. On the other hand, due to human interference, i.e. excessive intake of groundwater, conducting drainage works or excessive sealing of the area, the state of equilibrium is disturbed. The consequence of such a state may be the movement of salt water from under the seabed towards the water intake, which may lead to salinity of water from the intake points (wells). This phenomenon was called the ingression of marine waters.

## 5.5 Air and climate

### 5.5.1 Climate in the aPOWM area

#### 5.5.1.1 Air temperature

The analysis of the annual distribution of water temperature in the years 2009 – 2018 was carried out on the basis of data collected as part of the State Environmental Monitoring (PMŚ). Monitoring under the EMP is carried out by the WIOŚ (in transitional and coastal waters) and IMGW-PIB (in open waters). The following table presents data for sub-bodies that are part of the study. The temperatures are presented for the layer from the water surface to the bottom.

**Table 34 Water temperature in the surface layer of the sea in 2019**

| Indicator | Sub-bodies | | | |
|---|---|---|---|---|
| | Gdansk basin | Coastal waters of the Gdańsk basin | Bornholm basin | Eastern Gotland Basin |
| **Range Average water temperature** | 3.8–20.3°C | 3.7–20.1°C | 3.2–20.1°C | 3.2–19.8°C |
| **Maximum value of temperature** | 22.8°C | 21.9°C | 22.3°C | 22.6°C |
| **Minimum temperature value** | 3.4°C | 3.7°C | 1.8°C | 2.0°C |

*Source: Data developed on the basis of the Assessment of the state of the environment of Polish marine areas in the Baltic Sea on the basis of monitoring data from 2019 against the background of the decade 2009-2018*

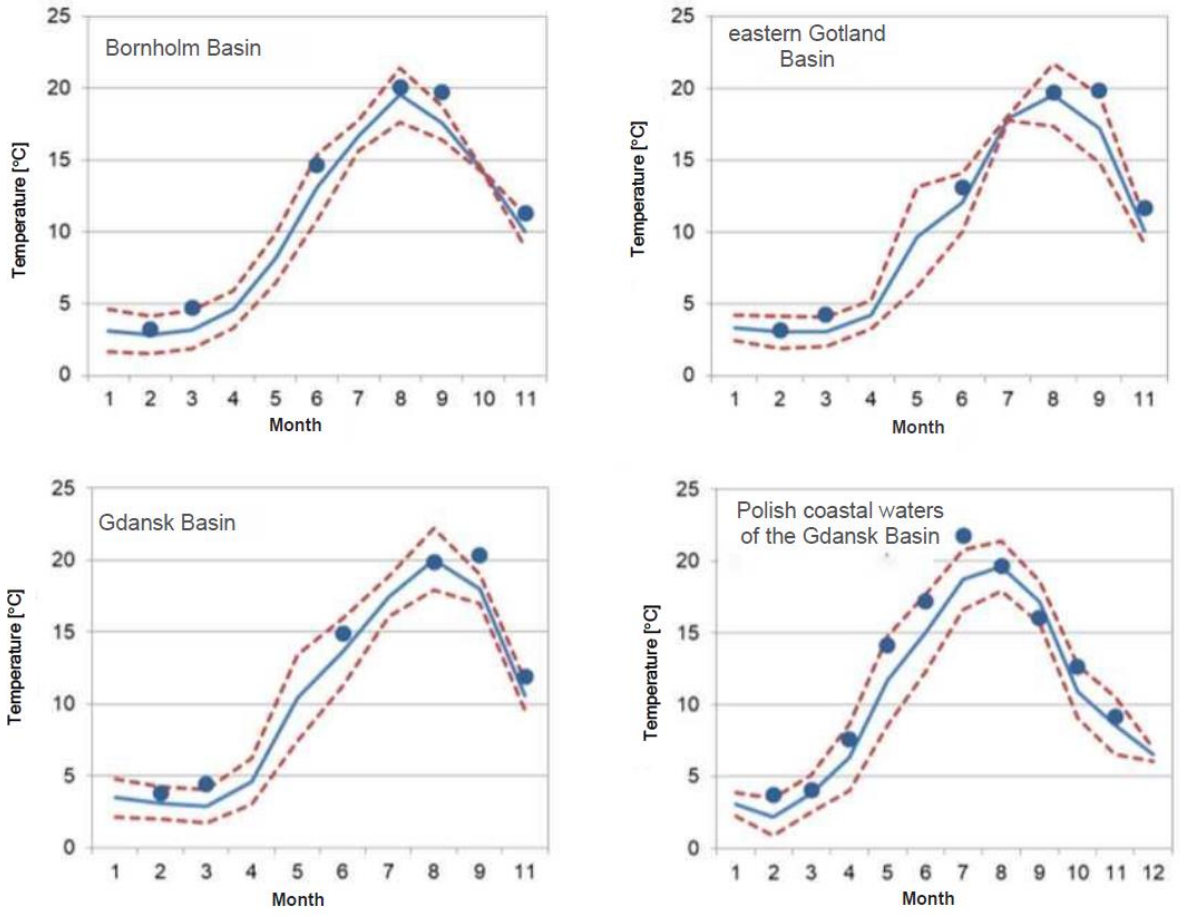



**Fig. 32 Water temperature in the surface layer of the sea in 2019 in separate areas of Polish maritime areas: Bornholm Basin, Eastern Gotland Basin, Gdańsk Basin, Polish coastal waters of the Gdańsk Basin (the graph shows data for the months for which the statistics could be calculated); continuous line – average 2009-2018; dashed lines - average ± standard deviation 2009-2018 points – monthly average in 2019**

*Source: Update of the preliminary assessment of the status of marine waters, Warsaw 2018*

The average water temperatures in 2019 in the surface layer (0-10 m) in deep water pools remained in a similar range of 3.2-20.3°C. The average maximum temperature in the coastal waters of the Gdańsk Basin was 19.7°C, while the lowest was 3.7°C. For all areas, the lowest values occurred in February, while the highest values occurred in August. The water temperature presented in the averaged linear approach (from the surface of the water to the bottom) shows a dependence until the season. In the winter months, it is lower in the summer months and higher. This is, of course, related to air temperatures and water mixing zones.

The spatial characteristics of changes in the Sea Surface Temperature (SST) in the years 2011-2016 were presented on the basis of satellite maps supplemented in the absence of data with the results of the PM3D model[71]. Such maps are saved in the SatBaltic System four times a day, on the basis of current satellite images. In the absence of satellite data due to cloud cover, the algorithm of combining

[71] Kowalewski M., Kowalewska-Kalkowska H., 2017, Sensitivity of the Baltic Sea level prediction to spatial model resolution, Journal of Marine Systems, 173, 101–113, http://dx.doi.org/10.1016/j.jmarsys.2017.05.001

previous satellite data and the hydrodynamic model is used[72]. The PM3D model continuously assimilates satellite-observed SST, which results in a significant reduction of errors.

The highest average temperature in the years 2011-2016 was recorded in the Szczecin and Vistula Lagoons, as well as in the Gulfs of Gdańsk and Pomerania. In these areas, there was also a higher variability expressed by higher values of standard deviation. A slightly lower average temperature than the open waters recorded in the coastal zone of the coast. On the other hand, the volatility was greater in the coastal zone. The exception was the area of occurrence of Hel upwelling, which was characterized by a lower average annual temperature and a lower standard deviation. This is due to the fact that in the summer upwelling is much colder than the surrounding waters, with a temperature close to the annual average. In winter, however, it is slightly warmer, which in total reduces the average annual temperature and reduces deviations from this average[73].

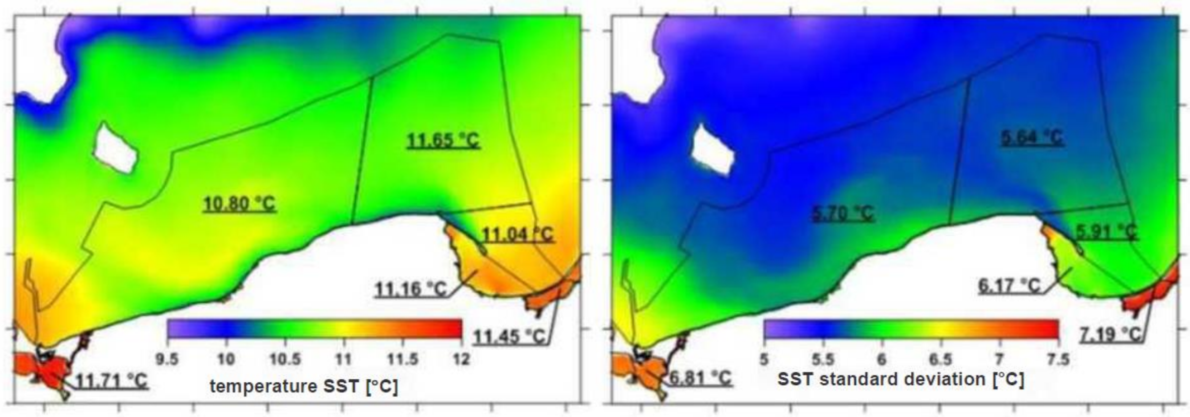



**Fig. 33 Distribution of mean sea surface temperature (SST) and its standard deviation based on data from the SatBaltic System for 2011-2016 and average values and standard deviations for individual waters**

*Source: Update of the preliminary assessment of the status of marine waters, Warsaw 2018*

The spatial distribution of the average surface temperature for the months from June to September was similar to the average annual one at higher values by approx. 6 –7 °C. However, the spatial diversity of the standard deviation differed significantly. The smallest values indicating low variability were recorded in the Gulf of Pomerania. Higher temperature variability was recorded in the Vistula Lagoon and Szczecin, in the Gulf of Puck and in the Hel upwelling area.[74]

[72] Konik M., Kowalewski M., Bradtke K., Darecki M. 2018. The operational method of filling information gaps in satellite imagery using numerical models
[73] Update of the preliminary assessment of the state of the marine waters, Warsaw 2018
[74] Update of the preliminary assessment of the status of marine waters environment, Warsaw 2018

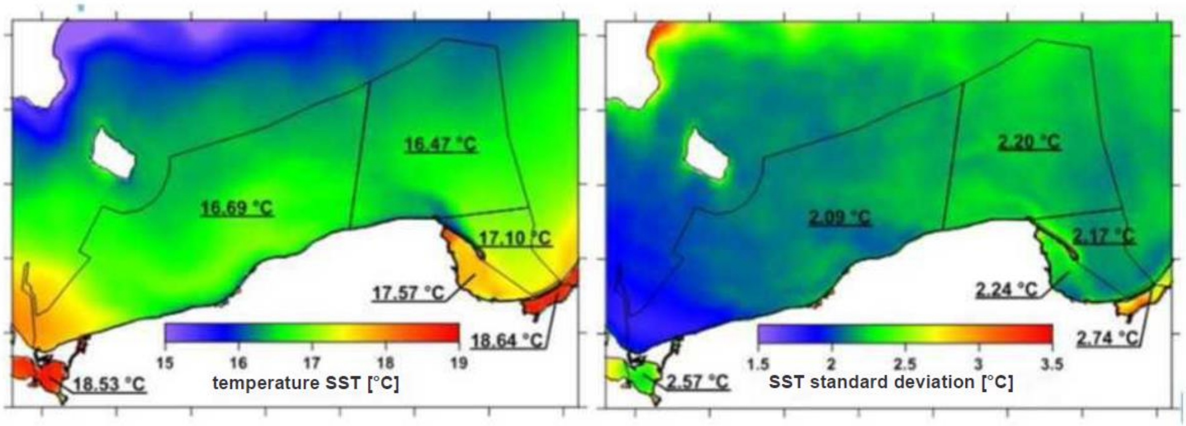



**Fig. 34 Distribution of mean sea surface temperature (SST) in summer months (VI-IX) and its standard deviation on the basis of data from the SatBaltic System for 2011-2016 and average values and standard deviations for individual waters**

*Source: Update of the preliminary assessment of the status of marine waters, Warsaw 2018*

### 5.5.1.2 Sea level

The hydrodynamic processes occurring within the southern Baltic Sea are modified in the shallow water and coastal zones, both by the bottom sculpture and the shoreline. Also, the degree of threat to the shore itself in situations of increasingly intense storms affects the degree of security of the areas in the hinterland. In transitional and coastal waters, changes in sea level, waves and currents in the coastal zone affect both the transport of matter and hydromorphological conditions.

Research on the changes in the level of the Baltic Sea in the area of the Polish coast indicates increasing trends[75]. In the 50 years, covering the second half of the 20th century, there was an increase in sea level, averaging from 7 to 14 cm from the west coast to the east coast[76].

Many factors are responsible for the rise in sea level, including: the thermal expansion of water, changes in the inflow of waters from land and glaciers, the balance of precipitation, changes in density and salinity of water. An important factor reflected in the rise in the level of the Baltic Sea is also the observed increase in the intensity of air mass flow from the west, which directly causes increased transport of water masses from the Atlantic Ocean through the Danish Straits[77]. This results in an increase in mean sea level and an increase in extreme values.

The characteristics of sea level changes were developed on the basis of measurement data from the period 2011-2016, collected within the framework of the state hydrological and meteorological service IMGW-PIB.

[75] Wróblewski A., 1993, Analysis and forecast of long-term sea along the Polish Baltic Sea coast. P. I.Annual sea level Maxima, Oceanology, 33, 65-85

[76] Miętus M., 1994, Vector of geostrophic wind in the Baltic Sea region as an index of local circulation and its relationship to hydro-meteorological characteristics along the Polish coast, In: R. Heion (ed.), Proceedings of the European Workshop on Climate Variations, Majvik, Finland, 15-18 May 1994. SILMU, 8-23

[77] Miętus M., Filipiak J., Owczarek M., 2004, Climate of the Southern Baltic Coast. The current state and perspectives of changes, in: J. Cyberski (ed.), The Environment of the Polish Southern Baltic Zone – present condition and anticipated changes in the eve of European integration. GTN, 11-44

In the discussed multi-year period, the eastern part of the Polish coast (the Gulf of Gdańsk – a station in Gdańsk in the Northern Port and Władysławowo) was characterized by the highest frequency of occurrence of warning states on a yearly basis. Almost 3 times lower frequency of occurrence of warning states was recorded in the western part of the coast (Świnoujście, Kołobrzeg stations). Comparing the frequency of alarm states in the multiannual period 2011-2016 on a yearly basis in individual coastal regions, also on the eastern coast, alarm states occurred more often (about 2 times) compared to the western coast.

**Table 35Frequency (%) of occurrence of sea levels reaching or exceeding the warning and alarm status (cm) at Polish coast stations in the multiannual period 2011-2016**

| Stations / States | Świnoujście | Ustka | Leba | Hel | Gdańsk Port Północny |
|---|---|---|---|---|---|
| warning | 0.80 | 0.61 | 0.53 | 2.37 | 3.06 |
| alarms | 0.27 | 0.07 | 0.07 | 0.52 | 0.65 |

*Source: Update of the preliminary assessment of the status of marine waters, Warsaw 2018*

In particular months, the most frequent occurrence of alert states falls on the winter months: December and January, this is reported throughout the coast. A typical period when there are storms and related high levels, as well as alert and warning states, is autumn and winter. Summer storms, which are rare, caused the occurrence of warning states in the eastern part of the coast (the station in Gdańsk-North Port and Władysławowo) in the summer (July, August). In May and June, there were no warning states on the entire coast. In the months from March to September of the 2011-2016 multi-year period, no warning states were recorded on the entire coast.

The least frequent, both warning and alarm states were recorded within the Polish coastal waters of the eastern Bornholm Basin (from Kołobrzeg to Ustka). The most common occurrence of alarm states is in the winter months: January and December, this is reported throughout the coast.

**Table 36 Frequency (%) of occurrence of sea levels reaching or exceeding the warning state (cm) in particular months, at stations of the Polish coast, 2011-2016**

| Station | Warning state | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Świnoujście Western Bornholm Basin** | 560 | 2.89 | 0.27 | 0.45 | 0.3 | | | | | 0.12 | 1.88 | 0.99 | 2.73 |
| **Western Kołobrzeg Bornholm Basin** | 570 | 3.02 | 0.91 | 0.09 | 0.05 | | | | | | 0.2 | 0.49 | 2.53 |
| **Ustka Eastern Bornholm Basin** | 570 | 2.64 | 0.69 | | 0.02 | | | | | | 0.16 | 0.44 | 2.35 |
| **Władysławowo -Eastern Gotland Basin** | 550 | 9.45 | 0.93 | 0.11 | 0.21 | | | 0.04 | 0.07 | 0.9 | 3.05 | 2.45 | 10.87 |
| **Gdańsk - Northern Port Gdańsk Basin** | 550 | 11.36 | 1.5 | 0.25 | 0.37 | | | 0.09 | 0.27 | 1.94 | 4.14 | 3.15 | 13.26 |

*Source: Update of the preliminary assessment of the status of marine waters, Warsaw 2018*

**Table 37 Frequency (%) of occurrence of sea levels reaching or exceeding the alarm state (cm) in particular months, at stations of the Polish coast, 2011-2016**

| Station | Alarm state | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Świnoujście Western Bornholm Basin | 580 | 1.21 | 0.51 | 0.45 | 0.3 | | | | | 0.12 | 1.88 | 0.99 | 2.73 |
| Western Kołobrzeg Bornholm Basin | 610 | 0.56 | 0.91 | 0.09 | 0.05 | | | | | | 0.2 | 0.49 | 2.53 |
| Ustka Eastern Bornholm Basin | 600 | 0.65 | 0.69 | | 0.02 | | | | | | 0.16 | 0.44 | 2.35 |
| Władysławowo-Eastern Gotland Basin | 570 | 2.71 | 0.93 | 0.11 | 0.21 | | | 0.04 | 0.07 | 0.9 | 3.05 | 2.45 | 10.87 |
| Gdańsk - Northern Port Gdańsk Basin | 570 | 3.38 | 1.5 | 0.25 | 0.37 | | | 0.09 | 0.27 | 1.94 | 4.14 | 3.15 | 13.26 |

*Source: Update of the preliminary assessment of the status of marine waters, Warsaw 2018*

### 5.5.1.3 Storm and low levels

**Storm levels**

The occurrence of storm levels in the southern part of the Baltic Sea is characterized by two periods: storm – from September to March and storm-free - from April to August[78]. The most dangerous storm surges were caused by the movement of the low-pressure system in the south-eastern direction from the Norwegian Sea to Scandinavia and the Baltic Sea[79].

Analyzing the number of storm levels over the 1960-2011 multi-year period, the trend is increasing. In the years 1960-69 there were cases of 107 storm levels and in the following decades the number increased to reach 321 in the years 1980-89. In the next decade of 1990-99, the number of storm level cases dropped to 237 and then increased to 367 in the years 2000-09 (Table 38).In summary, in the analyzed period, there were a total of 1,279 cases on all stations.

[78] Miętus M., von Storch H., 1997, Reconstruction of the wave climate in the Proper Baltic Basin, April 1947-March 1988, GKSS, External Report, 97/E/28, 30

[79] Sztobryn M., Stigge H. J.(ed.): Storm levels along the southern Baltic (western and central parts). Institute of Meteorology and Water Management, Warsaw 2005.

**Table 38 Number of storm level cases at the analysed stations in individual decades in the multi-year period 1960-2010**

| Decade | | | | |
|---|---|---|---|---|
| **1960-69** | **1970-79** | **1980-89** | **1990-99** | **2000-09** |
| **107** | 247 | 321 | 237 | 369 |

*Source: Przgrodzki P., Letkiewicz B., Inżynieria morska i geotechnika, no. 3/2015*

The table below presents the number of storm level cases for the 1960-2011 multi-year period. The highest number of storms was recorded in Gdańsk – 253 and the lowest in the station in Hel – 156. In Ustka, Świnoujście and Kołobrzeg, 210, 212 and 228 cases occurred respectively.

**Table 39Number of storm level cases at the analysed stations in the multi-year period 1960-2010**

| Station | Świnoujście | Kołobrzeg | Ustka | Hel | Gdynia | Gdańsk |
|---|---|---|---|---|---|---|
| **Number of storm peaks** | 212 | 228 | 210 | 156 | 220 | 253 |

*Source: Przgrodzki P., Letkiewicz B., Inżynieria morska i geotechnika, no. 3/2015*

The highest maximum level during the high level periosd was recorded at the station in Świnoujście in 1995 and amounted to 669 cm. The lowest maximum level occurred on Hel in 1983 and was 620 cm. The difference between the maxima is 49 cm. All the maximum levels were recorded in the last thirty years, while three of them were recorded in Gdańsk, Gdynia, Ustka on 23.11.2004.

**Table 40 Maximum water levels recorded at the analyzed mareographical stations in the multi-year period 1960-2010**

| Data | Stations | | | | | |
|---|---|---|---|---|---|---|
| | **Świnoujście** | **Kołobrzeg** | **Ustka** | **Hel** | **Gdynia** | **Gdańsk** |
| **Date of occurrence of the maximum level** | 04/11/1995 | 29/11/1988 | 23/11/2004 | 19/01/1983 | 23/11/2004 | 23/11/2004 |
| **Maximum level [cm]** | 669 | 647 | 640 | 620 | 632 | 644 |

*Source: Przgrodzki P., Letkiewicz B., Inżynieria morska i geotechnika, no. 3/2015*

According to the monitoring data from 2019 analyzed for the needs of environmental assessments of the Polish sea areas of the Baltic Sea, the highest wave value at the measuring point of the WaveGuide device was recorded on 2 January 2019, reaching a value of 7.48 m, and the maximum wave height of over 13 m. The simulation shown in the figure below shows the hydrodynamic conditions on the day of the storm. In the central and eastern parts of the southern Baltic, in the southern course, the waves reached the 5th and 6th degree Douglas scale (color scale in the figure below), i.e. 2.5 – 6 m of significant height. In the western part, the height of the significant wave ranged from 0.3 to 2.4 m. The lower values occurred only in the area of the Szczecin Lagoon and along the coast of the Gulf of Puck.

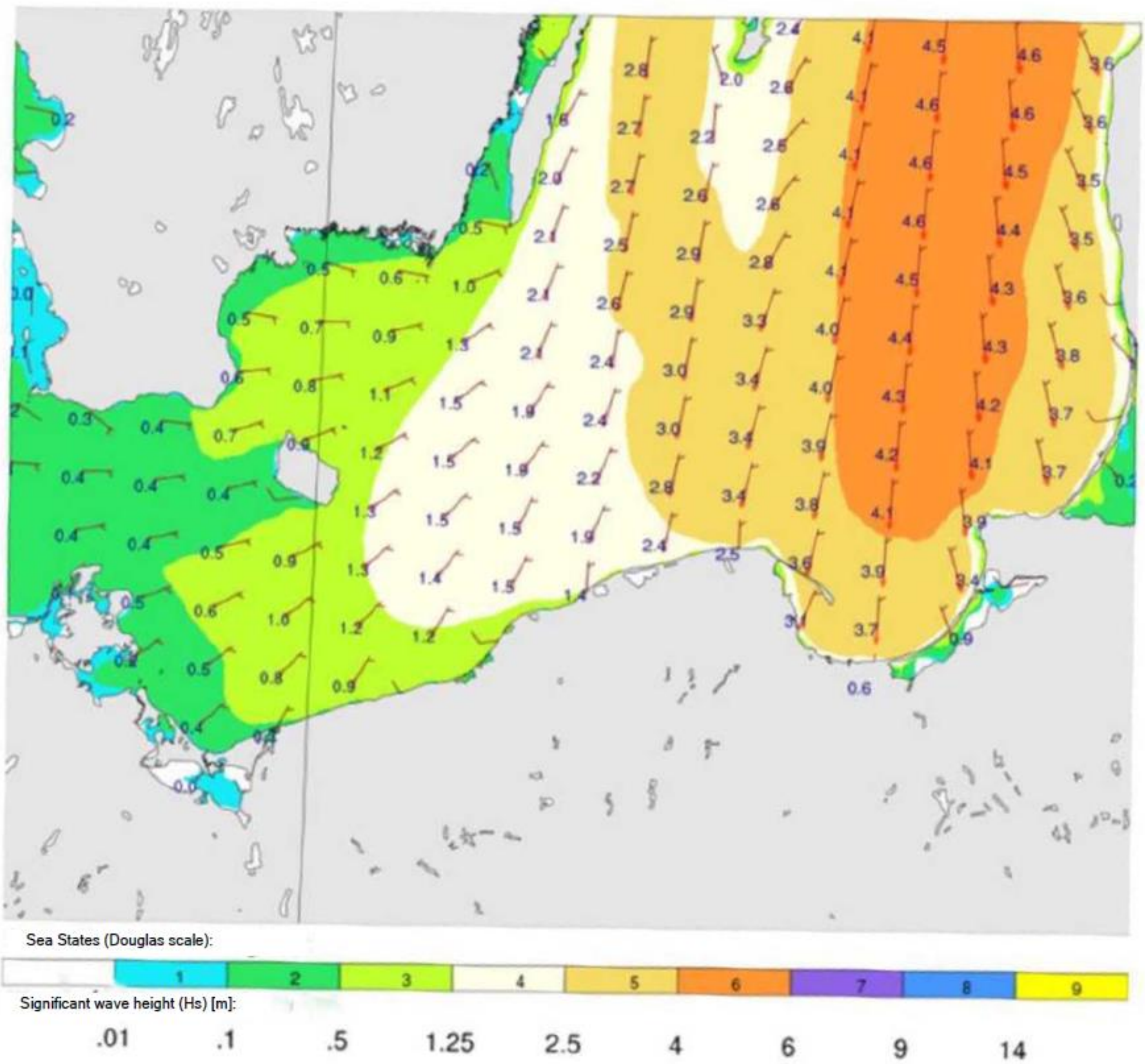



**Fig. 35 Simulation of the significant wave height of the SWAN model of 02 January 2019. (18:00 UTC) (color coded sea states according to Douglas, the value at the arrow means the simulated value of the significant wave height, and its vector determines the direction of wave propagation)**

*Source: Assessment of the Environmental Status of the Polish Maritime Areas of the Baltic Sea on the basis of Monitoring Data from 2019 against the background of the decade 2009-2018.*

One of the basic elements influencing the occurrence of storm level risers is the wind. The conditions of the impact of wind waves on the shore in 2019 in relation to the multiannual period 2009-2018 were presented indirectly, using the measurements of the direction and speed of wind at selected stations, representing individual areas of coastal and transitional waters. The wind characteristics were developed on the basis of measurement data from the period 2009-2019, collected within the framework of the state hydrological and meteorological service IMGW-PIB.

In 2009-2018, the wind from the west dominated the stations Ustka, Łeba and Hel. Swinoujscie and Gdańsk-Swibno stations were dominated by wind from the south. The share of wind from the other directions was less significant. With the wind blowing from the west, there are the highest speeds, which usually occur on the central coast**Błąd! Nie można odnaleźć źródła odwołania.**.

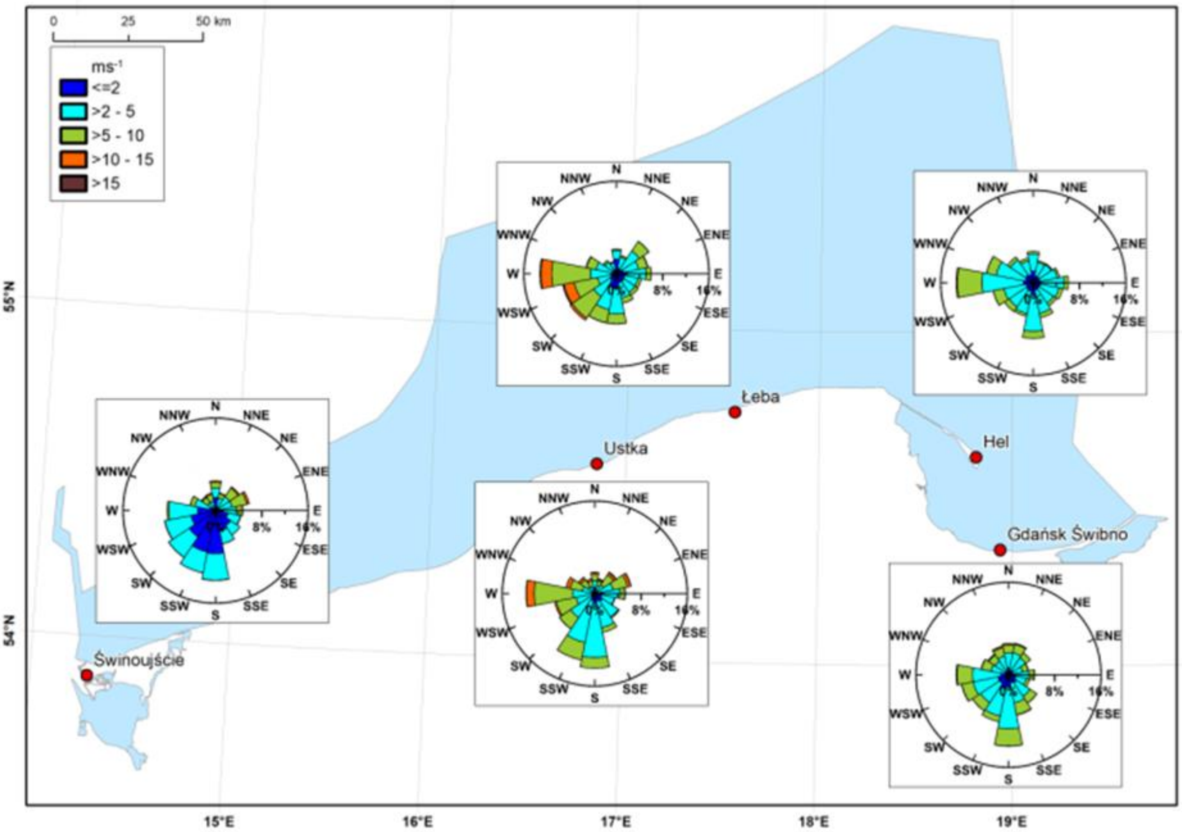



**Fig. 36 Direction and wind speed at selected stations of the Polish coast – multi-year 2009-2018**

*Source: Assessment of the Environmental Status of the Polish Maritime Areas of the Baltic Sea on the basis of Monitoring Data from 2019 against the background of the decade 2009-2018.*

In 2019, the distribution of wind directions and speeds at the stations of the Polish coast was very similar to the average distribution from the multi-year period. The increased share of wind from the west can be seen at stations in Łeba, Hel, similar to the analysis of directions and speeds for the multi-year period. (**Błąd! Nie można odnaleźć źródła odwołania.**). For the Gdańsk-Swibnie station in 2019, the dominant wind direction changed from south to west.

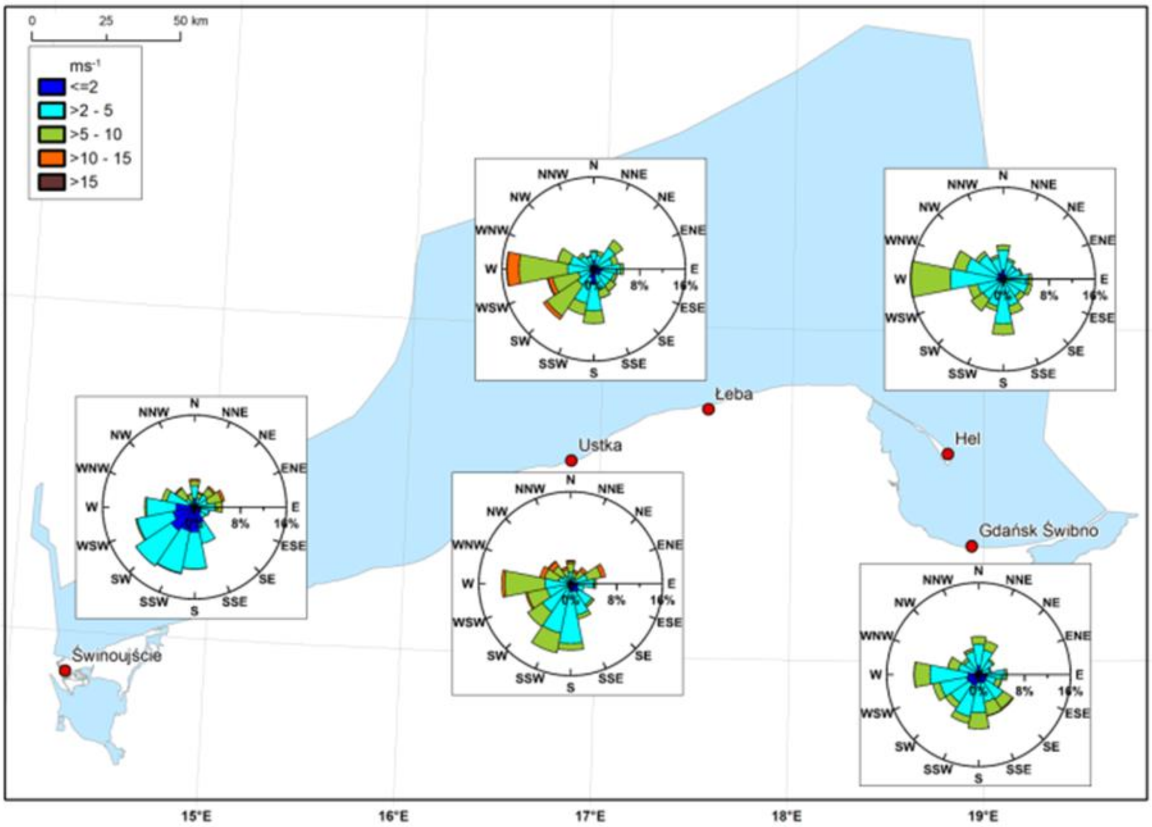



**Fig. 37 Direction and wind speed at selected stations of the Polish coast – year 2019**

*Source: Assessment of the Environmental Status of the Polish Maritime Areas of the Baltic Sea on the basis of Monitoring Data from 2019 against the background of the decade 2009-2018.*

### Low levels

Very low levels of the Baltic Sea occur irregularly. These states are a major threat to small ports and shipping, as low water levels can cause navigational difficulties. In Poland, it is assumed that any drop in sea level below 440 cm (incl.) is considered to be a low level.[80]

Extremely low levels are much less frequent compared to extremely high sea levels. The following table shows the period for the years 1947-2007, extremely low levels were recorded in 107 dates.[81]

**Table 41Catalogue of extremely low water levels on the Polish coast in the period 1974-2006**

| Low level no. | Period of lowering | Minimum water level | | | | |
|---|---|---|---|---|---|---|
| | | Świnoujście | Kołobrzeg | Ustka | Władysławowo | Gdańsk |
| **1** | 17/01/1947 | 426 | | 452 | | 446 |
| **2** | 10/09/1947 | 426 | 465 | 450 | 468 | 476 |
| **3** | 10/11/1978 | 424 | 460 | 481 | 500 | 492 |
| **4** | 03/10/1949 | 422 | 433 | 460 | 471 | 462 |
| **5** | 3-4.02.1950 | 417 | 420 | 428 | 419 | 425 |

[80] https://imgw.pl/sites/default/files/2020-08/klimat-tom-i-warunki-klimatyczne-i-oceanograficzne-w-polsce-i-na-baltyku-poludniowym-min.pdf
[81] Catalogue of flood surges and storm lows on the Polish Baltic coast, 2008. (B. Wiśniewski, T. Wolski)

| Low level no. | Period of lowering | Minimum water level | | | | |
|---|---|---|---|---|---|---|
| | | Świnoujście | Kołobrzeg | Ustka | Władysławowo | Gdańsk |
| **6** | 30/08/1950 | 427 | 467 | 464 | 475 | 470 |
| **7** | 18/02/1951 | 428 | 430 | 440 | 435 | 448 |
| **8** | 15/01/1953 | 422 | 432 | 458 | 453 | 451 |
| **9** | 08/11/1953 | 411 | 414 | 415 | 423 | 429 |
| **10** | 15/01/1954 | 430 | 451 | 452 | 458 | 454 |
| **11** | 24-26.02.1954 | 421 | 414 | 422 | 415 | 414 |
| **12** | 02/03/1954 | 428 | 414 | 425 | 431 | 428 |
| **13** | 11/01/1955 | 434 | 407 | 427 | 441 | 448 |
| **14** | 25/11/1956 | 401 | 393 | 450 | 444 | 448 |
| **15** | 19/01/1958 | 425 | 427 | 465 | 481 | 474 |
| **16** | 21/11/1959 | 430 | 430 | 437 | 440 | 441 |
| **17** | 16-18.12.1959 | 427 | 429 | 428 | 423 | 429 |
| **18** | 19/01/1960 | 416 | 425 | 440 | 460 | 463 |
| **19** | 04/02/1960 | 408 | 410 | 419 | 415 | 426 |
| **20** | 03/11/1960 | 427 | 433 | 436 | 438 | 438 |
| **21** | 29-30.01.1961 | 398 | 412 | 423 | 434 | 440 |
| **22** | 12/02/1962 | 428 | 458 | 468 | 492 | 490 |
| **23** | 15/11/1962 | 429 | 443 | 445 | 451 | 457 |
| **24** | 13/01/1963 | 428 | 455 | 465 | 473 | 470 |
| **25** | 31/12/1964 | 430 | 435 | 447 | 463 | 457 |
| **26** | 26-27.11.1965 | 420 | 438 | 449 | 443 | 438 |
| **27** | 06/12/1965 | 430 | 440 | 461 | 472 | 466 |
| **28** | 30/11/1966 | 426 | 445 | 457 | 460 | 465 |
| **29** | 18/12/1966 | 430 | 435 | 441 | 448 | 445 |
| **30** | 18/10/1967 | 366 | 410 | 437 | 476 | 466 |
| **31** | 22/01/1969 | 422 | 425 | 432 | 432 | 435 |
| **32** | 09/03/1969 | 412 | 430 | 445 | 457 | 460 |
| **33** | 22/09/1969 | 428 | 445 | 452 | 488 | 482 |

| Low level no. | Period of lowering | Minimum water level | | | | |
|---|---|---|---|---|---|---|
| | | Świnoujście | Kołobrzeg | Ustka | Władysławowo | Gdańsk |
| **34** | 02/01/1970 | 405 | 430 | 443 | 453 | 458 |
| **35** | 01/03/1970 | 430 | 441 | 449 | 457 | 453 |
| **36** | 20/10/1970 | 412 | 435 | 449 | 470 | 469 |
| **37** | 08/01/1971 | 403 | 424 | 434 | 433 | 441 |
| **38** | 12/03/1972 | 423 | 412 | 418 | 421 | 423 |
| **39** | 25/01/1973 | 426 | 431 | 441 | 444 | 452 |
| **40** | 9-10.10.1973 | 425 | 448 | 460 | 477 | 475 |
| **41** | 13/11/1973 | 423 | 446 | 463 | | |
| **42** | 19/03/1974 | 424 | 439 | | 495 | 499 |
| **43** | 16-17.11.1975 | 425 | | 451 | 451 | 460 |
| **44** | 24-25.02.1976 | 404 | 400 | 420 | 435 | 437 |
| **45** | 08/10/1976 | 425 | | | | |
| **46** | 01/12/1976 | 424 | 449 | 457 | 471 | 475 |
| **47** | 3-4.02.1977 | 426 | 450 | 460 | 455 | 459 |
| **48** | 12/12/1977 | | 427 | 437 | 439 | 449 |
| **49** | 24/12/1977 | 415 | 450 | 460 | | 468 |
| **50** | 20-21.02.1978 | 424 | | 447 | | 496 |
| **51** | 07/01/1979 | 410 | 403 | 418 | 430 | 431 |
| **52** | 04/11/1979 | 370 | 370 | 409 | 412 | 414 |
| **53** | 28/12/1979 | 423 | 430 | 439 | 446 | 450 |
| **54** | 28/02/1980 | 427 | 434 | 437 | 451 | 446 |
| **55** | 09/01/1981 | 425 | 442 | 466 | | |
| **56** | 24/11/1981 | 409 | 450 | 470 | | 503 |
| **57** | 20/10/1982 | 416 | 425 | 431 | 440 | 445 |
| **58** | 15-16.12.1982 | 410 | 420 | 444 | 471 | 476 |
| **59** | 13/01/1984 | 419 | 450 | 463 | 480 | 485 |
| **60** | 23/11/1984 | | | 439 | 429 | 417 |
| **61** | 28/11/1984 | 428 | 436 | | | |

| Low level no. | Period of lowering | Minimum water level | | | | |
|---|---|---|---|---|---|---|
| | | Świnoujście | Kołobrzeg | Ustka | Władysławowo | Gdańsk |
| **62** | 29/01/1985 | 425 | 435 | 436 | 455 | 452 |
| **63** | 29/03/1985 | 421 | | | | |
| **64** | 6-7.11.1985 | 415 | 457 | 462 | | |
| **65** | 23/03/1986 | 412 | 412 | 420 | | 430 |
| **66** | 30/01/1987 | 425 | 433 | | | |
| **67** | 11/04/1988 | 426 | | 459 | | 473 |
| **68** | 24/09/1988 | 428 | 463 | 477 | | 487 |
| **69** | 27/10/1988 | 429 | 438 | 452 | | 456 |
| **70** | 26/01/1990 | 415 | 461 | 473 | | 502 |
| **71** | 27/02/1990 | 407 | 443 | 468 | | 496 |
| **72** | 27/12/1990 | 420 | 426 | 440 | | 455 |
| **73** | 18/10/1991 | 408 | | | | |
| **74** | 02/11/1991 | 406 | 409 | 422 | 430 | 432 |
| **75** | 08/10/1992 | 426 | | | | 465 |
| **76** | 03/11/1992 | 426 | 429 | 444 | 460 | 463 |
| **77** | 14/01/1993 | 400 | 436 | 452 | 484 | 472 |
| **78** | 13/10/1993 | 405 | 428 | 437 | 442 | 446 |
| **79** | 11/11/1993 | 430 | 434 | 443 | 437 | 448 |
| **80** | 05/12/1993 | 415 | 430 | | | |
| **81** | 06/03/1994 | 434 | 411 | 440 | 442 | 441 |
| **82** | 14/11/1994 | 407 | 411 | 426 | 429 | 435 |
| **83** | 23/01/1995 | 420 | 437 | 441 | 461 | 459 |
| **84** | 26/09/1995 | 413 | 440 | 450 | 463 | 468 |
| **85** | 10/12/1995 | 430 | 448 | 463 | | |
| **86** | 15/02/1996 | 405 | 409 | 420 | 442 | 442 |
| **87** | 30/09/1996 | 426 | 434 | 441 | 449 | 447 |
| **88** | 15/12/1996 | 420 | | | | |
| **89** | 13/01/1997 | 425 | 431 | 438 | 464 | 462 |
| **90** | 04/02/1997 | 430 | 440 | 446 | 467 | 467 |
| **91** | 27/03/1997 | 413 | 436 | 440 | 446 | 442 |
| **92** | 06/12/1997 | 429 | 446 | 454 | | |

| Low level no. | Period of lowering | Minimum water level | | | | |
|---|---|---|---|---|---|---|
| | | Świnoujście | Kołobrzeg | Ustka | Władysławowo | Gdańsk |
| **93** | 29.11-1.12.1999 | 424 | 451 | 420 | 466 | 463 |
| **94** | 04/12/1999 | 379 | 416 | | | |
| **95** | 15/11/2001 | 421 | 456 | 478 | | |
| **96** | 21/12/2001 | 393 | 427 | 453 | 476 | 478 |
| **97** | 22/02/2002 | 412 | 439 | 460 | 467 | 470 |
| **98** | 19/12/2002 | 424 | 439 | 441 | | |
| **99** | 24/12/2003 | 428 | 443 | 456 | | 452 |
| **100** | 31/01/2004 | 430 | 444 | 453 | 465 | 465 |
| **101** | 12/11/2004 | 416 | 440 | 446 | 464 | 470 |
| **102** | 22-23.12.2004 | 419 | | 457 | 469 | 468 |
| **103** | 09/01/2005 | 410 | | 458 | 496 | 502 |
| **104** | 14-15.11.2005 | 416 | 455 | 461 | | 485 |
| **105** | 11/12/2005 | 427 | 448 | 465 | | 486 |
| **106** | 24/01/2006 | 420 | 437 | 439 | | |
| **107** | 6-7.02.2006 | 426 | 447 | 455 | 464 | 465 |
| | Low level period with water level << 400cm NN. | | | | | |

*Source: Catalogue of high and low levels on the Polish Baltic coast, 2008. (B. Wiśniewski, T. Wolski)*

The Table 41 results show that the number of extreme lowers is growing slightly – from 1.3 to 2.2 per year over the last 60 years. The highest incidence of lowers occurred in the season, in the months from October to March. All the lowers occurred during storm periods.

Another conclusion is that if the extremes of addition (high levels) and negative (low levels) increase over the years, the fluctuations in sea level on the Polish coast may also be greater and thus occur more often in the period from October to March. It is also worth noting that the lowest sea levels (<<400 cm NN) were recorded only on the western part of the coast, but not in the ports of the central or eastern coast (Table 42-Table 43).[82]

**Table 42 Amount of particularly low water level in individual ports for the period 1974-2006**

| Ports | Sea levels [cm] N.N | | |
|---|---|---|---|
| | (429-401) | <<400 | Total |
| **Świnoujście** | 97 | 6 | 103 |
| **Kołobrzeg** | 34 | 3 | 37 |

[82] Catalogue of high and low levels on the Polish Baltic coast, 2008. (B. Wiśniewski, T. Wolski)

| | | | |
|---|---|---|---|
| **Ustka** | 17 | 0 | 17 |
| **Władysławowo** | 11 | 0 | 11 |
| **Gdańsk** | 10 | 0 | 10 |

*Source: Catalogue of high and low levels on the Polish Baltic coast, 2008. (B. Wiśniewski, T. Wolski)*

**Table 43 Particularly low water levels recorded in ports on the western section of the Polish coast << 400 cm LV and with Swinoujscie-Gdańsk level difference > 20 cm**

| No. | No. per Table No. Table 41 | Period of lowering | Świnoujście | Kołobrzeg | Ustka | Władysławowo | Gdańsk |
|---|---|---|---|---|---|---|---|
| **1** | 21 | 29-30.01.1961 | 398 | 412 | 423 | 434 | 440 |
| **2** | 30 | 18/10/1967 | 366 | 410 | 437 | 476 | 466 |
| **3** | 52 | 04/11/1979 | 370 | 370 | 409 | 412 | 414 |
| **4** | 77 | 14/01/1993 | 400 | 436 | 452 | 484 | 472 |
| **5** | 94 | 04/12/1999 | 379 | 416 | | | |

*Source: Catalogue of high and low levels on the Polish Baltic coast, 2008. (B. Wiśniewski, T. Wolski)*

Higher amplitudes between the extreme levels were found on the western section of the Polish coast (Świnoujście – 3.03 m, Kołobrzeg – 2.77 m) than on the eastern coast (Ustka – 2.32 m, Gdańsk – 2.30 m).[83]

The general recommendation is to treat the increase in the frequency of various types of extreme events with their high year-to-year variability as an element of the functioning of the living environment and the management of people. Due to the continuous warming of the climate on a global scale, also observed in Poland, an increase in the frequency and intensity of meteorological, hydrological and, consequently, geomorphological extreme events should be expected. [84]

### 5.5.1.4 Waveforming

Corrugation in marine areas is an important element affecting the mixing of waters, the morphological variability of the seabed in the coastal zone and coastal erosion. The intensity of wave processes also affects the distribution of elements of the marine environment, the transport of which is conditioned by the impact of sea waves, e.g. transport of phytoplankton or pollution. In addition, extreme wave conditions (storms) directly affect the safety of vessels and the population of coastal towns. The most common type of waves in the southern Baltic Sea is wind waves. The force generating the water movement is the wind, or more precisely the friction at the interface of the atmosphere – the surface of the water, when the wind force is negligible or does not exist, then the waves are talked about from the swing (dead waves). These waves occur mainly in post-storm conditions, where there is a sharp reduction in the wind speed of its dominant direction. The height of the wave depends on the wind speed and its duration, as well as the depth and morphology of the seabed.[85]

[83] http://geoinfo.amu.edu.pl/sgp/LA/LA15/LA15_51-64.pdf
[84] Extreme meteorological, hydrological and geomorphological events in Poland, 2011 (J.A. Jania, Z. Zwoliński)
[85] Assessment of the Environmental Status of the Polish Maritime Areas of the Baltic Sea on the basis of Monitoring Data from 2019 against the background of the decade 2009-2018.

The conditions of the impact of wind waves on the shore in 2019 in relation to the multiannual period 2009-2018 are presented in subsection 5.5.1.3. Storm highs and lows.

The average wind speed at stations along the Polish coast varies depending on the water body. The highest average wind speed was recorded in Ustka, and the weakest in Świnoujście and Hel, decreased by approx. 1.4 m $s^{-1}$ (Table 44).

**Table 44Average wind speed (m s-1) at selected stations along the Polish coast in the multi-year period 2011-2016**

| Stations | Świnoujście | Ustka | Leba | Hel | Gdańsk Port Północny |
|---|---|---|---|---|---|
| **2011-2016** | 3.3 | 4.7 | 3.9 | 3.3 | 4.5 |

*Source: Assessment of the Environmental Status of the Polish Maritime Areas of the Baltic Sea on the basis of Monitoring Data from 2019 against the background of the decade 2009-2018.*

The maximum average wind speed and the corresponding direction changed at individual stations along the Polish coast (Table 45). The maximum average wind speed occurred in Łeba 7.1 m $s^{-1}$ occurred at west (W) wind directions. The wind from the west occurred in three stations. The lowest value was recorded in Helium 4.6 m $s^{-1}$.

**Table 45Average wind speed (m $s^{-1}$) at selected stations along the Polish coast in the multi-year period 2011-2016**

| Stations | Świnoujście | Ustka | Leba | Hel | Gdańsk Port Północny |
|---|---|---|---|---|---|
| **2011-2016** | 5.5 - NE | 6.9 - W | 7.1 - W | 4.6 - W | 6.3 - N |

*Source: Assessment of the Environmental Status of the Polish Maritime Areas of the Baltic Sea on the basis of Monitoring Data from 2019 against the background of the decade 2009-2018.*

Since December 2020, the website https://baltyk.imgw.pl/ has been launched, on which a wave forecast covering the height of a significant wave related to sea states is published. It is prepared in the Baltic Oceanography and Monitoring Department using the SWAN model powered by meteorological data from the COSMO model and input data in the field of water morphology and dynamics. The forecast is prepared every morning with validity for the next 72 hours with a step of 3 hours. The wave forecast is spatially interpolated, and the results should be considered concurrently with the forecast of weather conditions in the selected water body. The forecast is not constantly verified by a synopticist and cannot be a basis for process and expert studies.[86]

### 5.5.1.5 Icing

Icing is defined as the presence of sea ice. The extent and duration of the ice sheet is one of the most climate-sensitive elements of the marine environment. The stages of sea ice development are closely related to thermal conditions (heat transfer from water to the atmosphere, air temperature). With the current increase in average air temperature, it is expected that the range of sea ice will be reduced and the relegation period will be shortened.

The occurrence of ice phenomena in the southern Baltic Sea is small (number of days with ice, length of the ice season, dates of appearance of glaciation and its disappearance) compared to the rest of the

[86] https://baltyk.imgw.pl//index.php?page=18&subpage=100

Baltic Sea. In the Polish coastal zone, icing occurs only during moderate and harsh winters. Icing in individual waters varies.

Ice phenomena in the open sea are rare. In the Polish coastal zone, the most frequently observed forms of melting are the initial forms of ice and floe, and there is also ice from rivers. During the harsh winters, ice may appear on the Polish coast at the end of November and may last until the second half of March, or even until the beginning of April. The subsidence of glaciation is usually associated with the outflow of ice from the coast and falls on average at the end of February and the beginning of March.

The number of ice days per ice season is shown in the table below. In the multiannual period 2011/12 – 2016/17, the number of days with ice observed in the Polish coastal zone varies from approx. 12 days in Świnoujście to 1 day (for winters with ice in a given area).

The area of the central coast, i.e. the Polish coastal waters of the eastern Bornholm Basin, the Gotland Basin and the Gdansk Basin, is one of the waters with the mildest conditions of subsidence in the Polish coastal zone, where there is usually no ice outside the floods.

**Table 46Number of days with ice* in Polish coastal waters in the period 2011/12 to 2016/17**

| Water body | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 |
|---|---|---|---|---|---|---|
| **Polish coastal waters of the Bornholm Basin** | | | | | | |
| **Świnoujście** | 12 | 3 | 6 | 0 | 1 | 0 |
| **Szczecin Lagoon** | 26 | 75 | 34 | 0 | 32 | 50 |
| **Polish coastal waters of the Gotland Basin** | | | | | | |
| **Lt. Rozewie** | 6 | 0 | 0 | 0 | 0 | 0 |
| **Polish coastal waters of the Gdańsk Basin** | | | | | | |
| **Gdynia** | 5 | 0 | 0 | 0 | 0 | 0 |
| **Vistula Lagoon** | 34 | 119 | 48 | 11 | 32 | 53 |

*I. Stanisławczyk 2012-2017

The Polish part of the Vistula Lagoon and the Polish part of the Szczecin Lagoon belong to the waters with the greatest Icing in the area of Polish coastal and transitional waters.

The Vistula Lagoon is one of the areas where ice occurs annually, it is a good indicator of changes in the conditions of subsidence over the years, even when there was no subsidence in the coastal zone of the sea. The Vistula Lagoon also records the largest number of days with ice in the entire Polish coastal zone – 146 days. Next in order is the Bay of Puck – 128 days and later the Szczecin Lagoon – 115 days. It is almost twice the value of the largest number of days with icing in the open sea area.

Ice on the Szczecin Lagoon is a phenomenon occurring every year and is a major obstacle for shipping. Very rarely - in very warm winter - it happens that ice phenomena do not occur. In the period of 100 years (in the 20th century), this happened only 6 times.

Over the course of a hundred years, it was difficult to navigate in this area, while the number of days on which navigation took place without any obstacles (during the occurrence of ice phenomena) is very small, which results from the nature of the descent at the Szczecin Lagoon – the occurrence of solid ice and the difficulties related to it. However, during the harsh winter, difficulties in navigation increase to a large extent, both at the Szczecin Lagoon and at sea before Świnoujście.

The conditions of the Polish coastal zone are very heterogeneous. The 2018/19 ice season on the Polish coast was very short and very mild. In the Polish coastal zone (internal waters), icing occurred at the end of January and at the beginning of February 2019. Ice did not form in the open sea coastal zone. For this reason, no map of the Polish coastal zone was published this season. The occurrence of ice phenomena was limited to internal waters: The Vistula Lagoon and the Bay of Puck (Table 47). 47 days with ice were recorded in the Vistula Lagoon, and 38 days in the Gulf of Puck, when it occurs on average: 91 and 67 days, respectively (long-term average 1961-1990). At the Szczecin Lagoon in the northern part, fresh ice appeared in some places, but it was irrelevant for navigation. The icing in the Polish coastal zone in the 2018/19 ice season did not cause any navigation difficulties. In the 2018/19 season, sailing in the open sea area, as well as the Szczecin - Świnoujście fairway, took place without any obstacles. The maximum ice range in the Baltic Sea occurred on 27 January 2019 and amounted to approx. 88,000 km$^2$.

**Table 47 Conditions of descent in Polish coastal waters during winter 2018/19**

| Stations | First ice | Last Ice | Season length | Number of days with ice | Max thickness [cm] |
|---|---|---|---|---|---|
| **Reservoirs/coastal waters** | | | | | |
| **Vistula Lagoon** | 1.12 | 13.02 | 75 | 33 | 10 |
| **Puck, port and adjacent waters** | 25.01 | 3.02 | 10 | 10 | 5 |

*Source: Assessment of the Environmental Status of the Polish Maritime Areas of the Baltic Sea on the basis of Monitoring Data from 2019 against the background of the decade 2009-2018.*

The maps of Ice Concentration (CICE model) and Ice Thickness (CICE model) are recorded in the SatBaltic System four times a day, based on the current satellite images. In addition, in 2020, the website https://baltyk.imgw.pl/ was launched, on which a map of the Polish coastal zone was published up to three times a week (Monday, Wednesday, Friday), depending on the severity of winter and the degree of icing.

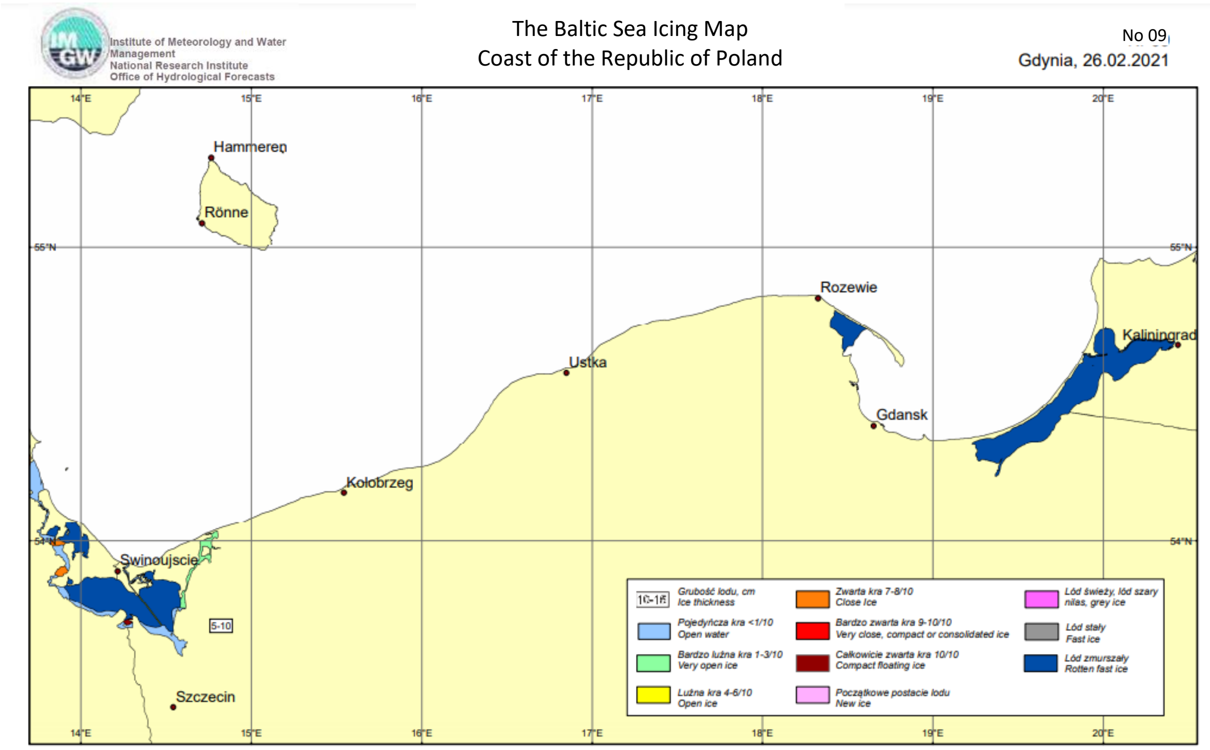



**Fig. 38 Map of the Polish coastal zone icing 26.02.2021**

*Source: https://baltyk.imgw.pl/*

The Baltic Sea Icing Map and the Polish Coastal Zone icing Map present the current ice situation in the Baltic Sea. The map also contains additional information about the thickness of ice, the location and operation of icebreakers. The Ice Map is forwarded along with other products (ice bulletins and ice reports) to national users and for international exchange.

According to the ice report, in the winter of 2019-2020, the maximum extent of ice in the Baltic Sea occurred on 5 March 2020 and amounted to approx. 37000 km$^2$ (the map is available from 02/03/2020 - figure below). In the Polish coastal zone (internal waters), icing did not occur at all in the 2019/20 season, so navigation in the area of the open sea and the Szczecin - Świnoujście fairway took place without hindrance. In the 2019/2020 season, the icing did not occur even in internal waters, especially in the Vistula Lagoon, which has not happened in the last 75 years, i.e. since the observation – since 1946.

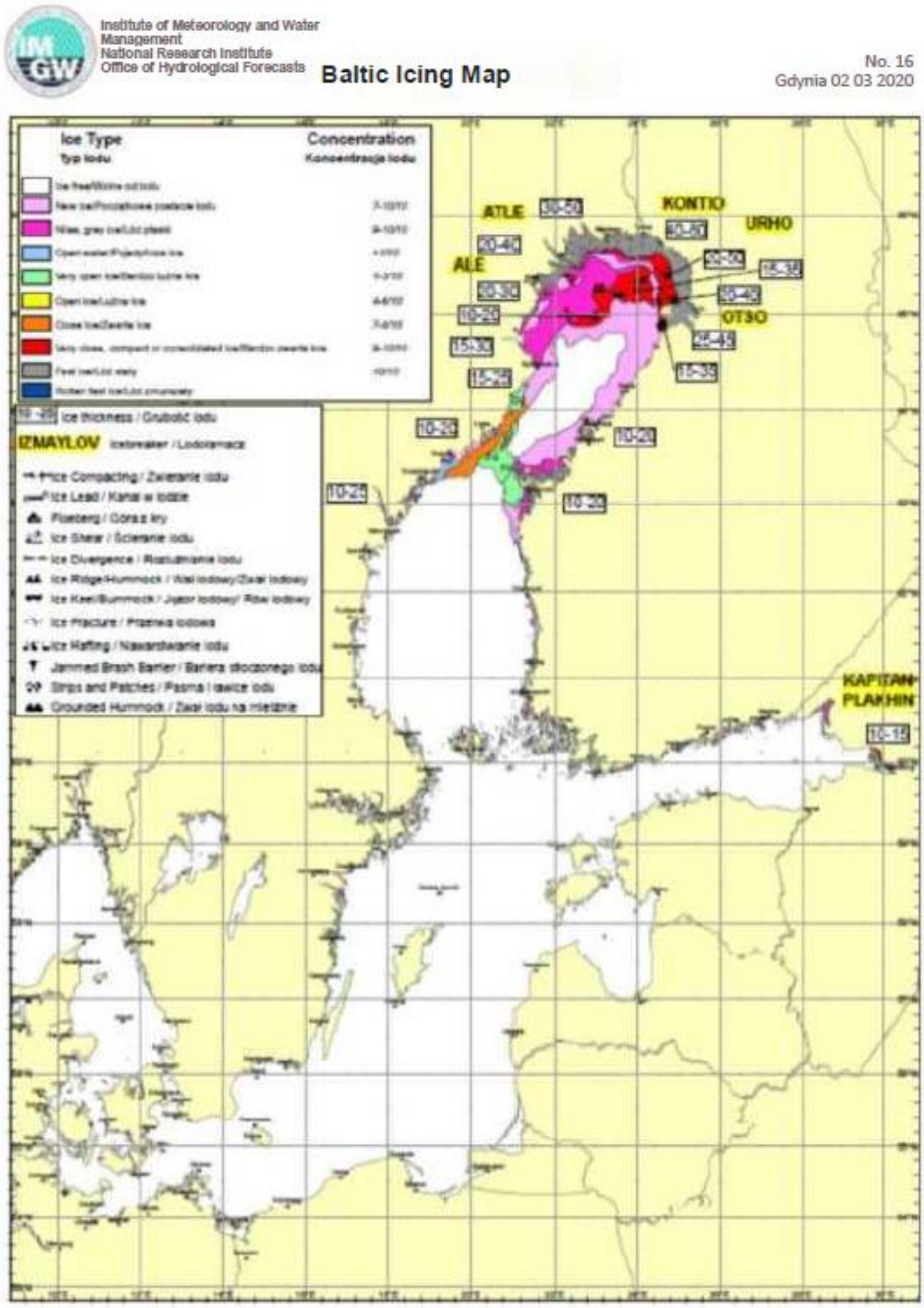



**Fig. 39 Maximum range of icing of the entire Baltic Sea in the 2019/2020 season**

*Source: https://baltyk.imgw.pl/*

## 5.5.2 Projected changes and climate variability in Poland

The effects of climate change translate into eutrophication of inland, transitional, coastal and marine waters, greater demand for electricity during the summer season and thus reduced cooling capacity of thermal power plants, which translates into a decrease in production capacity and congestion of the power grid. Negative climatic effects also lead to an increased threat to human life and health as a result of thermal stress and air pollution.

The problem of eutrophication particularly affects the areas of the Baltic Sea, as a result of which sea bathing sites are often closed, in which some of the cyanobacteria occur in the blooms of the plankton in the summer season. Of the 146 coastal bathing sites, due to the bloom of cyanobacteria, in 2018 there were 11 bathing sites from the Zachodniopomorskie province and 55 bathing sites from the Pomorskie province. The longest inaccessible for beachers due to cyanobacteria blooms – for 15 days – was the swimming pool in Chałupy.[87]

One of the many challenges facing Poland for sustainable development is adapting to climate change by improving the resilience of particular sectors of the economy. There is also a large impact of the climate on the country's water management. Poland has relatively small water resources, and the efficiency of their use is small. Across the country, the risk of flooding is growing, which is mainly related to: the increase in impermeable areas – this phenomenon is most visible in cities, with insufficient retention capacity of natural and artificial reservoirs, excessive outflow of water from small catchments caused by improperly carried out regulations and river maintenance, as well as insufficient number of devices stacking water in drainage ditch systems. In addition, natural floodplains are being restricted.[88]

As a result of climate change, an increase in the intensity and frequency of storms is forecast, as well as an increase in the phenomenon of coastal erosion as a result of the increase in wave heights in the Baltic Sea. In addition, the salinity of groundwater in the lower areas is expected to increase.

In all types of sea shore protection projects, it is advisable to implement them taking into account the preservation of natural shore dynamics processes. The most vulnerable areas are: Central Coast and Hel Peninsula. Climate change also affects the occurrence of milder winters, which is associated with the reduction of the glacial cover, which is a natural barrier against storm waves and the reduction of the shore's resistance to blurring.[89]

The forecasting of climate change is based on complex computational models based primarily on the massive amount of data collected over the past decades. These models are well described in the extensive work.For the purposes[90] of the Environmental Impact Forecast, the conclusions of these forecasts have been quoted.

The direction of climate change in the Baltic Sea follows the changes taking place in our climate zone, i.e. the increase in average temperature, as well as the increasing occurrence of extreme phenomena (heavy rainfall, heat, prolonged periods of drought, strong winds). The projections for sea-level changes present three emission scenarios: A1, A1B and A2. These changes take into account the period 2011 – 2030 and 2081 – 2100.

*Definitions of emission scenarios acc. to the document Assessment of the impact of current and future climate change on the Polish coast zone and the Baltic Sea ecosystem, 2014.*

The SRES emission scenarios are scenarios developed by Nakičenovič and Swart (2000) and are used, inter alia, as a basis for projections of climate change in the IPCC (Intergovernmental Panel on Climate Change) Fourth Assessment Report. They are grouped into four groups/families (A1, A2, B1, and B2), which describe alternative global development pathways covering a wide range of demographic, technological and resulting greenhouse gas emissions indicators. They do not include additional "pro-

State Environmental[87] Policy 2030
State Environmental[88] Policy 2030
State Environmental[89] Policy 2030
[90] Wibig J., Jakusik E. (ed.) "Climatic and oceanographic conditions in Poland and in the Southern Baltic Sea, expected changes and guidelines for the development of adaptation strategies in the national economy", Institute of Meteorology and Water Management, National Research Institute, Warsaw 2012

climatic" measures beyond those currently implemented. Emission scenarios are widely used to assess future climate change and its impact.

- SRES A1 It assumes a world of rapid economic growth, which is associated with population growth from the maximum in the mid-21st century and the rapid introduction of more efficient technologies. Scenario A1 is divided into three subgroups describing alternative directions of technological change (A1FI - intensive use of fossil fuels, A1T – reducing the use of these sources and A1B – sustainable use of energy sources)
- SRES B1 A convergent world with the same population growth dynamics as in A1, but with faster changes in economic structures focused on the dominance of information services and technologies. Scenario B2 assumes average population growth and average economic growth, with an emphasis on local solutions leading to sustainable development in economic, social and environmental terms. Scenario A2 presents a very heterogeneous world, with a high population growth, slow economic growth and development, and slow technological change.[91]

Temperature scenarios show that the average annual temperature in the period 2011-2030 over the polish coast will not fluctuate significantly compared to the average values from the reference period 1971-1990. According to emission scenarios B1 and A1B, the temperature increase will not exceed 0.1°C. Slightly larger changes are foreseen in scenario A2, where there will be a cooling-off compared to the reference period.

The projected scenarios for precipitation, as in the case of temperature, show slight changes in relation to the reference period. Scenarios based on the annual model indicate that the annual sums of precipitation on the polish coast will be slightly higher, but not more than 5% for scenario B1. For scenarios A1B and A2, the increase should not exceed 3%.

The number of days with precipitation may slightly increase according to scenarios B1 and A1B, in a way that does not exceed 2%. The results for scenario A2 indicate that no noticeable changes in this element are to be expected.

The projected changes in the Baltic Sea rejuvenation in the 21st century, according to scenarios developed on the basis of future changes in the average temperature field from 2 m above sea level in the Baltic Sea region, indicate that in the period 2011-2030 in the case of emission scenarios B1 and A1B there is a probability of a smaller number of days with rejuvenation than in the reference period (1971-1990).

Effects on B1 scenarios indicate a decrease of 20% at all analyzed measurement points, however, the value of the change in the eastern direction slightly increases. The results for the A1B scenario bring more diverse data, where for Hel the decrease is less than 2%, and in Świnoujście and Gdynia it reaches 20%. Scenario A2 predicts an increase in the number of days with icing along the entire coast – in the case of Świnoujście from approx. 11% to over 30% in Ustka and Hel.

Climate change from an ecological and economic point of view can cause risks from rising or falling mean sea levels. The 2011-2030 scenarios, developed on the basis of changes in the regional pressure field simulated by the ECHAM5 model and taking into account global changes in the average sea level, predict that the average sea level in these years will increase by about 4-5 cm in relation to the values from the reference period 1971-1990.

[91] Assessment of the impact of current and future climate change on the Polish coast and the Baltic Sea ecosystem, 2014

The estimated average sea level for the 2081-2100 scenarios varies, with all scenarios increasing relative to the reference period. Scenario B1 predicts the lowest growth of approx. 20 cm. In the A1B emission scenario, the expected increase in mean sea level reaches approx. 25 cm, and in the case of A2 – approx. 28 cm. Significant changes are forecast for the maximum sea level, which are respectively: 25 cm (B1) up to approx. 35 cm, and in the western part of the Coast up to approx. 38 cm (A2). [92]

**Temperature**

The models[93] used to determine the changes in the water temperature in the Baltic Sea show that in the 21st century the average annual temperature at the surface will increase in the range of 2 to 4°C. The following figures show the results.

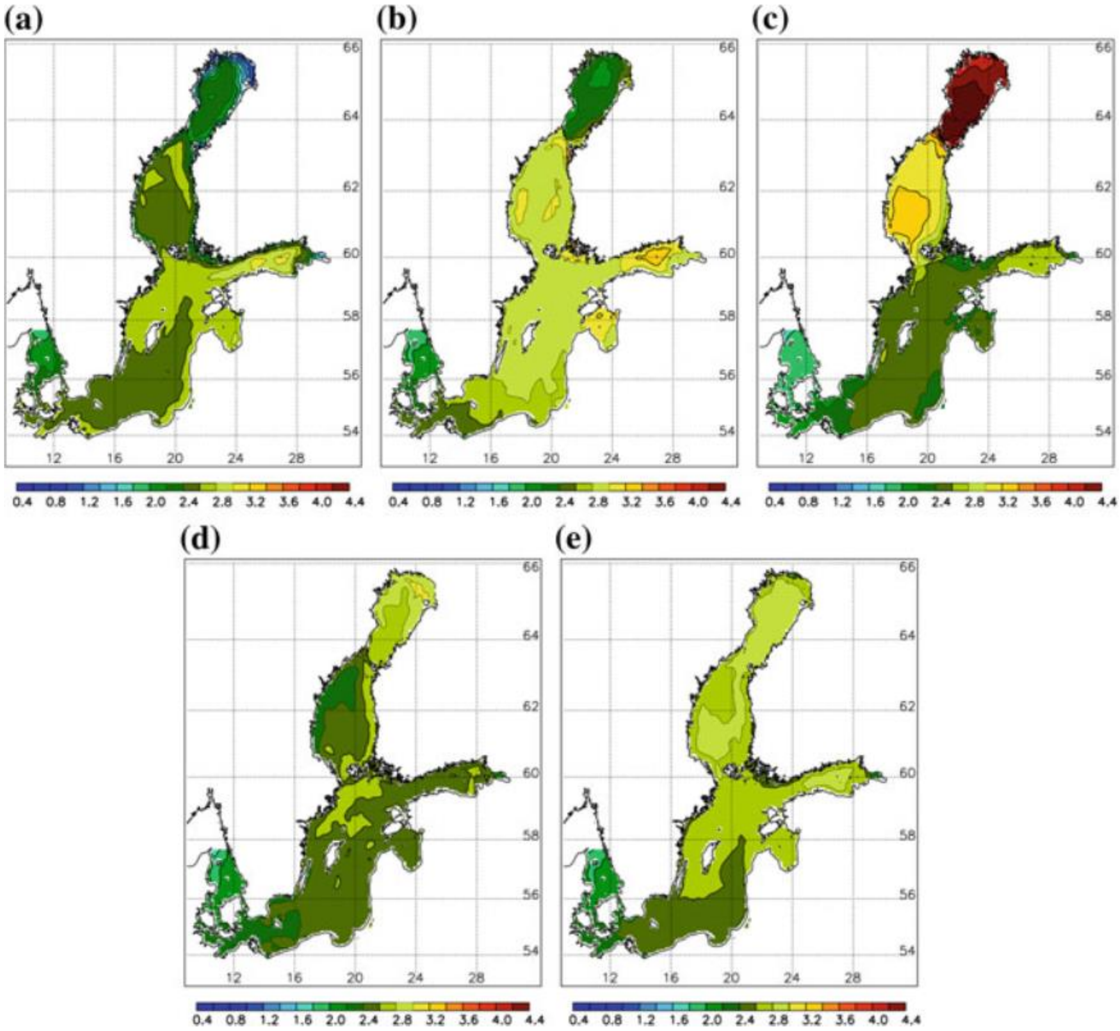



**Fig. 40 Projected changes: seasonal (a) winter (b) spring (c) summer (d) autumn and annual (e) water temperatures in the Baltic Sea in the years 2069 – 2098**

*Source: [Second Assessment of Climate Change for the Baltic Sea Basin]*

The data for the model come from direct measurements of water temperature in the years 1978 – 2007. The modelling was performed for the forecast period 2069 – 2098. Due to the fact that the

[92] Wibig J., Jakusik E. (ed.) "Climatic and oceanographic conditions in Poland and in the Southern Baltic Sea, expected changes and guidelines for the development of adaptation strategies in the national economy", Institute of Meteorology and Water Management, National Research Institute, Warsaw 2012
Seasonal temperature changes[93] were also analysed. The model covered the entire Baltic Sea.

temperature of water rises much slower than the air temperature, the scope of changes caught in the 2030 horizon would be too insignificant.

The average annual change in water temperature is approx. 2.4°C and is constant. Changes occur depending on the season, where:

- in the winter, the temperature change in the bays and the mouth of the Odra is approx. 2.6-2.80°C, while for the central coast it is the same as the annual average,
- in the spring, in the western part, the temperature rises by approx. 2.4°C, and in the central and eastern parts by 2.6 – 2.8°C,
- in the summer season, in the central and eastern part of the coast, the temperature rises by approx. 2.4°C and approx. 2.2°C in the western part,
- in the autumn season, the change is basically constant approx. 2.4°C with a slight difference right at the mouth of the Oder approx. 2.2°C.

**Sea level**

According to Communication 02/2021 of the interdisciplinary advisory team for the climate crisis at the President of the Polish Academy of SCIENCES on climate change and sea level rise, the global sea level has risen by more than 20 cm since the 19th century. The 2019 IPCC ocean and cryosphere data show that average sea level growth was 3.6 mm/year over the period 2006-2015. In the last hundred years, the rate of sea level rise was unprecedented and about 2.5 times higher compared to the period 1901-1990.

Recent scientific research shows that the last stage of the last ice age in about 10 thousand years the sea level increased by about 120 cm, among others due to the increase in the average temperature of the planet by about 5°C. At that time, there were several hundred-year periods when the rate of sea growth exceeded 5 cm/year, as a result of the destabilization of disappearing ice sheets in the northern and southern hemispheres. According to the latest research results, analogous destabilisation may occur as a result of anthropogenic climate change in the landlocked areas of West Antarctica and Greenland. [94]

Other studies show that sea levels have been rising since the 1960s. This phenomenon is based on the previously mentioned melting of glaciers and ice sheets and, to a lesser extent, the thermal expansion of ocean waters and the reduction of the weight of water on the surface and in the soil of continents as well as in lakes. As a result, sea levels have risen to 4.8 mm per year over the past decade.

Forecasts of sea level rise depend, among others, on the amount of greenhouse gas emissions, hence they are made for several emission pathways: "from the commitments of the Paris Agreement (RCP2.6) regarding the temperature increase of 1.5°C to the continuation of emissions practically unchanged (RCP8.5). Such projections shall be made either by adding the components of the impact from all processes affecting sea level in climate models (process-based projections) or by extrapolating the historical relationships between global temperature and sea level (semi-empirical projections). '

The 2019 IPCC Ocean and Cryosphere Report provides a 2/3 probability increase in sea level of 29-59 cm over the next two decades of the 21st century for a RCP2.6 and 61-100 cm for RCP8.5. It is assumed that the projected rate of sea level rise will accelerate depending on the emission scenario. The pace of the global average sea level can reach about 15 mm/year in 2100, and in the 22nd century analyses assume that it will exceed even a few centimetres per year.

[94] Komunikat_02_2021_w-sprawie-wzrostu-poziomu-morza_2001_01_26_FINAL.pdf (pan.pl)

Local forecasts for the Polish coast are similar to the global ones. Elements such as coastal infrastructure and the impact of vertical movements of the earth's crust relative to the local seabed will also have an impact on the apparent rise in sea level.

The obtained preliminary results show that there are no vertical movements of the bottom for the western ends of the Polish coast and its central part. They also indicate a decrease by approx. 1 mm/year of the coast in the area of the Gulf of Gdańsk and even 2 mm/year in the area of Żuławy. All of these elements may contribute to the acceleration of the relative growth of the mean sea level by about 10-20 cm per 100 years. As a result, there may be threats in the form of covering ever larger areas of significant importance for the country, such as the historical part of Gdańsk, Żuława or the Hel Peninsula.[95]

**Storm and low levels**

Storm levels are an important factor posing a threat to the coastal zone. Tests for the occurrence of extreme sea levels were carried out for the Hel station. This place was chosen due to its location and best reflecting the "sea" conditions. On the Hel Peninsula, the highest sea level was recorded on 14 January 1993 and amounted to 622 cm. These data come from research carried out continuously since 1945. In earlier years, however, levels were even higher. The highest level of the Baltic Sea recorded took place on December 5, 1899 and was 700 cm. The lowest observed sea level was 412 cm (4 November 1979), while the lowest recorded sea level in the history of observation was 410 cm (1937). The figures below show how the projected sea levels are shaped in the different scenarios.[96]

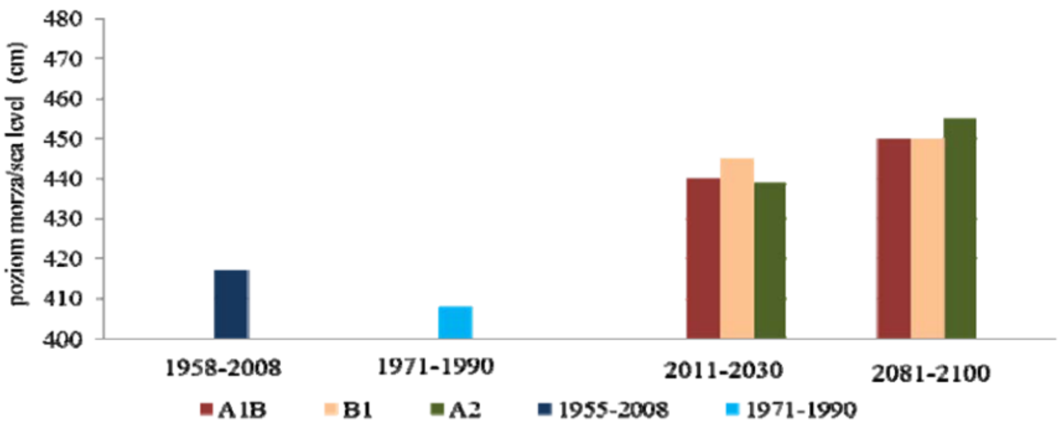



**Fig. 41 Sea level values with a probability of not reaching 1% on the basis of calculations at the Hel station in the main, reference and scenario periods 2011-2030 and 2081-2100**

*Source: Wibig J., Jakusik E. (ed.) "Climatic and oceanographic conditions in Poland and in the Southern Baltic Sea, expected changes and guidelines for the development of adaptation strategies in the national economy", Institute of Meteorology and Water Management, National Research Institute, Warsaw 2012*

The figure above shows the sea level values with a probability of not reaching 1% for the measurement period, i.e. 1958-2008, the reference period 1971-1990 and two projection periods 2011-2030 and 2081-2100. The values for the scenario periods were calculated on the basis of an empirical and statistical model, based on monthly percentiles of 5%. The level from the measuring period is higher than from the reference period (by 11 cm.). This difference is most likely due to the choice of the period

[95] Communication 02/2021 of the interdisciplinary advisory team on the climate crisis at the President of the Polish Academy of SCIENCES on climate change and sea level rise, 2021.

[96] Wibig J., Jakusik E. (ed.) "Climatic and oceanographic conditions in Poland and in the Southern Baltic Sea, expected changes and guidelines for the development of adaptation strategies in the national economy", Institute of Meteorology and Water Management, National Research Institute, Warsaw 2012

1971-1990 as the reference period. In addition, the lowest water levels were recorded in the years 1971-1980. According to all 3 scenarios, a water increase with a probability of not reaching 1% is expected, which is in line with the expected increase in the average sea level. In the forecast period 2011-2030, scenario B1 and in the period 2081-2100 – scenario A2 provide the greatest changes.[97]

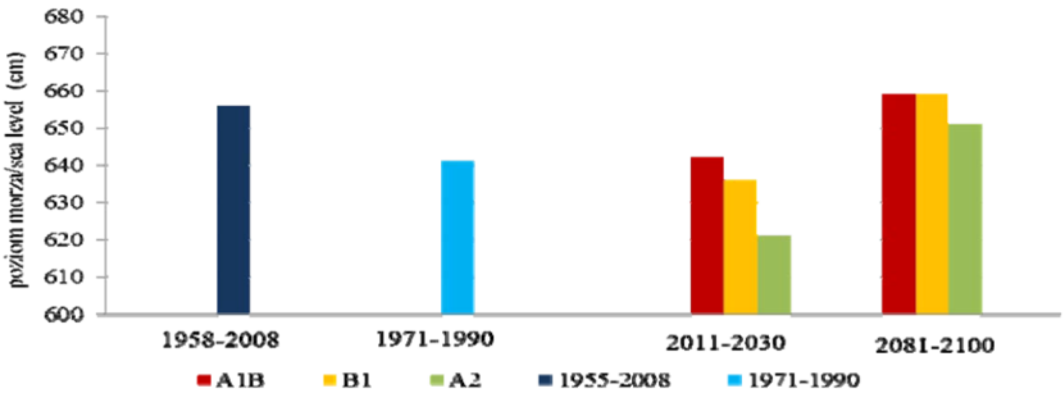



**Fig. 42 Sea level values with a probability of exceeding 1% based on calculations at the Hel station in the main, reference and scenario periods 2011-2030 and 2081-2100**

*Source: Wibig J., Jakusik E. (ed.)"Climatic and oceanographic conditions in Poland and the Southern Baltic expected changes and guidelines for the development of adaptation strategies in the national economy", Institute of Meteorology and Water Management, National Research Institute, Warsaw 2012*

The figure above shows a comparison of the hundred-year water values with those calculated for the measurement and reference period. The differences between these periods (i.e. measurement and reference periods) are mainly due to the fact that in the measurement period there were on average about five years with maximum annual levels above 600 cm, while in the reference period only three years. In the scenario period 2011-2030 (scenario A1B), the estimated value of the so-called 100-year water should remain at a level similar to the reference period; the other 2 scenarios provide for a slight decrease. However, in the period 2081-2100, the designed values of 100-year water should reach (in the A1B and B1 scenarios) a slightly higher level than in the measurement period[98].

The authors of the report for the IPCC (Intergovernmental Panel on Climate Change) indicate that the increase in sea level in the world will cause an increase in the frequency of extreme events in most locations. It is anticipated that local sea level values, which historically occurred once per age, will occur in all RCP scenarios, at least once a year, in most locations, by 2100. It is anticipated that many low-lying areas and small islands will experience the historical events of the century at least once a year, until 2050. The year in which the historic event of the century will become an annual event falls at the earliest on RCP8.5, and at the latest on RCP2.6. The increasing frequency of high water levels can have serious consequences in many places[99].

---

[97] Wibig J., Jakusik E. (ed.) "Climatic and oceanographic conditions in Poland and in the Southern Baltic Sea, expected changes and guidelines for the development of adaptation strategies in the national economy", Institute of Meteorology and Water Management, National Research Institute, Warsaw 2012

[98] Wibig J., Jakusik E. (ed.) "Climatic and oceanographic conditions in Poland and in the Southern Baltic Sea, expected changes and guidelines for the development of adaptation strategies in the national economy", Institute of Meteorology and Water Management, National Research Institute, Warsaw 2012

[99] https://www.ipcc.ch/srocc/chapter/summary-for-policymakers/

The existing literature on the subject suggests an increased future storminess for the region of Central Europe and the Baltic Sea, but the uncertainty of these projections is still high[100]. However, a summary of the world's work suggests that in the next 30 years, storm levels will be likely, which may be several times more frequent than in the past[101].

**Waveforming**

The wave climate in the southern Baltic Sea in the years 2011-2030, regardless of the analysed emission scenario, will not change significantly compared to the values from the reference period (1988-1993). The trends of these changes are shown in the figures below.

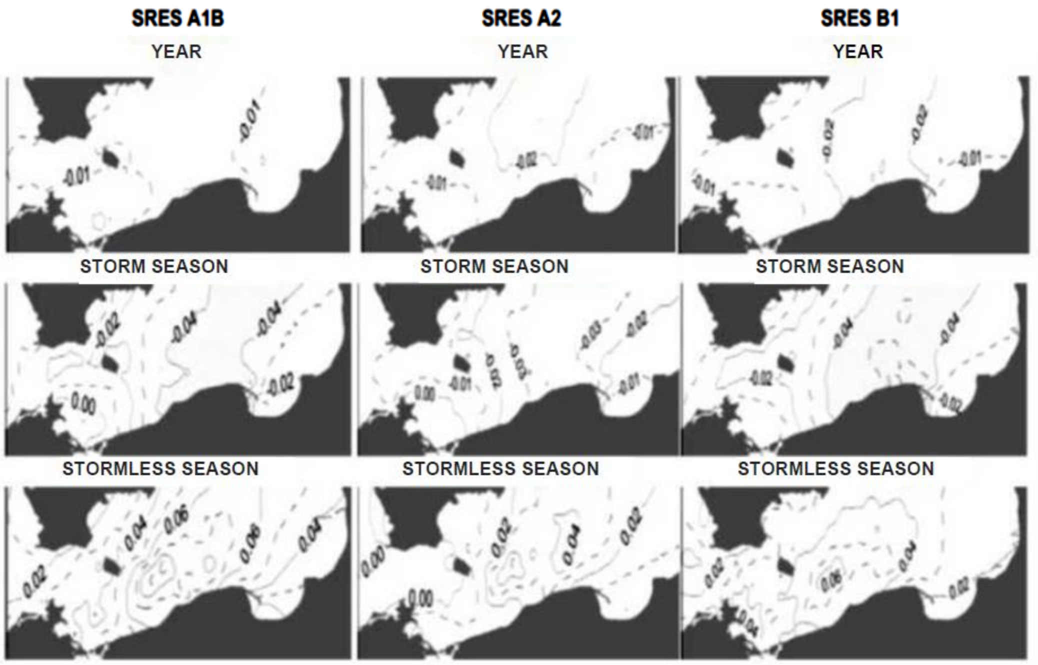



**Fig. 43 Expected changes in the quantile 50% of total wave height (m) in 2011 – 2030 on a yearly basis and in seasons in relation to 1988 – 1993 on the basis of statistical-empirical downscaling (CCA) ECHAM5**

*Source: Wibig J., Jakusik E. (ed.) "Climatic and oceanographic conditions in Poland and in the Southern Baltic Sea, expected changes and guidelines for the development of adaptation strategies in the national economy", Institute of Meteorology and Water Management, National Research Institute, Warsaw 2012*

The wave climate in the southern Baltic Sea in the years 2011-2030, regardless of the analysed emission scenario, will not change significantly compared to the values from the reference period (1988-1993). The spatial distribution of the median (quantile 50%) wave height in the year and in the storm season presented in the figure above indicates slight decreases in values in most of the analysis area.

According to all emission scenarios, the biggest annual changes will be in the East Bornholm Basin and the East Gotland Basin. They should not exceed 0.02 m.

In the storm season, all emission scenarios signal a decrease in the value of the discussed indicator in most of the analyzed research area. In the period 2011-2030, the greatest changes are expected in the Eastern Gotland Basin, where they may range from 0.03 m (A2) to 0.05 m (B1) depending on the

[100] Mölter et al., 2016, Review on the Projections of Future Storminess over the North Atlantic European Region, Atmosphere, 7(60), https://doi.org/10.3390/atmos7040060.
[101] https://www.ipcc.ch/srocc/chapter/summary-for-policymakers/

emission path. Only for scenarios A1B and B1 in the Gulf of Pomerania, no change in the value of the indicator is expected for the reference period.

In the storm-free season, the results of the simulation of changes in the quantile value of 50% of the total wave height in each of the three considered emission scenarios indicate a systematic increase in the value of the analyzed element in relation to the adopted reference period 1988-1993. It should be emphasized that these changes are much more pronounced than in the case of the year and the storm season. The area of the strongest increase in the average quantile value of 50% of the wave height in the southern Baltic Sea is the Eastern Bornholm Basin, specifically the Bornholm Basin. At least the value of the discussed quantile should increase in the Gulf of Gdansk and in the Western Bornholm Basin and the eastern coasts of Sweden. In the 2011-2030 subperiod, the increase in the value of the element should not be greater than 0.08 m in the A1B scenario. It can be expected that in the last twentieth century of the 21st century, the value of the considered quantile will be greater by more than 0.10 m.

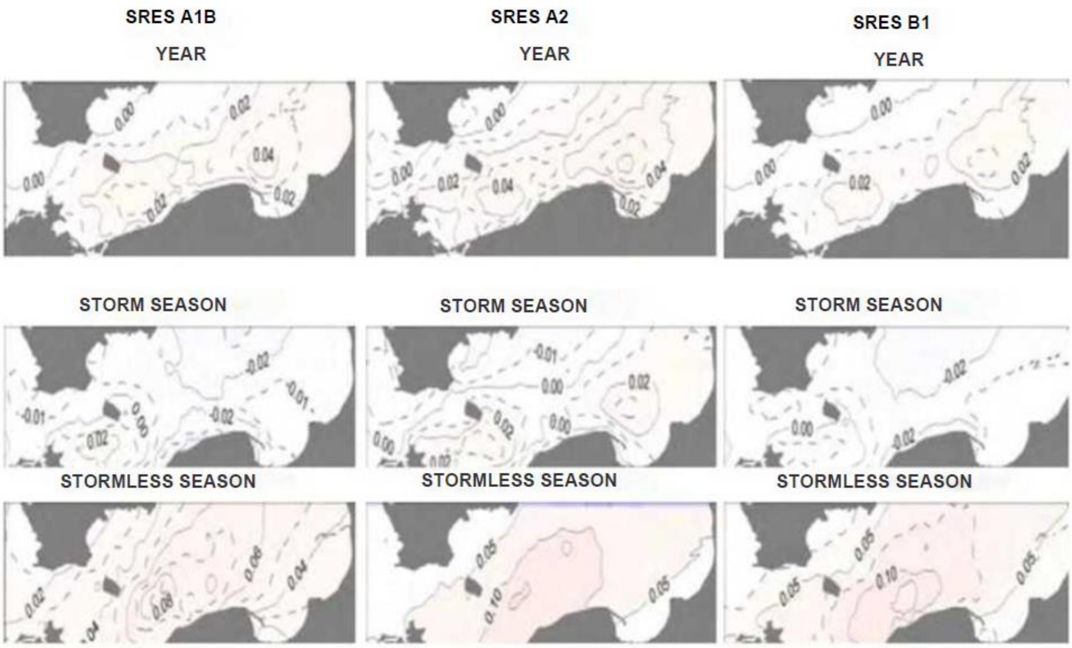



**Fig. 44 Expected changes in quantile 50% of total wave height (m) between 2081-2100 per year and seasons for 1988-1993 based on statistical-empirical downscaling (CCA) ECHAM5**

*Source: Wibig J., Jakusik E. (ed.)"Climatic and oceanographic conditions in Poland and the Southern Baltic expected changes and guidelines for the development of adaptation strategies in the national economy", Institute of Meteorology and Water Management, National Research Institute, Warsaw 2012*

However, the greater scope of the expected changes mainly concerns the second half of the 21st century.

In the last two decades of the 21st century, the increase in the quantile value of 50% of the total wave height is also small, although more spatially diverse. The largest increase will occur in scenario A2 and the anomaly values will exceed 0.06 m. For comparison According to the other two emission scenarios, i.e. A1B and B1, the value of the considered element in the final twentieth century of the 21st century should be higher by approx. 0.04 m and 0.03 m, respectively. The biggest changes will concern the Gdańsk Deep.

In the storm season, all emission scenarios signal a decrease in the value of the discussed indicator in most of the analyzed research area. At the end of the 21st century, the obtained simulation results give a differentiated picture of the expected changes for the quantile value of 50% of the total wave height in the southern part of the Baltic Sea. In the case of scenarios A1B and B1, an increase in the value of the considered element should be expected in the area of the Gulf of Gdańsk and in the southern part of the Bornholm Basin. According to the A2 emission path, the largest increase (exceeding 0.03 m) will take place in the area of the Gulf of Pomerania and the Gulf of Gdańsk, as well as in the southern part of the Bornholm Basin and the Eastern Gotland Basin. In the remaining area, all emission scenarios will have a reduction in wave height.

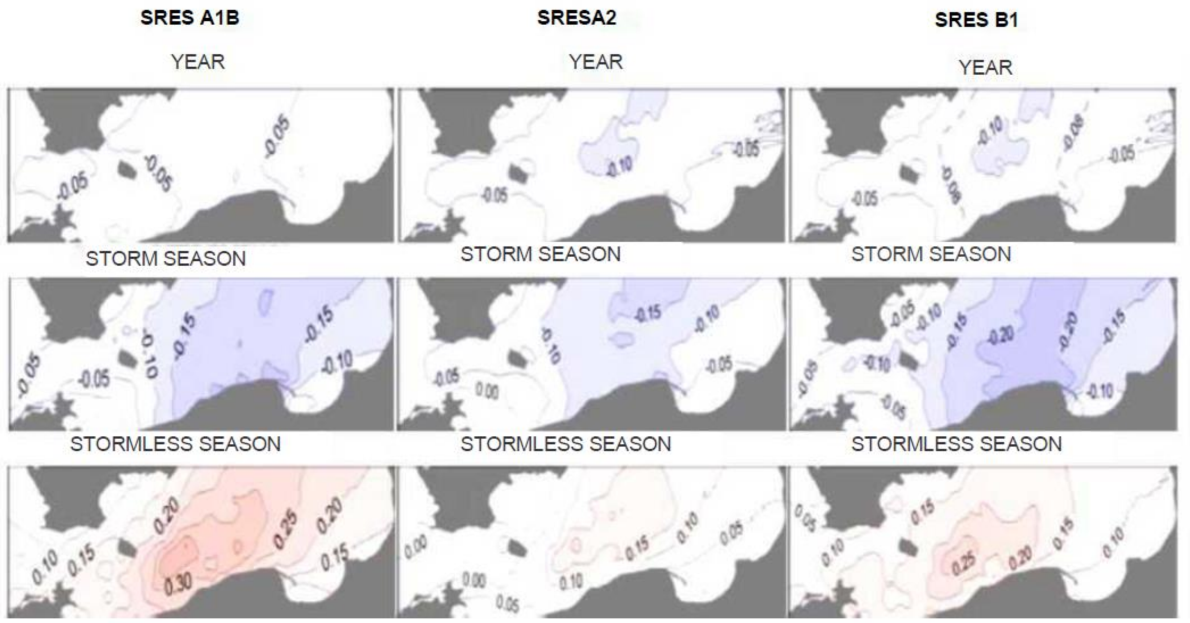



**Fig. 45 Expected changes in the quantile 95% of total wave height (m) in 2011 – 2030 on a yearly basis and in seasons in relation to 1988 – 1993 on the basis of statistical-empirical downscaling (CCA) ECHAM5**

*Source: Wibig J., Jakusik E. (ed.) "Climatic and oceanographic conditions in Poland and in the Southern Baltic Sea, expected changes and guidelines for the development of adaptation strategies in the national economy", Institute of Meteorology and Water Management, National Research Institute, Warsaw 2012*

The expected changes in the quantile of 95% of the total wave height in the years 2011-2030, on an annual basis, in relation to the period 1988-1993 for the analyzed emission scenarios will be small and will not exceed 0.10 m as a rule. The biggest changes (declines) are to be expected along the border between the Eastern Bornholm Basin and the Eastern Gotland Basin.

In the storm season, slight (up to 0.20 m) decreases in the quantile value of 95% of the total wave height are expected in the twenty years of 2011-2030. These changes can be seen most strongly in the open sea and the least near the coast. The smallest changes in the value of the analyzed indicator are expected in the Gulf of Pomerania and in the western Bornholm Basin and the eastern coast of Sweden, and the largest in the central part of the eastern Gotland Basin.

In the storm-free season, increases in the quantile value of 95% of the total wave height are clearly visible throughout the analyzed area. For the two years analysed, the largest changes in the indicator under consideration are expected in the central part of the eastern Basin, precisely in the area of the Bornholm Basin, and the smallest in the western Bornholm Basin and along the south-east coast of Sweden and in the bays. In the 2011-2030 subperiod, the smallest changes (increases) are expected under scenario A2 (> 0.15 m) and the largest under scenario A1B (> 0.30 m).

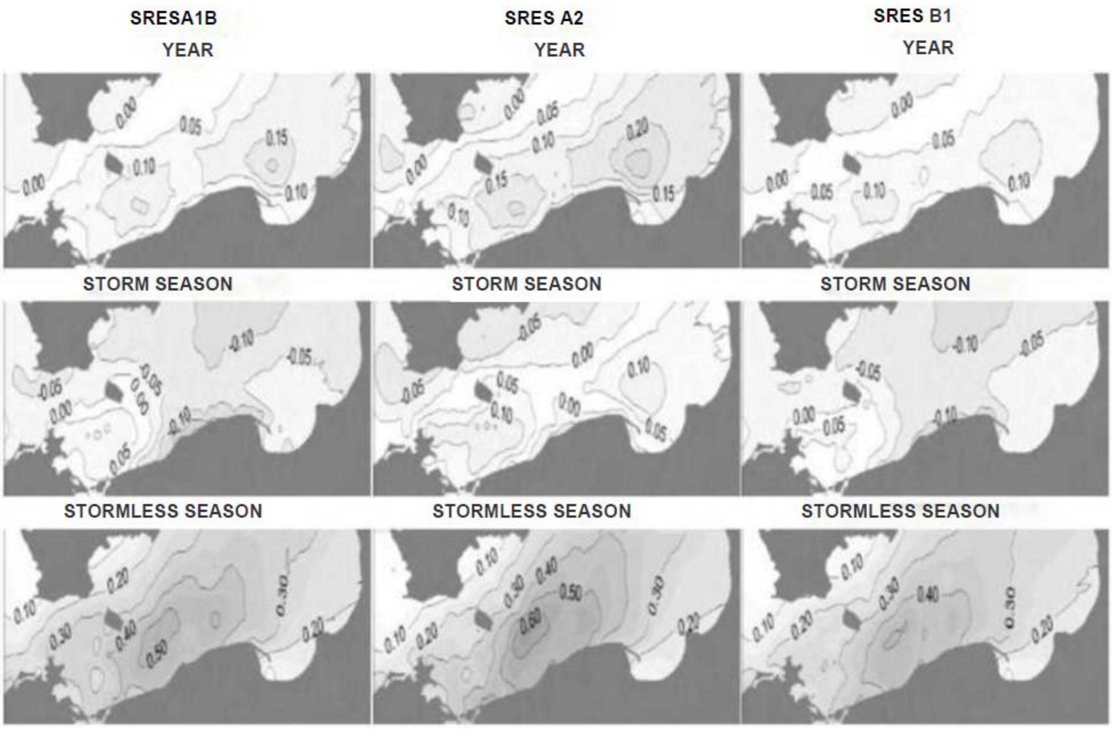



**Fig. 46 Expected changes in quantile 95% of total wave height (m) between 2081-2100 per year and seasons for 1988-1993 based on statistical-empirical downscaling (CCA) ECHAM5**

*Source: Wibig J., Jakusik E. (ed.) "Climatic and oceanographic conditions in Poland and in the Southern Baltic Sea, expected changes and guidelines for the development of adaptation strategies in the national economy", Institute of Meteorology and Water Management, National Research Institute, Warsaw 2012*

In the last two decades of the 21st century, the expected changes in the quantile of 95% of the wave height indicate slight increases in the value of the analyzed index in relation to the reference period 1988-1993. The largest increases in the considered element are expected in the area of Gdańsk Deep and may exceed 0.20 m according to the A2 scenario.

In the storm season in the last two decades of the 21st century, the range of expected changes in wave extremes will decrease significantly and in the case of emission scenarios A1B and B1, a decrease in value by slightly more than 0.10 m can be expected (negative sign of anomalies for most of the research area). For emission scenario A2, the wave height drops shall not exceed 0,05 m.

In the storm-free season, the expected changes in the quantile of 95% of the total wave height will be more clearly marked than in the period 2011-2030. This will be most marked in the case of scenarios A2 and B1, where the anomalies will most likely exceed 0.50 m and will be more than 0.25 m higher compared to the previously analyzed period. The anomalies recorded in the A1B scenario will deviate only slightly from the multiannual period 2011-2030.

The obtained results indicate a certain time delay in the occurrence of large wave height values, characteristic so far mainly in the storm season, for the remaining months, which is confirmed by recent years in which storm surges were recorded on the Polish coast, including in the spring period. Extending the period of occurrence of anomalous situations in the wave climate in the South Baltic Sea is undoubtedly an unfavourable factor from the point of view of maritime navigation – it may cause an increase in difficulties for fishing (mainly small dominant units in the general structure of the Polish fishing fleet), transport and passenger traffic, including those related to seasonal tourist traffic.

**Icing**

Scenarios of changes in the occurrence of icing were developed on the basis of

- simulated by the ECHAM5 global model (run 1) of changes in the regional pressure field (SLP),
- fields of average air temperature from the level of 2 m above sea level (T2),
- average air temperature field from 700 hPa (T700).

Each of the above-mentioned predictors had a separate scenario: Future icing changes were determined using statistical models describing the quantitative relationship between the regional field of extortion and the number of days with icing or the value of the icing severity index, the verification of which confirmed their representativeness.[102]

In relation to the applied simulation – the results are very diverse, presented in the following figures.

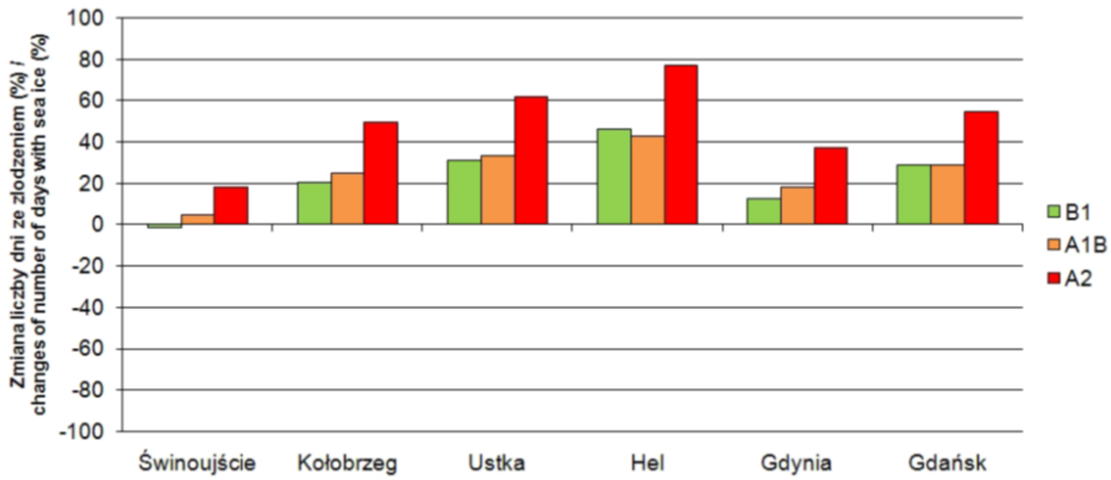



**Fig. 47 Expected changes in the number of days with icing on the Polish coast in the period 2011-2030, developed on the basis of changes in regional atmospheric circulation, in relation to the average value from the reference period 1971 – 1990**

*Source: Wibig J., Jakusik E. (ed.) "Climatic and oceanographic conditions in Poland and in the Southern Baltic Sea, expected changes and guidelines for the development of adaptation strategies in the national economy", Institute of Meteorology and Water Management, National Research Institute, Warsaw 2012*

Static models describing the quantitative relationship between the regional inducement field and the number of days with icing or the value of the icing severity index, the verification of which confirmed their representativeness, were used to determine future icing changes.

The effects of the scenarios prepared for the region of Europe and the North Atlantic, based on future changes in the pressure field, show that in the period 2011-2030, a clear increase in the number of days with icing along the Polish coast should be expected in relation to the reference period 1971-1990. Such an increase is projected for each of the analysed emission scenarios. The scale of these changes is varied – the smallest in Świnoujście, while the largest in Ustka and Hel.

In scenario B1, modifications in the number of days with icing reach approx. 30% in Ustka and Gdańsk, while in Hel they exceed as much as 45%. The smallest changes are expected for Świnoujście – less than 2% compared to the reference period. The A1B scenario predicts slightly larger changes, while the clear increase in the number of days with icing shows the A2 scenario, for which the increase in

[102] Wibig J., Jakusik E. (ed.) "Climatic and oceanographic conditions in Poland and in the Southern Baltic Sea, expected changes and guidelines for the development of adaptation strategies in the national economy", Institute of Meteorology and Water Management, National Research Institute, Warsaw 2012

days for Świnoujście is approx. 20%, while in the case of Hel as much as 75%. The A1B scenario predicts slightly larger changes, while the clear increase in the number of days with icing shows the A2 scenario, for which the increase in days for Świnoujście is approx. 20%, while in the case of Hel as much as 75%. [103]

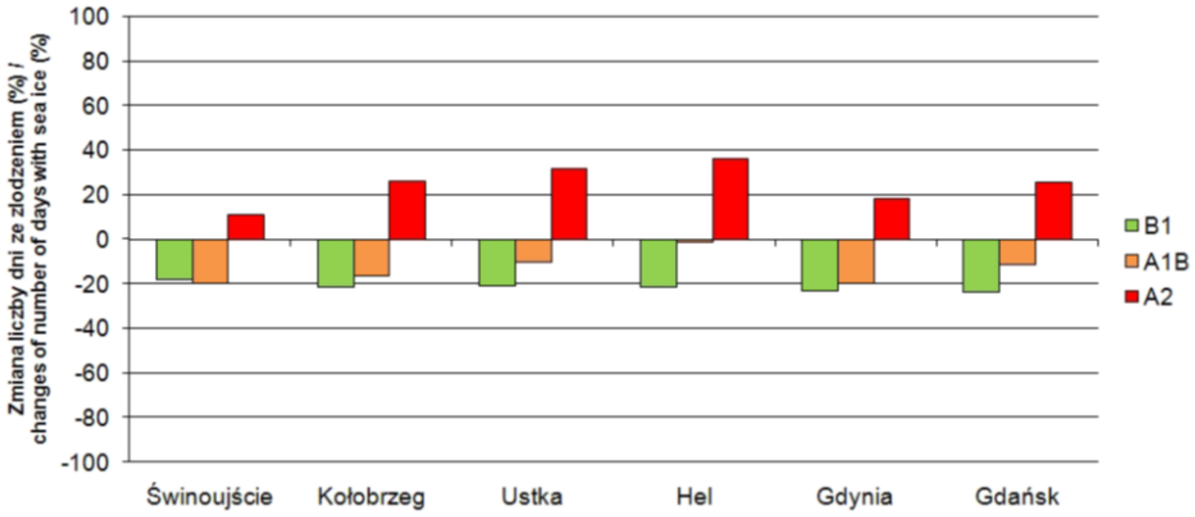



**Fig. 48 Expected changes in the number of days with icing on the Polish coast in the period 2011-2030 developed on the basis of changes in average air temperature from the level of 2m above sea level, in relation to the average value from the reference period 1971 – 1990**

*Source: Wibig J., Jakusik E. (ed.) "Climatic and oceanographic conditions in Poland and in the Southern Baltic Sea, expected changes and guidelines for the development of adaptation strategies in the national economy", Institute of Meteorology and Water Management, National Research Institute, Warsaw 2012*

Different in terms of the sign, the scenarios were obtained taking into account the expected changes in the average air temperature field from the level of 2 m above sea level in the area of the Baltic Sea**Błąd! Nie można odnaleźć źródła odwołania.**. Only in the case of the A2 emission scenario, as in the scenarios of the developed changes in the pressure field, an increase in the number of days with icing along the entire coast is expected – from approx. 11% in Świnoujście to over 30% in Ustka and Hel. On the other hand, emission scenarios B1 and A1B can be expected to have a lower number of icing days than in the reference period. The results of scenario B1 indicate a decrease of 20% at all analyzed measurement points, while the value of the change increases slightly in the eastern direction. In the A1B scenario, the scale of changes varies significantly and ranges from less than 2% in Hel to almost 20% in Świnoujście and Gdynia.[104]

[103] Wibig J., Jakusik E. (ed.) "Climatic and oceanographic conditions in Poland and in the Southern Baltic Sea, expected changes and guidelines for the development of adaptation strategies in the national economy", Institute of Meteorology and Water Management, National Research Institute, Warsaw 2012

[104] Wibig J., Jakusik E. (ed.) "Climatic and oceanographic conditions in Poland and in the Southern Baltic Sea, expected changes and guidelines for the development of adaptation strategies in the national economy", Institute of Meteorology and Water Management, National Research Institute, Warsaw 2012

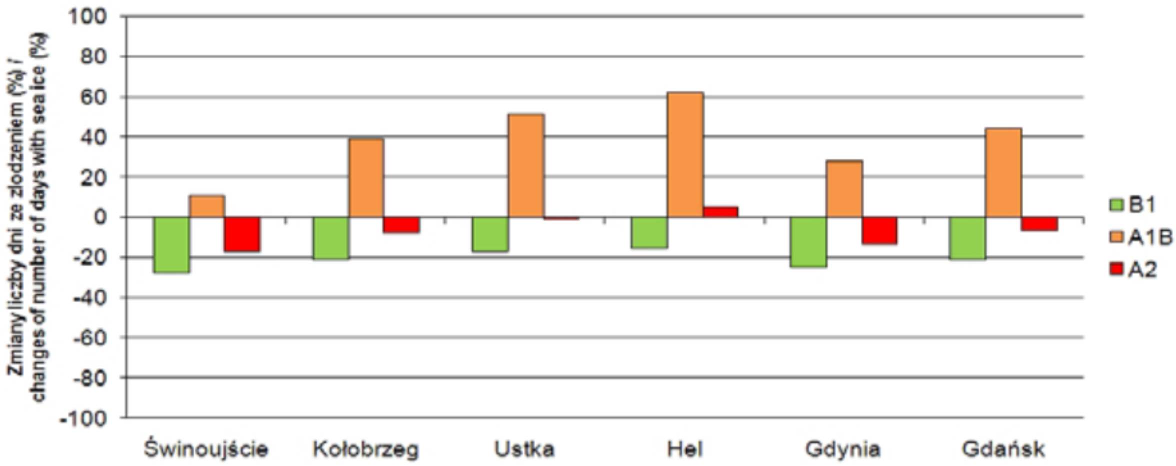



**Fig. 49 Expected changes in the number of days with icing on the Polish coast in the period 2011-2030, developed on the basis of changes in average air temperature from 700 hPa, in relation to the average value from the reference period 1971 – 1990**

*Source: Wibig J., Jakusik E. (ed.) "Climatic and oceanographic conditions in Poland and in the Southern Baltic Sea, expected changes and guidelines for the development of adaptation strategies in the national economy", Institute of Meteorology and Water Management, National Research Institute, Warsaw 2012*

The results based on the expected changes in the average air temperature field from 700 hPa (**Błąd! Nie można odnaleźć źródła odwołania.**) show a different direction of changes depending on the emission scenario. Scenario B1 will see a significant reduction in the average number of days with icing in the period 2011-2030 compared to the period 1971-1990. On most of the stations in question, the changes will exceed 20%, and in Świnoujście they will approach up to 30%, only in Ustka and Hel they will amount to approx. 15-17%. A decrease in the number of days, although significantly smaller than in the case of B1, is also expected in the case of scenario A2, with maximum values in Gdynia and Świnoujście (approx. 13% and 17%, respectively). Only in Hel the results indicate a slight increase in the average number of days with icing. A completely different direction of change is expected in the A1B scenario, which indicates a significant increase in the number of days with Icing along the entire coast from approx. 30% in Gdynia to over 60% in Hel, only in Świnoujście the increase will slightly exceed 10%.[105]

### 5.5.3 Air quality

The document in force in Poland is the Convention on Long-range Transboundary Air Pollution, drawn up in Geneva on 13 November 1979 and ratified by Poland. According to the abovementioned Convention, '*long-range transboundary air pollution' means air pollution the physical origin of which is situated wholly or partly within an area under the jurisdiction of one State and which has a detrimental effect on an area under the jurisdiction of another State over such a distance that it is not at all possible to distinguish the contribution of individual sources or groups of sources*. '

In order to monitor the situation of transboundary movements of air pollutants, the EMEP programme has been set up in Europe, a co-operative programme for monitoring and evaluation of the long range transmission of air pollutants in Europe. At Polish stations, the following scope is implemented: measurements in the gas phase $SO_2$, $NO_2$, $O_3$; in the aerosol: $SO_4^{2-}$, $NO_3^-$, $NH_4^+$, $Cl^-$; in precipitation: $SO_4^{2-}$

[105] Wibig J., Jakusik E. (ed.) "Climatic and oceanographic conditions in Poland and in the Southern Baltic Sea, expected changes and guidelines for the development of adaptation strategies in the national economy", Institute of Meteorology and Water Management, National Research Institute, Warsaw 2012

, $NO^{3-}$, $NH_4^+$, $Cl^-$, $Na^+$, $Ca^{2+}$, $K^+$, $Mg^{2+}$, electrolytic conductivity, pH and at stations in Łeba and Borecka Forest - heavy metals.[106]

The largest accumulation of pollutants occurs within the entire body of water, they are on routes intensively used by maritime transport, in the Danish straits, in the vicinity of large port cities. The values are even orders of magnitude higher than those recorded overland, with the exception of larger agglomerations (e.g. Szczecin, Tricity). The above observation is reflected on the surface of the entire Baltic Sea.[107]

## 5.6 Geological structure and earth surface

The geological structure in the Baltic Sea area is the result of long-term sedimentation processes, contemporary changes taking place at the bottom of the sea, as well as the activity of the Scandinavian ice sheets.

Due to the intracontinental nature of the Baltic Sea, its geological structure is similar to the land surrounding the basin. The two main units of geological structure are separated by the Teysser-Tornquist line (collision trans-European shelf) with a course similar to the Koszalin-Telleborg line and are represented by the Eastern European and Western European platforms.[108]

The Eastern Eropean platform runs east of the TT line, built of a crystal plinth of Precambrian rocks, covered with a complex of Mesozoic era sedimentary rocks, and covers the north-western end of the Baltic syneclise. Syneclise from the east creates an extensive depression of the crystalline substrate, and its axis runs on the Petersburg-Riga-Królewiec-Łeba line. The Peribaltic syneclise borders the Baltic shield in the north, the Latvian valley in the east, reaching all the way to the Taissere-Tornquist line in the south-west.[109]

The Paleozoic and Mesozoic rock complexes of the Eastern European platform are included in the system of tectonic blocks limited by faults, which are mostly embedded in the Precambrian crystalline foundation.[110]

The Western European platform runs west of the TT line, built of Paleozoic sediments subjected to Caledonian and Variscan orogeny, covered with folded Mesozoic sediments. The area belonging to the Western European Paleozoic Platform shows a greater degree of tectonic deformation. The ceiling of the Precambrian rocks is located here at a depth of about 10-15 km. Above are the undulating sediments of the lower Paleozoic (Cambrian, Ordovician and Silurian), which are covered with sediments of permian and mesozoic, and locally also paleogene.[111]

**The shape of the surface of the Baltic Sea**

The Baltic Sea is a shallow, northern European internal sea, which is also an epicontinental shelf sea (the average depth is 52 m, while the maximum is 459 m). The Danish straits connecting the Baltic Sea

[106] https://powietrze.gios.gov.pl/pjp/content/regional_background_pollution_emep
[107] Data for Poland is available at the following link: https://webdab01.umweltbundesamt.at/cgi-bin/wedb2_off_choose_pollutants_trend.pl?cgiproxy_skip=1
[108] Plan for the spatial development of internal marine waters, the territorial sea and the exclusive economic zone, 2021
Environmental Impact[109] Assessment of the project involving exploration for and exploration for oil and natural gas deposits within the limits of the "Gołdap" concession, Warsaw April 2012.
[110]http://www.iopan.pl/baltyk2015/materialy/StreszczeniaWykladowKonferencyjnych/15_RolaProcesowGeologicznych.pdf
[111] The role of geological processes in shaping the Baltic environment.

with the North Sea are: Skagerrak, Kattegat (outer straits) and Sund, Great Belt and Little Belt (inner straits).[112]

The catchment area, otherwise the drainage area (1,721,233 km$^2$) is four times larger in relation to the surface of marine waters (415,266 km$^2$). A list of morphological data and the Baltic Sea basins is separated in the table below[113]:

**Table 48 Morphometric data of the Baltic Sea and its seven basins on the basis of the study "Physical and geographical characteristics of the Baltic Sea basin"**

| Water bodies | Catchment area [km$^2$] | Area [km$^2$] | Water volume [km$^3$] | Maximum depth [m] | Average depth [m] |
|---|---|---|---|---|---|
| **Gulf of Bothnia** | 269,950 | 36,260 | 1,481 | 156 | 40.8 |
| **Bothnian Sea** | 229,700 | 79,257 | 4,448 | 294 | 61.7 |
| **Gulf of Finland** | 419,200 | 29,498 | 1,098 | 123 | 37.2 |
| **Gulf of Riga** | 127,400 | 17,913 | 406 | 51 | 22.7 |
| **Baltic Proper** | 568,973 | 209,930 | 13,045 | 459 | 62.1 |
| **Sound and the Belts Sea** | 27,360 | 20,121 | 287 | 38 | 14.3 |
| **Kattegat** | 78,650 | 22,287 | 515 | 109 | 23.1 |
| **Total** | **1,721,233** | **415,266** | **21,721** | **459** | **52.3** |

*Source: Wayback Machine (archive.org)*

[112] https://naszbaltyk.pl/cechy-morphometryczne/

[113] Håkanson L., 1991, Physical and Geographical Characteristics of the Baltic Sea Basin, Ed. Baltic Sea Environment, 1-37

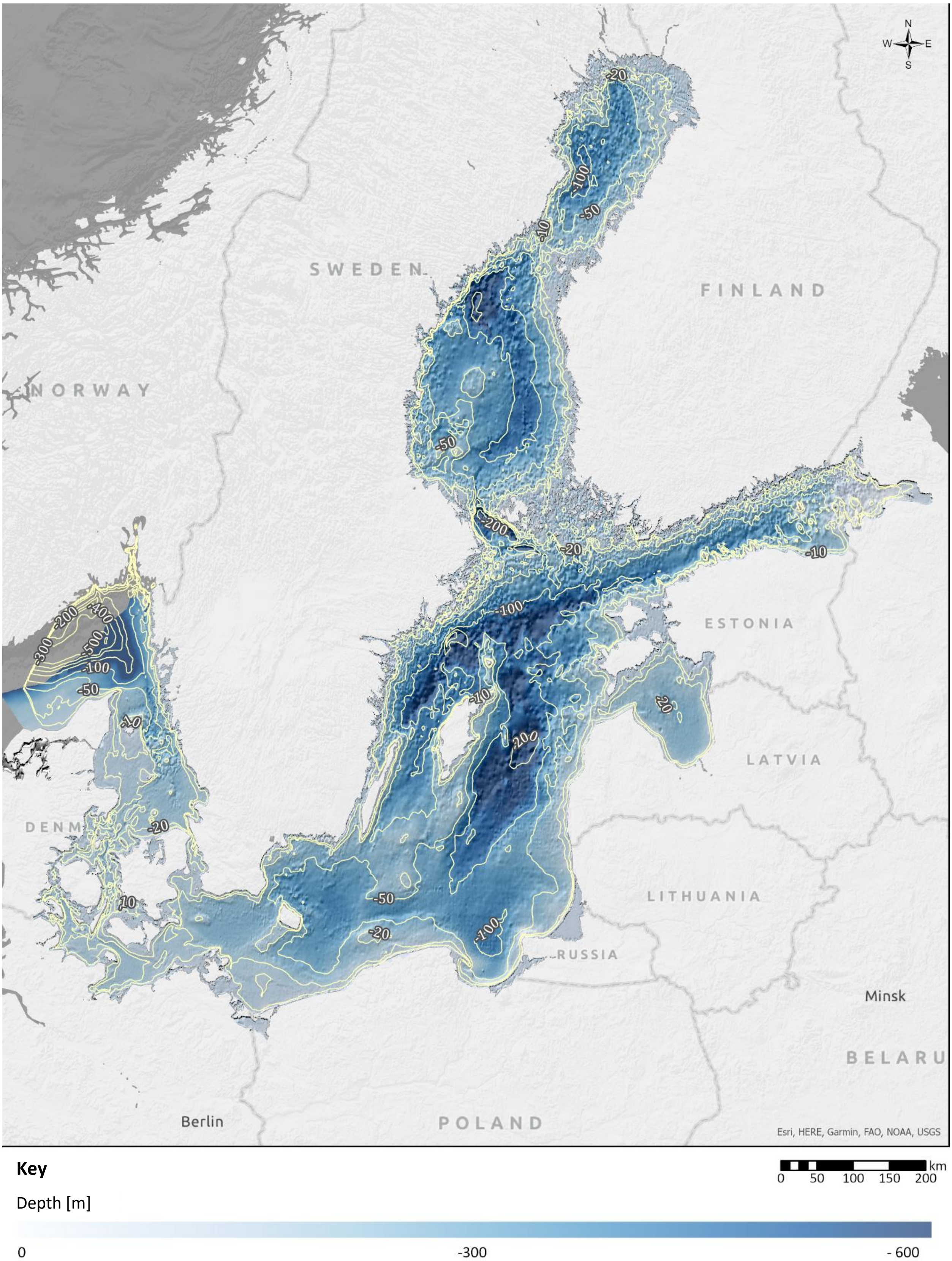



**Fig. 50 Baltic bathymetry**

*Source: Own study based on HELCOM*

The boundaries of the area covered by the study are located in the Baltic Sea basin, which is also its deepest part (the average depth is 62.1 m).

The sub-regions belonging to the polish maritime zone are covered by the following sub-regions: the southern part of the Bornholm Basin, the Słupsk Basin, the eastern part of the Gdańsk Basin and the western part of the Pomeranian Gulf. On the length of the coast, the depth does not exceed 30 m, the shallowing stretches with the Odra and Słupsk Bars located above 20 km from the coast.

In the dominant part, the bottom of the Baltic Sea slopes in the northern direction (a slight slope) without the Gulf of Gdańsk, where there is a steep slope towards the Gdańsk Deep. The most intensively sloped slopes are located on the edge of the Gulf of Puck and in the areas of the Hel Peninsula.[114]

[114] Forecast of the impact on the environment of the draft plan for the spatial development of internal marine waters, the territorial sea and the exclusive economic zone (Gdańsk, 2018)

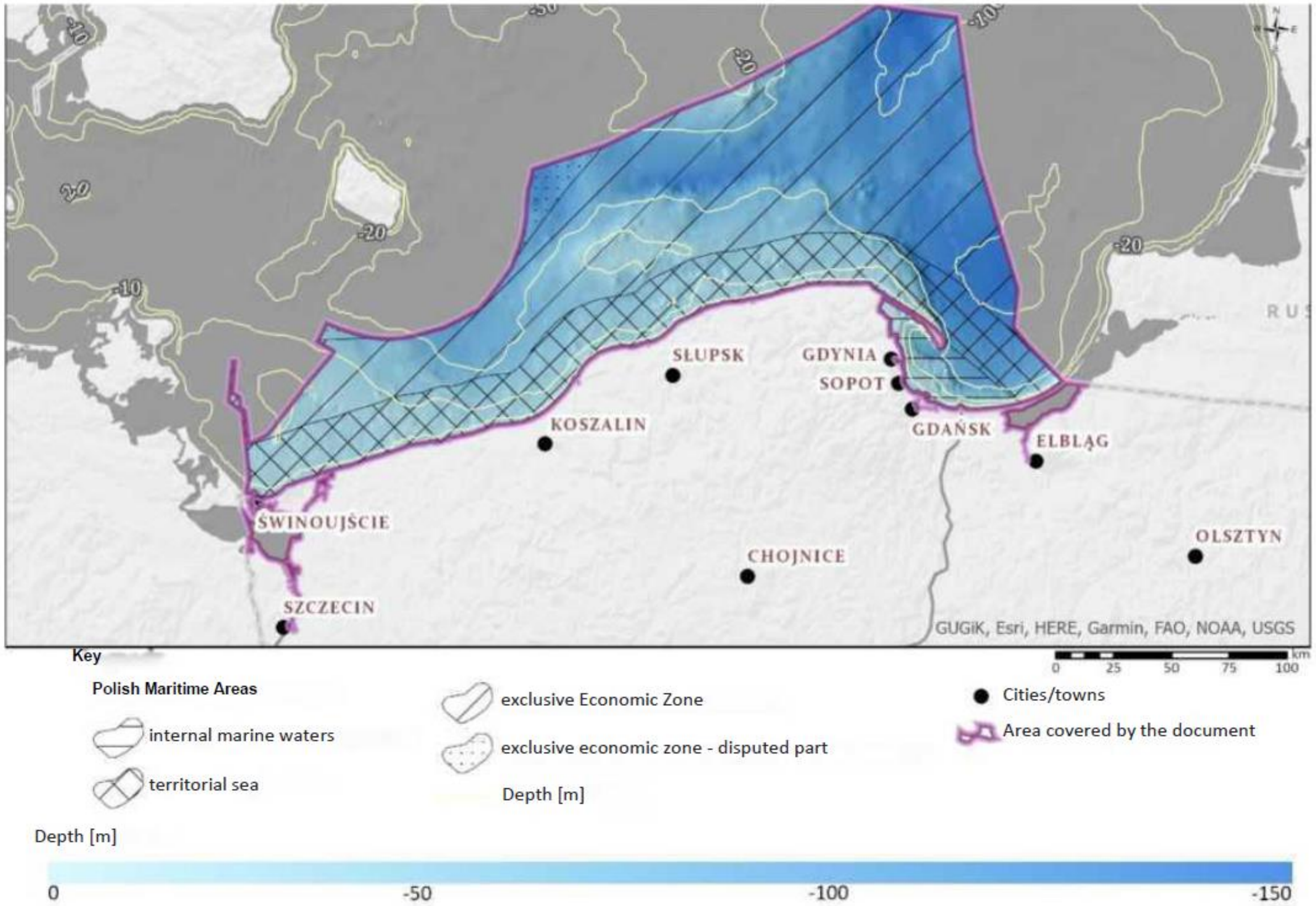



**Fig. 51 Bathymetry of Polish sea areas**

*Source: Own study based on HELCOM data*

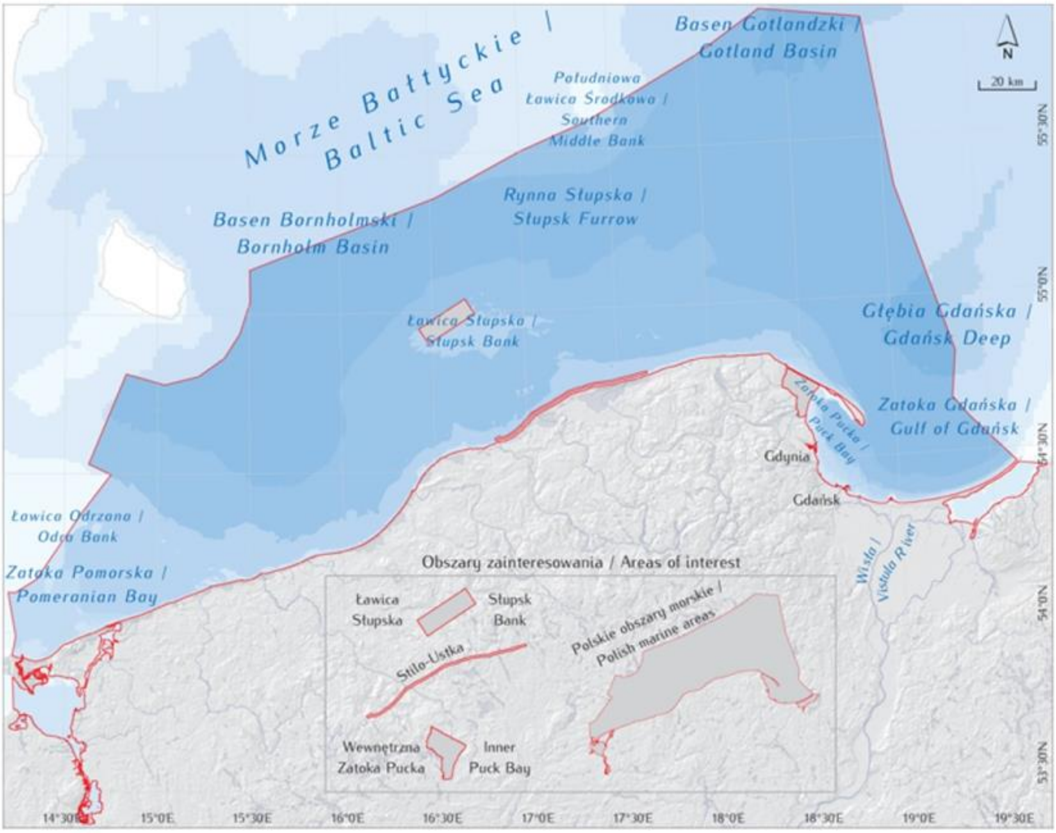



**Fig. 52 Morphological elements of the bottom of the Baltic Sea in the area of impact**

*Source: Atlas of the bottom habitats of Polish marine areas.*

The surface of the Baltic Sea bottom is the result of the last Pleistocene glaciation – the Scandinavian icebergs invaded Poland several times during this period. The ice crossed the Baltic Sea Basin, entering the Central European Lowlands. The youngest glaciation was the northern glaciation, the so-called Vistula Glaciation. In addition, the formation of the bottom was also influenced by the processes of accumulation and erosion, the accompanying processes at sea currents, as well as the waves and the processes of accumulation of sediments from the land.

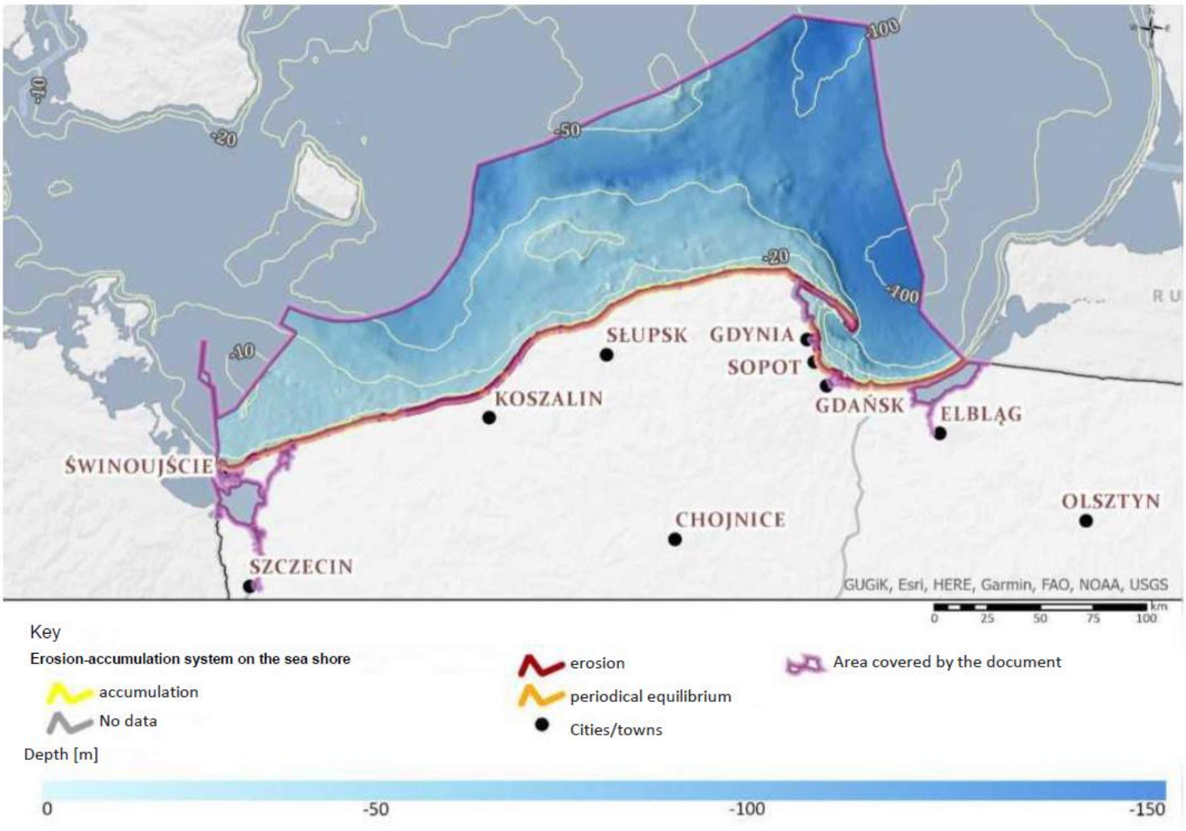



**Fig. 53 Seabed shaping and geomorphological processes taking place on the Baltic coast**

*Source: Own elaboration on the basis of: Study of Conditions for Spatial Development of Polish Maritime Areas.*

**Coast shape**

The coastal zone is understood as forms of terrain shaped by the transition strip, located between the coast and the sea. The shore itself is commonly identified with the mainland, which is everything that is located in the immediate vicinity of the sea – cliffs, dunes and beach. The beach is the central part of the coastal zone, which is flooded as a result of the change in sea level. As a result, the forms and coastal zone are shifted towards the sea or land. This state may occur periodically – fluctuations in sea level or permanently – through erosion or accumulation.

The Baltic belongs to the seas with no drains, and the periodic changes in the level are mainly related to the variable pressure system, as well as the developing wind waves.[115]

In the area covered by the Forecast covering the southern coast of the Baltic Sea, the following geomorphological forms shaped by the processes can be distinguished:

- land accumulation (alluvial fans at estuaries),
- marine accumulation (beaches, spits),
- marine and terrestrial accumulation (dunes),
- abrasion (marine erosion), e.g. cliff.

The Baltic coast, as well as its coastal zone, is currently most shaped by processes such as coastal zone currents, sea waves, as well as changes in water levels and ecological processes.

[115] Ways of protecting the sea shores and their impact on the natural environment of the Polish Baltic coast, 2013 WWF

In Poland, due to the terrain and geological structure, three basic types of sea coasts can be distinguished: flat coast (alluvial), dune coast (aligned) and cliffs.

The length of the sea shore is 77% covered by dune coasts. These coasts were created as a result of secondary ecological processes and direct marine sedimentation, built of the sands of the holocene age.[116]

One of the areas covered by the Forecast is the Słowiński National Park, whose characteristic features are the dunes located in it and measures – which are narrow strips of land separating the lakes from the sea, on which the dunes constitute the main landscape element. Within the Słowiński National Park, the most important measures are: Gardnieńska and Łebska Spits, which due to their exceptional values were entered in the Red Book of Polish Landscape as a dune-forest area. **Around 500 hectares are mobile dunes with a height of more than 40 m, which is considered to be the largest area in Europe.[117]**

In 13 areas of the Polish coast, with the exception of the Hel Peninsula, there are measurements. They represent about 32% of the coastline of the South Baltic coast from Piaski to Świnoujście, which translates into 137.5 km.

The most pronounced form in the morphology of the southern shores of the Baltic Sea are the cliffs. Their average height is from 10 to 30 m, while the active cliffs reach an average height of approx. 18 m. The highest cliffs can reach approx. 90 m and are located in Wolin (Gosań hill). Cliffs with an average height of 45-50 m can be found in the vicinity of Jastrzębia Góra and Chłapów. The origin of the cliff coasts reaches back to the Pleistocene and is associated with glacial and fluvioglacial sedimentation.

The stability of the cliffs is mainly influenced by the hydrodynamic activity of the sea, which shapes high and steep coasts. Other influencing factors may be weather conditions such as heavy rain, freezing, wind, as well as human activity or an unfavourable geochemical system.

**Bottom Coverage**

The water catchment area of the Baltic Sea covers the entire area of the Quaternary sediments. In the Baltic shield area, the thickness of the Pleistocene cover rarely exceeds a few metres, while the thickness of the Pleistocene increases strongly from the eastern and southern coasts of the Baltic to the south and south-east.[118] Pleistocene thickness variation in the Polish Baltic zone may vary from about 5 to 30-40 m. The highest can be reached in subglacial gutters, where it reaches 50 m or more.

Often, pleistocene deposits such as clays, gyttja and muds are visible on the bottom surface or covered with a small layer of residual deposits. Quaternary sediments with the lowest thickness can be observed in the area of deep-water pools, which is the result of exaggeration processes that took place during the Pleistocene period. In the Polish zone, the areas with the largest total thickness are: Gdańsk basin (approx. 10 m), Bornholm basin (approx. 5 m) and the southern part of the Gotland basin (3-4 m).

Therefore, two areas can be distinguished in the area of the seabed of the southern part of the Baltic Sea:

---

[116] Forecast of the impact on the environment of the draft plan for the spatial development of internal marine waters, the territorial sea and the exclusive economic zone (Gdańsk, 2018)
[117] Rutkowski, P., Wajsowicz, T., Maciejewska-Rutkowska, I., Nowiński, M. (2016). Forest soils of the Gardieńsko-Łebska Spit (Słowiński National Park) against the background of selected areas of Polish inland dunes in the context of natural forest regeneration
[118] Uścinowicz S., Geochemistry of surface sediments of the Baltic Sea, National Geological Survey, 2011

- with sand and gravel deposits, as areas with a depth less than the surface of the pycnocline,
- with silty-clay deposits, as areas located in the deeper parts of the bottom, below the surface of the pycnocline.[119]

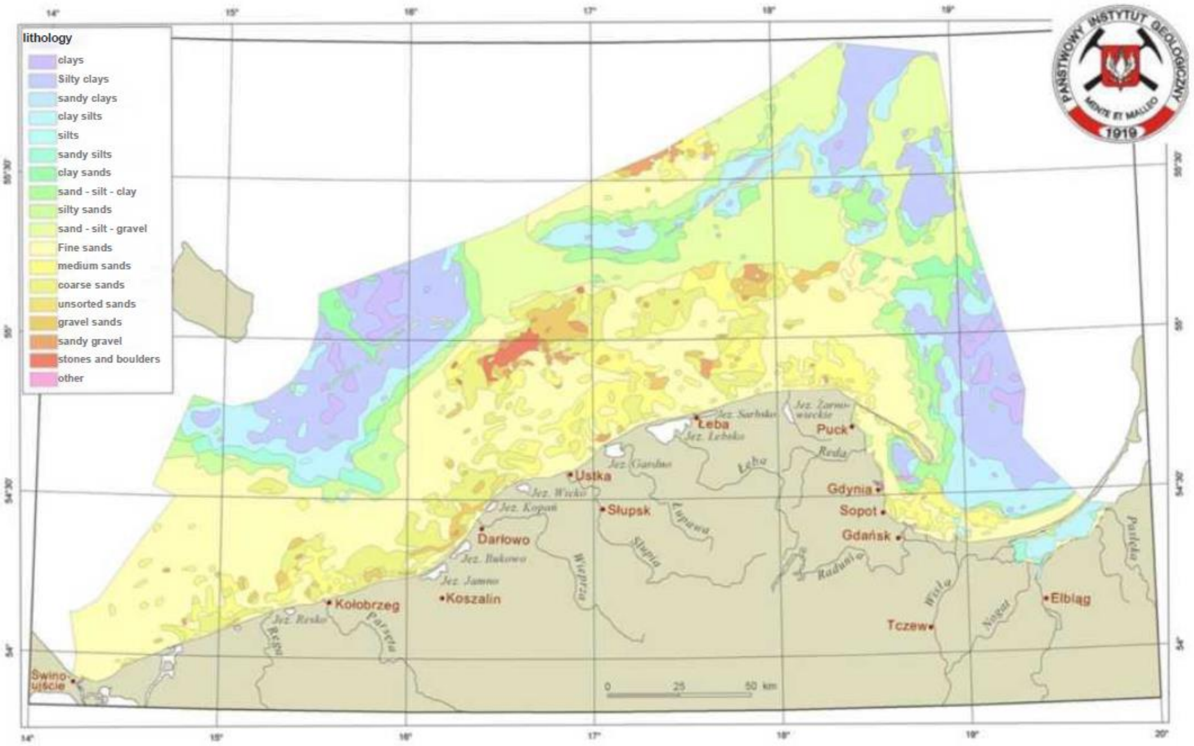



**Fig. 54 Map of surface sediments (simplified version) based on the boundaries in the source material**

*Source: PGI https://www.pgi.gov.pl/docman-tree/oddzial-geologii-morza/opracowania-oddzialu-geologii-morza/mapa-geologiczna-dna-baltyku-arcgis/1223-mapa-osadow-powierzchniowych/file.html*

The above map shows that a large area includes areas of the bottom covered with sandy material. They occur in the Odra Bar, the Stilo Bar, the southern part of the Słupsk Bar, the southern Central Bar and the Czołpińska Bar.

Bottom areas covered with sands with gravel and gravel occur in the region of the southern Central Bar, the Słupsk Bar, and to a lesser extent in the position of shallow water areas along the coast.

In the deep water areas, below the pycnocline, the mud-clay sediments predominate, mainly located within the Bornholm Basin bottom, a significant part of the Rynna Słupska bottom, the Gotland Basin and the Gdańsk Basin. Clay sediments originate in particular from the yoldia sea and ancylus lake, while silty-silky sediments from lithography and polythorn sediments under a small thickness are covered by modern small-clastic sediments. Locally, there are also outcrops of underwater clays and tills[120].

In the coastal zone of the Baltic Sea, typical forms for areas of the sandy bottom up to 10 m can be distinguished: reefs, channels and fans of breaking currents. Larger depths above 10 m and up to approx. 30 m will be characteristic for accumulations in the form of sand waves and megaripplemarks, as well as relics of post-glacial sculpture. At the depth of the bottom below 25-30 m, the surface is

[119] Forecast of the impact on the environment of the draft plan for the spatial development of internal marine waters, the territorial sea and the exclusive economic zone (Gdańsk, 2018)
[120] Forecast of the impact on the environment of the draft plan for the spatial development of internal marine waters, the territorial sea and the exclusive economic zone (Gdańsk, 2018)

usually levelled and in few places there are traces of feeding, ripple marks and, as in the case of the previous layer, relics. In the deepest parts, where the conditions are anaerobic, the bottom surface is leveled and the deposits occurring there are laminated muddy clays[121].

The following figure shows the distribution of surface sediments at the bottom of the Polish Baltic Sea[122].

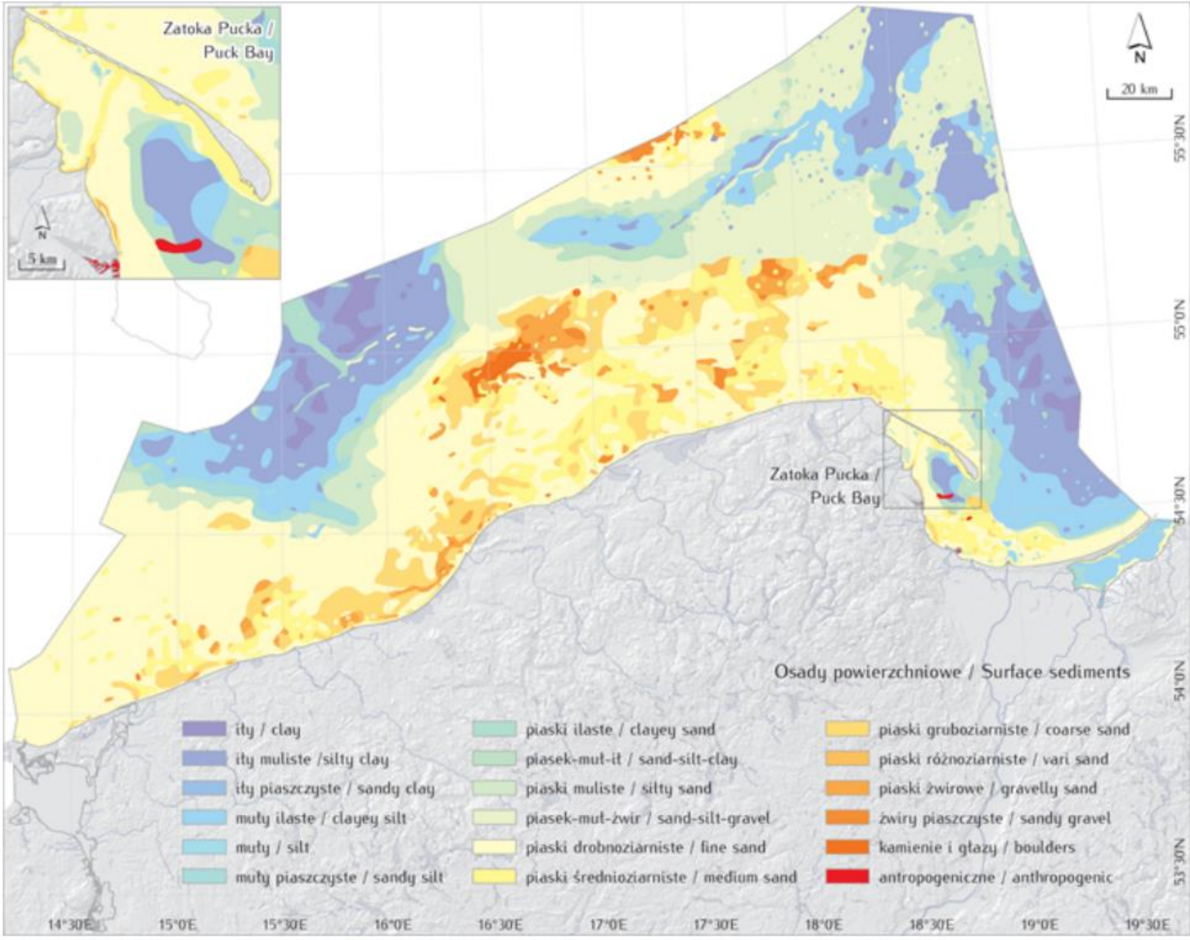



**Fig. 55 Surface sediments of the Baltic Sea seabed in the area of the Polish coast**

*Source: Atlas of the Habitats of the Seabed of Polish Marine Areas, Gdynia 2009*

## 5.7 Landscape

In Article 5 p.23 of the Nature Conservation Act of 16 April 2004, landscape values are defined as "landscape values – natural, cultural, historical, aesthetic and visual values of the area and the associated terrain, formations and components of nature and elements of civilisation, shaped by natural forces or human activity". In turn, in the Act on the Protection of the Environment of 27 April 2001, the landscape is understood as one of the natural elements of the environment, on an equal footing with water, air, plants or animals (Article 3, point 39). On the other hand, the definition of the cultural landscape is contained in Art. 3 point 14 of the Act of 23 July 2003 on protection and care of

[121] Forecast of the impact on the environment of the draft plan for the spatial development of internal marine waters, the territorial sea and the exclusive economic zone (Gdańsk, 2018)
[122] Forecast of the impact on the environment of the draft plan for the spatial development of internal marine waters, the territorial sea and the exclusive economic zone (Gdańsk, 2018)

monuments. The cultural landscape is "a space perceived by people, containing natural elements and products of civilization, historically shaped as a result of natural factors and human activity".

In the case of pom, the division into the waterfront landscape and the underwater landscape should be adopted with reference to the elements of the cultural landscape.

**The waterfront landscape** of the southern Baltic Sea is diversified in terms of the types of landscapes. According to the data contained in the "Study of Spatial Development Conditions of the Polish Maritime Areas with spatial analyses" (Gdańsk, February 2015), the following natural landscapes can be indicated on the Polish coast. The Fluvioglacial landscape dominates spatially on the Polish coast. In the valleys of rivers leading to the sea there is a landscape of floodplain river valleys. Delta landscapes occur in the region of Lake Łebsko and Lake Gardno and in the vicinity of the Szczecin Lagoon and the Gulf of Gdańsk. However, the area of the Szczecin Lagoon is dominated by the marsh landscape, and in the area of the Gulf of Gdańsk, the landscape of the flood plains prevails. The surroundings of the Gulf of Szczecin are mainly marsh and delta landscapes, and the Gulf of Gdańsk delta landscapes and floodplains. The ranges of natural landscapes of the Polish coast are shown in the figure below.

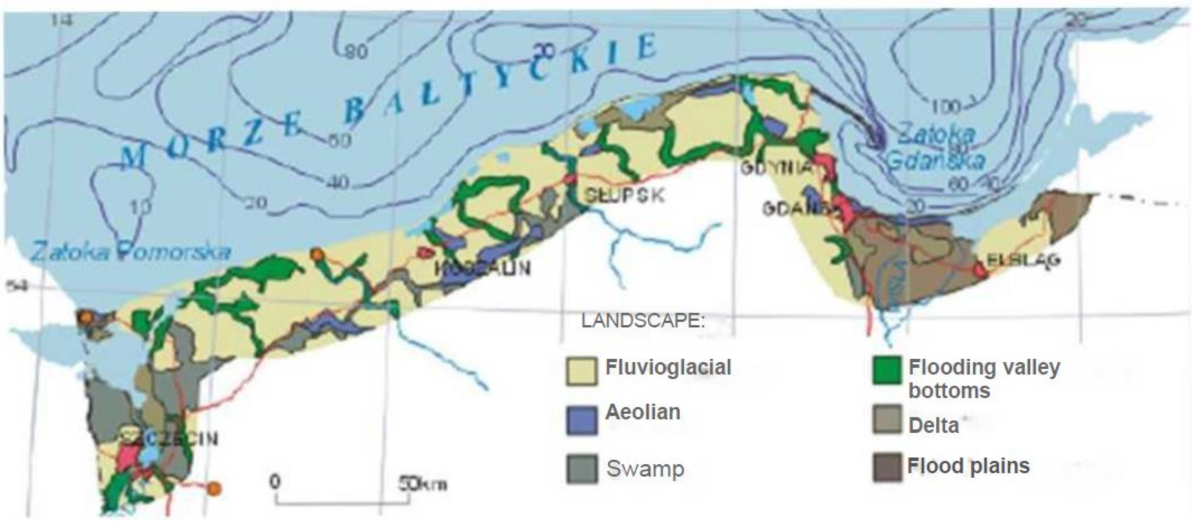



**Fig. 56 Reach of natural landscapes on the Polish coast**

*Source: „Studium Uwarunkowań Zagospodarowania Przestrzennego Polskich Obszarów Morskich z analizami przestrzennymi", Maritime Institute in Gdańsk, Independent Laboratory of Spatial Policy, Gdańsk, February 2015.*

In turn, as part of the development of the forecast of the impact of the pom spatial development plan, it[123] was indicated that the current types of landscapes are the result of the location of the coast in the Baltic Sea contact zone and the significant role of the phenomenon of anthropopressure in coastal shaping. As a result, several types of coastal landscapes were created:

- type of high coasts (cliff) - cliff sections currently include approx. 65 km of the open Polish sea, the height of cliff sections varies from up to 95 m of cliff height in Wolin, through 45-50 m in the vicinity of Jastrzębia Góra and Chłapów, 15-40 m on the section between Ustka and Rowy, to lower reaching 10-15 m of height between Dziwnówek and Niechorz and very low – up to 6 m of height in the vicinity of Bagicz (Kołobrzeg-Sianożety),

[123] Forecast of the impact on the environment of the draft plan for the spatial development of internal marine waters, the territorial sea and the exclusive economic zone (Gdańsk, 2018)

- the type of low coasts (measured) – in particular: Hel Peninsula, Łeba spit, Jamno lake spit, Vistula Spit,
- dune type - dune coasts with dune bands with heights of 2-30 m above sea level constitute about 85% of the Polish coast,
- the type of alluvial coastal plains and the type of river valley bottom – in the estuary sections of rivers leading to the Baltic Sea, in particular in the area of the Vistula delta and the Szczecin Lagoon or Lake Łebsko.

In addition, there are sections of varying degrees of anthropogenic transformation within the banks, forming a "visible maritime cultural landscape". These are areas occupied by ports and their infrastructure, as well as other objects and structures related to maritime measures, such as marinas, quays and piers, lighthouses, warehouses and buildings, and objects of material cultural heritage.

The landscape on the high seas is also shaped by anthropogenic elements related to maritime management, transport, fisheries, extraction of raw materials, energy production:

- offshore permanent or long-term point facilities such as drilling platforms and wind turbines,
- moving point objects – fishing boats, vessels, tankers.

No offshore wind farms have yet been built in the POM. However, after the planned wind farms have been built, they will constitute the most distinctive elements of the open sea landscape. Depending on the technical parameters (especially the height of the turbines) and the location, the turbines may also be visible from the coast.

Types of natural landscapes occurring **in the underwater part of** the Baltic Sea are mainly shaped by the type of substrate and flora and fauna complexes of a given part of the seabed. The seabed in the Baltic coastal zone is very diverse, ranging from sandy shoals to extensive pebbles. The bottom of the Gulf of Gdansk and Puck are covered with sands, while in the deeper parts of the sea the substrate is shaped by silts and silty loams. A characteristic element of the underwater landscape of the Gulf of Pomerania is the Odra Bank, which forms a large shoal patch in the central part of the Gulf. On the other hand, there is a different type of landscape within the Słupsk Bar, the bottom here is shallow sand and gravel, with fields of stones and glacial boulders. These fields measuring up to several kilometres are also referred to as the "stone reef"[124]. The shoreline of the Baltic Sea has undergone significant changes since the last glaciation. This caused the coastal areas of the southern Baltic to be submerged with the remains of sediments and surrounding landscapes. For this reason, the area located up to 30 km from the coastline, both the coastal zone and open sea waters are areas with a high probability of the occurrence of sunken settlements and landscapes.

The open sea area is not classified as above for types of natural landscapes. The project BALANCE (Baltic Sea Management – Nature Conservation and Sustainable Development of the Ecosystem through Spatial Planning) created the concept of underwater landscapes[125]. As part of this concept, it was proposed to divide the Baltic Sea into 60 types of underwater landscapes identified on the basis of the criterion of bottom sediments, depth (sunlight) and salinity. The pom subsea landscape types (19 types) are shown in the figure below.

[124] Forecast of the impact on the environment of the draft plan for the spatial development of internal marine waters, the territorial sea and the exclusive economic zone (Gdańsk, 2018)
Source: Baltic Sea Management – Nature Conservation and Sustainable Development of the Ecosystem through Spatial Planning http://balance-eu.org/

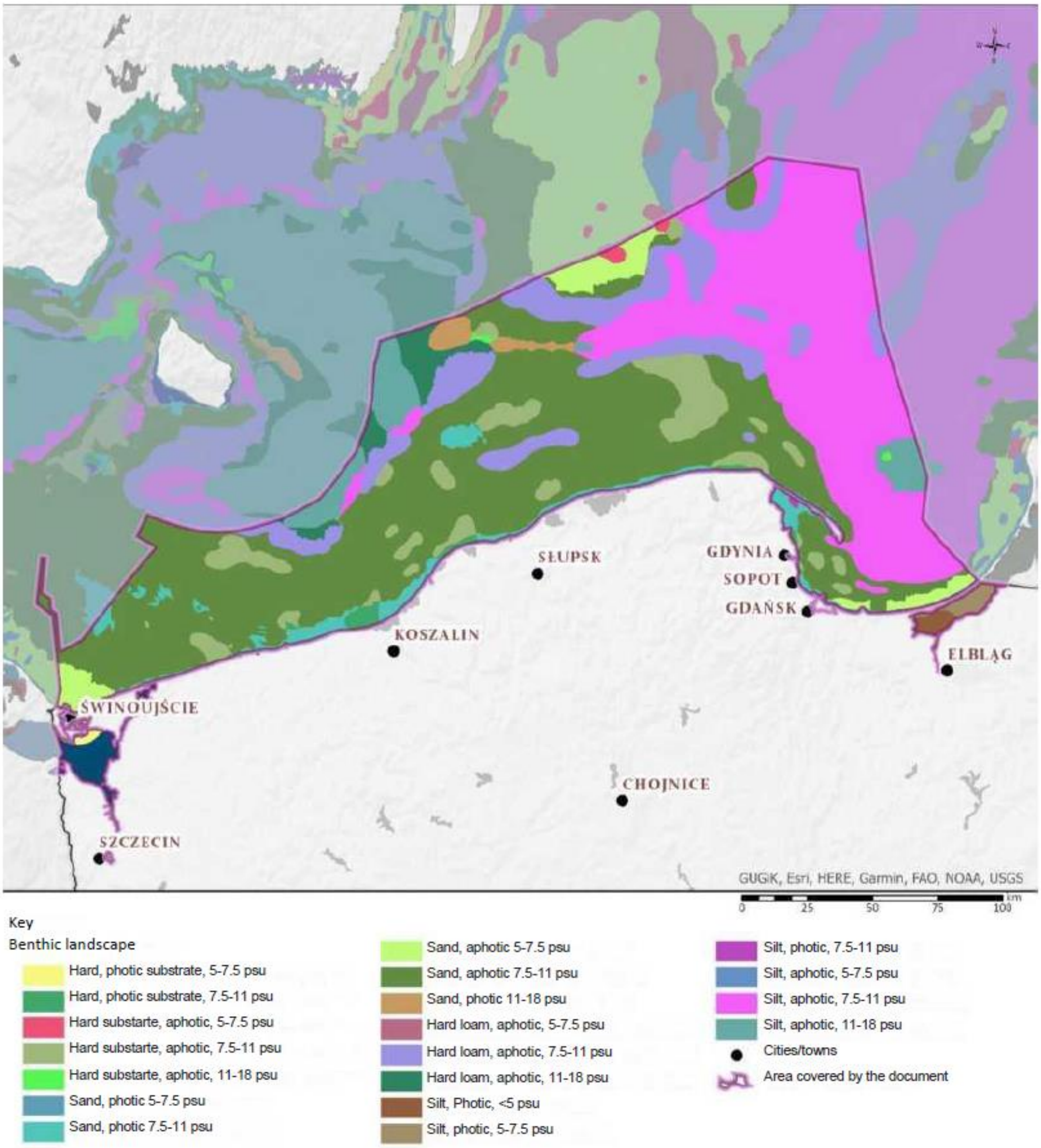



**Fig. 57 Benthic Marine Landscape of the Baltic Sea within pom**

*Source: own study based on HELCOM and balance-eu.org Polish names of landscape types in accordance with: Zaucha J. (2018). Maritime space management. Warsaw: Wydawnictwo Akademickie SEDNO).*

Polish nomenclature of landscape types in accordance with: Zaucha J. (2018). Maritime space management. Warsaw: Wydawnictwo Akademickie SEDNO).

There is also a distinctive maritime cultural landscape. According to the terms of the National Maritime Museum in Gdańsk, the maritime cultural landscape is closely related to changes in coastal areas and the seabed. Facilities and structures related to maritime measures, such as berths with mooring piles, quays and piers, lighthouses, warehouses and buildings and other remains found on land are referred to as the 'visible maritime cultural landscape'. The invisible part of the maritime cultural landscape are, for example, stories and tales related to the sea. They are so-called intangible sources. All these elements of the maritime cultural landscape – visible and invisible – form a kind of network covering the Baltic Sea and the North Sea. Only some parts of the marine cultural landscape are accessible to the public. The others are underwater.[126]

Sunken sediments and landscapes are generally not only covered by water, but also partially or completely covered by sediments on the seabed. Elements of the underwater cultural heritage which constitute '*any trace of human existence of a cultural, historical or archaeological nature which has remained partially or wholly underwater, periodically or permanently, for at least 100 years, such as, but not limited to, ships, aircraft, other vehicles or parts thereof, including cargo*'[127], are described in Chapter 5.10.

Within the analysed area, there are a number of forms of nature protection under the Nature Conservation Act, within which the landscape is an element subject to legal protection. These are in particular:

- national parks (Woliński PN, Słowiński PN),
- natural and landscape complexes (Helski Cypel, Usedom Peat bogs, Dębina),
- landscape parks (Seaside PK, PK of the Elbląg Upland, PK of the Vistula Spit),
- protected landscape areas (OChK Nogat River, OChK Bauda River, OChK Koszalin Coastal Belt, OChK Staroprussian Coastal Belt, OChK Coastal Belt East of Ustka, OChK Coastal Belt West of Ustka, OChK Coastal Belt West of Ustka (West Pomeranian province), OChK River Szkarpawa and Tuga, OChK Sobieszewska Island, OChK Coastal Belt, OChK Elbląg Upland – East).

One of the most unique places on the coast in terms of the value of the landscape is the Słowiński National Park, due to the dune belt with moving dunes.

## 5.8 Natural resources

So far, the geological survey of the area of Polish maritime areas in terms of extraction of mineral resources has shown the existence of oil, natural gas, construction aggregate and amber. Four areas were distinguished, where there are significant resources of gravel and coarse-grained sands.[128]

The bottom of the Baltic Sea is rich in a large concentration of resources from which we can extract building materials, such as: boulders, gravel, pebbles and sands. The Polish maritime zone includes a significant accumulation of these materials in the Central Bank, the Gulf of Koszalin and the Słupsk Bar. Documented three deposits of gravel and sand aggregate with balance resources of 147,983 thousand tonnes on a total area of deposit fields of 70.8 km$^2$. Decks of natural aggregates are mainly found in coastal and coastal zones, within banks and bank embankments (ibidem).[129] According to the data from the CBDG[130] (as of 21.01.2021), 39 mineral resources are located in the analyzed area. These include:

- 4 deposits of natural gas,
- 3 oil fields,
- 22 deposits of natural aggregates,
- 2 deposit of sands with heavy minerals,
- 1 bed of rock salt,

[126] National Maritime Museum in Gdańsk: http://www.2wrecks.nmm.pl/czym-jest-morski-krajobraz-kulturalurowy
[127] UNESCO Convention on the Protection of the Underwater Cultural Heritage of 2 November 2001
[128] Update of the preliminary assessment of the state of the marine environment
[129] MPZP PM
[130] Central Geological Database [CBDG (pgi.gov.pl)](pgi.gov.pl)

- 2 deposits of potassium salts,
- 3 deposits of medicinal waters,
- 1 thermal water deposit,
- 1 amber deposit.

The arrangement of these deposits is shown in the figure below.

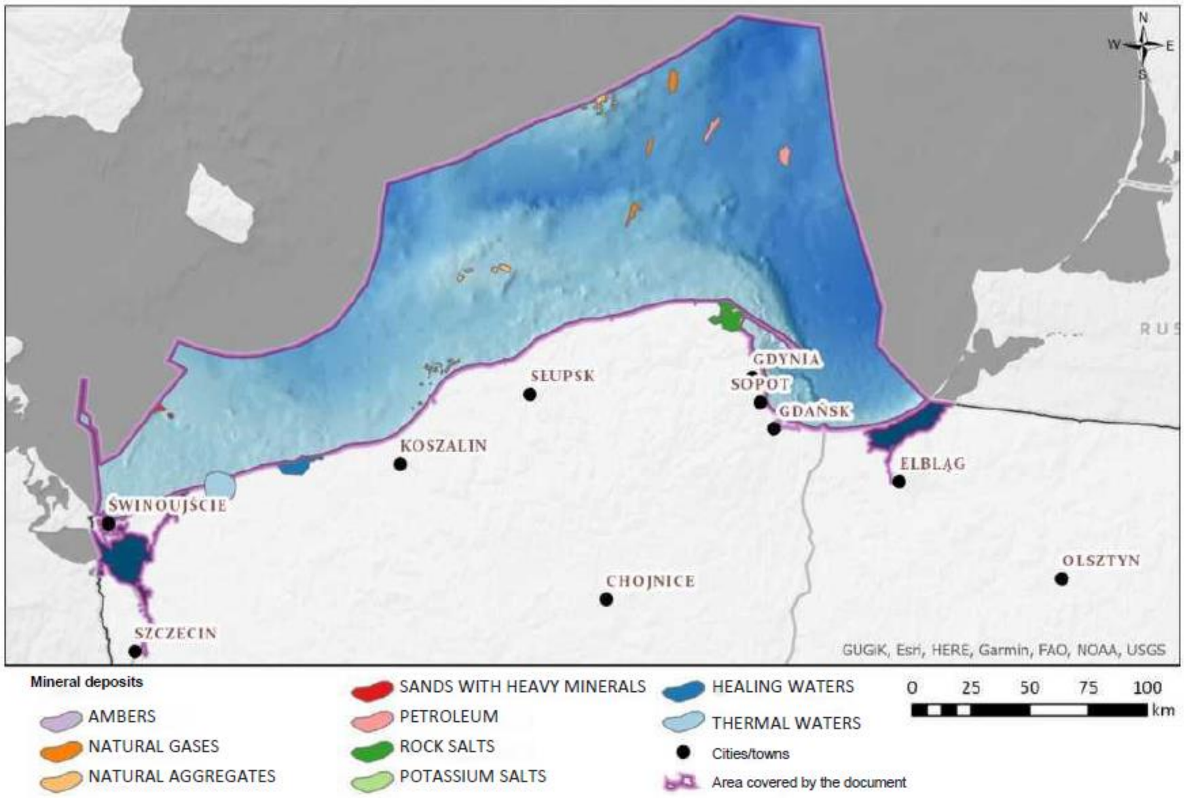



**Fig. 58 Distribution of deposits in the area covered by the study (white marked developed deposits)**

*Source: Own elaboration based on data from PIG.*

Although a significant part of Polish maritime areas is covered by exploration licenses, the full list of raw material deposits available in maritime areas is not known (

Table 49)

The Act of 9 June 2011 Geological and Mining Law (i.e. Journal of Of Laws of 2021, item 914) defines the terms and conditions for undertaking, performing and terminating measures in the field of: geological works; extraction of minerals from deposits; underground tankless storage of substances; underground storage of waste; underground storage of carbon dioxide in order to carry out a demonstration project of carbon dioxide capture and storage.[131]

[131] The Act of 9 June 2011 Geological and Mining Law (Journal of Laws of 2017, item 1566,)

Table 49 Areas designated on the basis of the provisions of the Geological and Mining Law

| Task | Area type | Restriction/ approval | Valid until |
|---|---|---|---|
| **'Southern Central Bank - Southern Baltic Sea' deposit** | concession no. 3/2006 | Basic function – aggregate extraction | 15/11/2031 |
| **"Gulf of Koszalin" deposit (deposit fields marked with numbers: I, II, III, IV, X, XIII, XIV, XV, XVI, XVII)** | concession no. 3/2015 | | 06/11/2040 |
| **"Gulf of Koszalin" deposit (deposit fields marked)** | concession no. 1/2016 | | 26/02/2041 |
| **Sand deposit "Gulf of Gdańsk"** | geological works design | exploration and exploration of the deposit | 19/12/2017 |
| **Zone Gotland** | concession no. 36/2001/p | Exploration for and prospecting for oil and natural gas deposits | 14/12/2016 |
| **Rozewie** | concession no. 38/2001/p | | 14/12/2015 |
| **Łeba** | concession no. 37/2001/p | | 14/12/2016 |
| **b3 deposit** | concession no. 108/94 | Hydrocarbon extraction | 29/07/2026 |
| **b4 deposit** | concession no. 6/2007 | | 11/05/2032 |
| **b6 deposit** | concession no. 2/2006 | | 07/11/2032 |
| **b8 deposit** | concession no. 1/2006 | | 05/09/2031 |
| **Ustronie** | bidding zone | conducting tenders for the award of concessions for exploration, prospection and extraction of hydrocarbons from deposits | announced in 2016 |
| **Wolin** | bidding zone | | announced in 2015 |
| **the vicinity of Trzsacz** | concession no. 1/2015 | extraction of thermal water from the early Jurassic period | 18/03/2035 |
| **Cambrian reservoir in the exclusive economic zone of the Republic of Poland** | Regulation of the Minister of Environment of 3 September 2014 (Polish Journal of Laws 2014, item 1272) | it is allowed to locate the underground carbon dioxide storage complex | indefinitely |

*Source: Forecast of the impact on the environment of the draft plan for the spatial development of internal marine waters, the territorial sea and the exclusive economic zone 2019.*

The Baltic Sea, in relation to other seas, has a relatively large amount of iron-manganese concretions. Their resources are estimated to be around 100 million tonnes. At the moment, the exploitation of land deposits of iron and manganese meets the needs of the economy, so it is not necessary to obtain them from the Baltic concretions, but in the future they may constitute a valuable source of these metals.

The document Forecasts of the impact on the environment of the draft plan for the spatial development of internal marine waters, the territorial sea and the exclusive economic zone shows that to protect the banks by means of artificial supply by 2023, it will be necessary to use a minimum of 60 million $m^3$ of sand with an average granulation of 0.20 to 1 mm. It is necessary to identify the availability of sand resources that would be used to power the banks. Complementing the deficit of sediments in the coastal zone is recommended with the use of sandy sediments in the sea. This is the most advantageous option from an economic, technical and environmental point of view. The extraction of sediments from the seabed at the place of their accumulation excludes the need to exploit land deposits, and a medium-size dredger delivers in one cycle an amount of sand corresponding to the load of up to several hundred trucks.

Mining works may be carried out within the territorial sea at a minimum distance of 3 km from the shore, always outside the underwater coastal slope.

The extraction of sand, and other aggregates, has a strong impact on the lowering of the seabed, the violation of the sediment layer and the destruction of benthic units with a periodic increase in turbidity and a decrease in transparency, as well as the deterioration of the aerobic conditions of water in the area of the works.

The impact of sand extraction from the sea on the environment, like other aggregates, is mainly related to the reduction of the seabed, violation of the sediment layer and destruction of benthic assemblies, periodic increase in turbidity and decrease in transparency, and deterioration of the aerobic conditions of water in the area of works. Therefore, it is necessary to adjust the intensity of sand extraction from marine accumulations to the environmental conditions, as well as its monitoring.[132]

## 5.9 Cultural heritage

Cultural heritage is a material and spiritual achievement of previous generations, as well as the achievements of present times. Among the goods, both tangible and intangible values can be distinguished, which are transmitted by ancestors and determine a given culture. Cultural heritage consists of both material heritage (immovable monuments), movable and intangible heritage (transmitted through oral communication and tradition). Cultural heritage is considered to be an important factor in socio-economic development, a means of seeking ways of reconciliation in regions affected by ethnic or religious conflicts, and an expression of the cultural diversity of countries and regions of the world.

From the point of view of the subject of this study, the most important elements of the heritage are located in the maritime area, mostly underwater.

[132] Forecast of the impact on the environment of the draft plan for the spatial development of internal marine waters, the territorial sea and the exclusive economic zone 2019.

Underwater cultural heritage in Poland is protected on the basis of international and national law, i.e.:

- The Convention on the Protection of the World Cultural and Natural Heritage of 16 November 1972 (journal of Laws 1976, no.32 item 190) ,
- Convention for the Protection of the Underwater Cultural Heritage of 2 November 2001 Act of 27 October 2020 on the ratification of the Convention for the Protection of the Underwater Cultural Heritage, adopted in Paris on 2 November 2001 (journal of Laws 2020, item 2201),
- The European Convention for the Protection of the Archaeological Heritage, drawn up in La Valetta on 16 January 1992 (journal of Laws 1996.120.564).

and under two national legal acts which apply in parallel to the succession:

- The Act of September 18, 2001 Maritime Code (KM), (journal of Laws 2018, item 2175),
- Act of 23 July 2003 on the protection and care of monuments, (consolidated text Journal of Laws of 2021, item 710).

The first international legal act on the protection of the underwater heritage, adopted by UNESCO, is the Convention on the Protection of the Underwater Cultural Heritage. Article 1 of the Convention defines the concept of underwater cultural heritage as' any trace of human existence having a cultural, historical or archaeological character which has remained wholly or partly underwater, periodically or permanently, for at least 100 years', together with its archaeological and natural context, including sites, structures, artefacts and human remains; ships, aircraft and other means of transport or parts thereof, cargoes or other contents, and objects of a prehistoric nature.

**Underwater cultural heritage sites - sunken settlements and landscapes**

Sunken sediments and landscapes are most often covered with water and partially or completely covered by sediments on the seabed. Since the last glaciation, the coastline of the Baltic Sea has undergone significant changes, which has resulted in the former coastal areas of the southern Baltic being submerged with residues from sediments and surrounding landscapes. The areas of the southern Baltic Sea located up to 30 km from the coastline are areas with a high probability of occurrence of sunken settlements and landscapes.

**Underwater Cultural Heritage Facilities – Shipwrecks**

According to the UNESCO Convention, a wreck that has remained underwater for at least 100 years is considered a historical site. However, despite not meeting the age criterion, many wrecks (sunk during World War II) were classified as protected facilities due to their specificity and the need to guarantee adequate protection – the so-called war cemeteries.

The most important source of knowledge about the archaeological historical resource in relation to the Polish maritime areas is the Register of Underwater Archaeological Sites (EPSA), which has been created by the National Maritime Museum (NMM) since 2002. Due to legal conditions, coastal countries collect information mainly on cultural heritage objects within their territorial waters and the adjacent zone, if they have one, while information on objects outside territorial waters is limited and accidental. Hence, knowledge about wrecks and sunken landscapes and sediments remains fragmentary, due to the impossibility of examining the entire bottom of Polish maritime areas in this respect. In order to carry out an environmental impact forecast as part of the strategic environmental impact assessment of the project, the update of the marine waters protection programme (aPOWM) should be assumed that facilities with archaeological value may be located everywhere in marine areas and a large percentage of them has not yet been found.

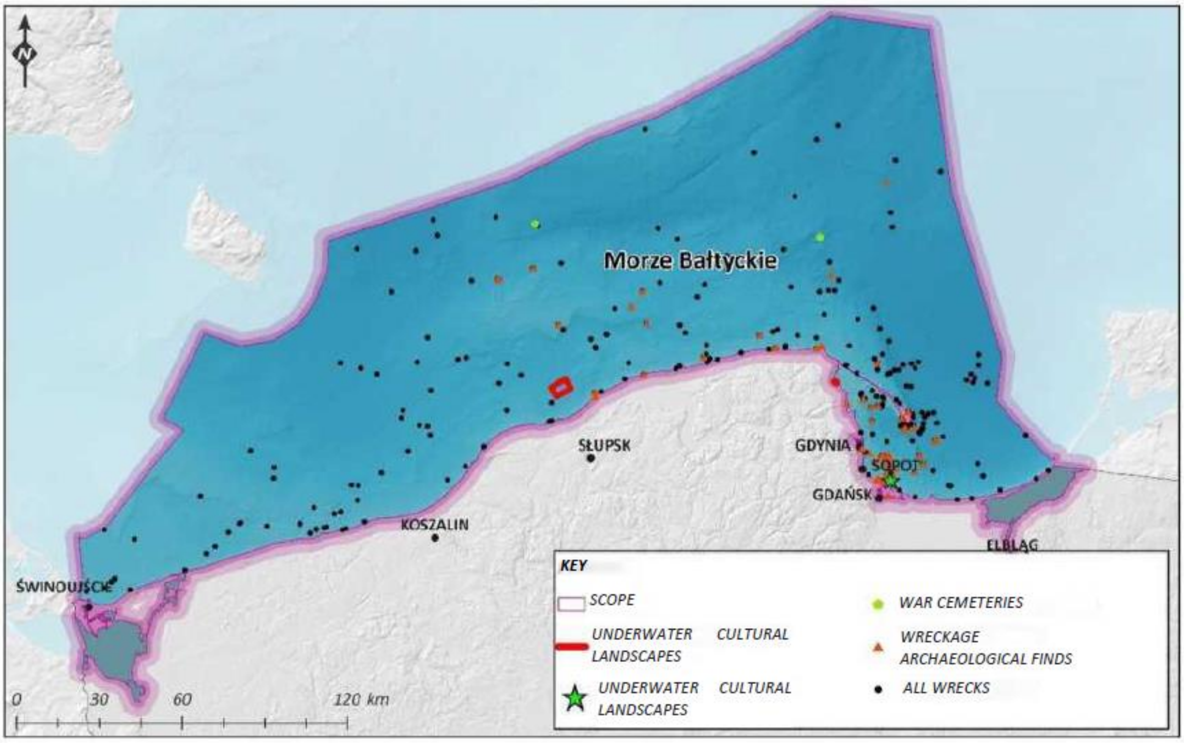



**Fig. 59 Elements of underwater cultural heritage in Polish maritime areas**

*Source Developed on the basis of: Study of the conditions of Spatial Development of Polish Maritime Areas*.

**Table 50 Basic information on selected wrecks based on the results of research conducted by the National Maritime Museum in Gdańsk**

| Item | Wreck name | Description | Built age | Material | Legal status |
|---|---|---|---|---|---|
| **1** | "Koga" from Rowy | The remains of a 13th-century wooden wreck were discovered during dredging works in the port basin in Rowy. After analyzing the excavated elements of the wreck, the initial assumptions were confirmed that it was a ship of the Koga type measuring about 18 meters in length. It was the first unit, built in this technique, found in our country. | XIII | wood | protected |
| **2** | Agne | The wreck lies at a depth of 4.2 m at a distance of 1980 m from the entrance to the New Port in Gdańsk in a bearing of 125 degrees and 1690 m from the south-western end of the breakwater covering the entrance to the working pool of the Northern Port, about 140 m from the modern coastline. | XVIII | wood | protected |
| **3** | Arngast (W-28) | German steam tug, built in 1908 at the Eiderwerft AG plant in Tonningen (building number 84) for Kaiserliche Werft Wilhelmshaven. It sank in January 1921 during a strong storm during a cruise from Wilhelmshaven to Gdańsk. "Arngast" had a length of 29 meters (in some Polish studies appear sizes 32, 33 and even 35 meters), a width of 6.08 meters, a draft of approx. 2.5 meters, a displacement of 195 GRT (270 tons according to the standards of the navy). The unit was equipped with a modern, for those times, three-pressure steam engine with a power of approx. 600 hp, which allowed to develop a speed of up to 10 knots. | XX | Metal/ wood | protected |
| **4** | Ship North Port | At a depth of 17 m rests a part of the side with a length of 9.07 m and a width of 2.4 m, which lies on the sandy bottom. The dimensions and construction features suggest that it is a fragment of a sailing ship hull from the 16th to the 19th centuries with a length of 25-30 meters. A part of the side consists of 6 outer panel flaps mounted at the contact and 14 frames. Two strips of the inner sheathing have been preserved on the frames. Three more frames have been preserved on the outer panel at a distance of about 2 meters. | XVI | wood | protected |
| **5** | Catharina | This 55-tonne galeas cabotage ship was built in 1861 in the Elmshorn River Shipyard (north-west of Hamburg) on the Krückau River, the right tributary of the Elbe River. The ship sailed in the 19th century on the Baltic Sea and the North Sea (it was known, for example, September 5, 1879, it sailed from the port of Gdansk, carrying a load of wheat to Hamburg). In 1941, "Catharina" was purchased in Tolkmick by Emil Marek of Rewa, and then renovated | XIX | wood | protected |

| Item | Wreck name | Description | Built age | Material | Legal status |
|---|---|---|---|---|---|
| | | and rebuilt. After reconstruction in 1941, the unit traveled around the Gulf of Gdańsk transporting gravel, sand and peat. "Catharina" sank in March 1945 as a result of the bombing by the Soviet army. | | | |
| **6** | Drewniak | Remnants of a wooden sailing ship, probably a ship from the turn of the 16th/17th century, located 200 meters from the beach on Hel, at the height of the Swedish Mountain, at a depth of 5 meters. The structure consists of the remains of a wooden structure in the form of a keel, a multi-element overhang with side reinforcements and a mast socket, hull bottoms, an external sheathing and an internal formwork. The design of the unit is defined as mixed pine-oak. Elements of transverse stiffening, such as logs, are made of oak, connected to the logs with pine pegs. Ballast stones and small amounts of ceramics lie on the structure. The length of the facility is estimated at 23 m, and the width is 11 m (including the area of ballast stones). The wood used to build the unit comes from Sweden. | XVI | wood | protected |
| **7** | Falburt | The holka hull from the first half of the 15th century, who was a Northern European cargo ship. At the time of commencing the inventory work from the sandy bottom, at a depth of 4.9 m, the upper edge of the side protruded with a length of 11.2 m and a width of 2.3 m, the remaining part of which was buried in the sand. The facility was located on the north-east axis (bow) – south-west (stern). The side was made of patches mounted on an overlap or with rivets every 21-23 cm. In addition - from the outside of the side - the structures were reinforced by two long side stiffeners with a thickness of 7-8 cm and a width of 30 cm, one of which is a rail beam. Five transverse reinforcements are installed between the supports. In the bow part, frames with a width of 13-19 cm and a thickness of 11 cm were visible. The inner edge of the side was reinforced by a beam with a thickness of 9 cm and a width of 25 cm. The total thickness of the side edge was 25 cm, which consisted of an internal rail - 9 cm, frames - 9 cm and an external rail - 7 cm. | XVI | wood | protected |
| **8** | General Carleton of Whitby (W-32) | This English barge, a carbonator, was built in 1777 in Whitby and sank during the Baltic Sea disaster on 27 May 1785. The crew of the barge consisted of 18 sailors (skipper, officer, cook, carpenter and 14 boys learning a seafaring profession). The unit was owned by Nathaniel Campion. T. Pyman was the skipper of the barge, and William Hustler took over | XVIII | wood | protected |

| Item | Wreck name | Description | Built age | Material | Legal status |
|---|---|---|---|---|---|
| | | his duties from 1772. Lloyd's records show that "General Carleton of Whitby" sailed mainly between English ports and Riga for 8 years. In 1782, numerous and important changes were noted concerning the ship. Its hull was coated with a protective coating and armed with ten 6-pound cannons. The length of the unit was 28 m, width: 8 m and a buoyancy of 500 tonnes. | | | |
| **9** | Hary | The facility consists of strips of an outer sheathing mounted on a contact, about 40 cm wide, and an internal formwork. In some places, you can see frames about 20 cm wide. Only a small fragment of the wreck is visible on the surface, most of the elements of the wreck structure are buried under the sea bottom. At a depth of 4.8 m, a fragment of a wooden hull protrudes from the bottom, measuring: 6.8 meters (length) and 3.2 meters (width).<br>Two samples of wood were taken to date the age of the wreck, one of which was probably determined for the years after 1582. | XVI | wood | protected |
| **10** | Helena (W-3) | The first search for "Helena" involves amateur divers from the Kotwica club in Gdynia, who began penetration of the bottom in the vicinity of Rewa and Osłonin. Thanks to these searches, well-preserved remains of a wooden wreck were found, lying at the depth of four meters. On the basis of conversations with the owner of the sunken ship, the captain of the small sailing ship Clement Long, it was determined that it is a wreck of the "Helena" built in 1872 in Kosh's boatbuilding workshop, commissioned by Józef Buda from Rewa. In 1895, Helena was bought by Józef Długi from Rewa. The sailing ship was rebuilt into a two-masted ketch in 1927. He sank in March 1945 at the anchorage near Bece as a result of the war. | XIX | wood | protected |
| **11** | Kerk | The wreck lies 1920 meters from the entrance to the New Port in Gdańsk at a bearing of 107 degrees, about 700 m from today's coastline of degrees at a depth of 5.8 m. The age of the wreck can be initially determined, on the basis of design features, for the 16th - 18th centuries. The bottom section of the fuselage consists of five elements of transverse stiffening, an outer sheathing laid on the contact and an inner formwork. Wreck dimensions – length: 4.6 m, Width: 2 m. | XVII | wood | protected |

| Item | Wreck name | Description | Built age | Material | Legal status |
|---|---|---|---|---|---|
| **12** | Loreley | The Loreley was built at the Rostock Shipyard in 1863 by H. Rickmann. He sailed under the German flag (home port – Rostock). The ship carried out long-haul shipments between the White Sea and the Atlantic Ocean, serving Russian, British and French ports. The barge also traveled through the waters of the Gulf of Gdańsk, transporting bulk goods, mainly wood. He sank in November 15, 1887 at the approach to the port of Gdańsk as a result of a violent storm that pushed the unit to the surface. | XIX | wood | protected |
| **13** | Łyżwa | This wreck rests on the sandy bottom at a depth of 16.9 meters on the axis SSW-NNE and is deepened to the east side, so that its opposite side protrudes to a depth of 16.3 m. In the vertical projection, the tested unit is the widest on the midship and tapers towards both ends to go to the sharper-terminated aft and bow. The flat bottom, made of 9–11 cm thick and 25 cm wide, was reinforced with about 30 diaries, placed every 0.5 meters, in rectangular cross-section, with dimensions of 30-40 cm. Only the middle patch was thicker than the others (24 cm), but it is not certain whether it is related to the way of forming the end to connect with the stew and whether this thickness also occurs in the midship area. Short elbow frames strengthening the sides were attached to the edges of the side hull bottom with metal pins. A fragmentary strip of the lower cover on the "eastern" part has been preserved from the sides, while many of their remains were scattered next to it. The shape of the frames indicates that the split sides (approx. 120 degrees) were made of contact-mounted plating flaps, 6-7 cm thick. The sealing of the sheathing strips was formed by a strip, nailed in the grooves, specially grooved at the edges of the adjacent sheathing flaps. | XVIII | wood | protected |
| **14** | Łyżwa II | A shipwreck of a merchant vessel consisting of a remnant of a bottom part of wood. The analysis of three samples taken from the hull for dendrochronological research shows that the ship was built after 1592 from wood from the area of north-western Europe. The remains of the hull consist of: an outer sheathing mounted in contact with the planks with a width of 33-35 cm and a thickness of 6-7 cm, closely placed diaries and frames with dimensions of 15 x 17 cm, an inner formwork with a width of 39 cm and a thickness of 6 cm. The main part of the load consists of bundles of iron bars with a length of approx. 3-4 meters placed along the hull, on which barrels have been loaded. Only closer to the bow is | XVI | wood | protected |

| Item | Wreck name | Description | Built age | Material | Legal status |
|---|---|---|---|---|---|
| | | one of the beams positioned transversely to the axis of the hull. The wooden remains of the hull are completely covered by the cargo. Only from the east is the edge of the right side protruding, which is formed by frames and planks joined in contact. The north-eastern part of the wreck is closed by the protruding part of the right side. The southwestern part is formed by barrels that have slid to the left side. The number of barrels in different states that can be inventoried by surface, is a total of 78 pieces. In all barrels, in which the content was visible, the presence of molten iron lumps was found. | | | |
| **15** | Miedziowiec (W-5) | The wreck of the Copper Tower was discovered in 1969 during bottom dredging by the units of the Gdańsk Maritime Office and the Polish Maritime Rescue Service. During the inventory in 1971, it was found that at a depth of about 15 meters, in the sandy bottom lies a dark block of irregular shape, allowing to recognize a fragment of the side. Next to the body, there were individual structural elements of the wooden ship. The remaining part of the wreckage with the cargo was hidden under the surface of a uniform fossil, which was a mixture of tar, iron ore and sea sand.<br><br>In 1975, it was decided to extract both the ship's wreckage and its cargo in order to continue research on land. After examining it, it turned out that these are the remains of a ship of the type of holk.<br><br>Miedziowiec was built from oak, using the shell method. On the basis of the analysis of the preserved fragments of the structure, it is estimated that the length of the ship was 24 m, width 8 m, height 4 m, and the load capacity of about 150 battens, i.e. about 300 tons. | XV | wood | protected |
| **16** | Napoleon (W-20) | The wreck was discovered in 1973 by a crew of the hydrographic ship m/s "Koziorożec". It lies approx. 17 km to the north – east from the entrance to the port of Gdańsk at a depth of 46 - 56 meters. CMM divers and archaeologists, supported by the ships of the Maritime Office in Gdynia "Konstelacja" and "Hydrograf 10", made several attempts to search for the wreckage and prepare the documentation of the facility in 1978, 1980 and 1981. According to the reports of divers, the W-20 wreck is a remnant of a 19th-century wooden sailing ship with a length of approx. 40 meters and a width of approx. 6 meters, with sides covered with copper sheet | XIX | Metal/ | 16 |

| Item | Wreck name | Description | Built age | Material | Legal status |
|---|---|---|---|---|---|
| **17** | Smug | At the bottom at a depth of 5.6 m there are residues of the flat-bottomed unit, resting in the position of the bottom up most probably of a large river vessel. Analyses of two samples taken from the hull for dendrochronological research indicate that the unit was built in the second half of the 16th century.<br>Vessel dimensions - length: 9.5 m, Width: 3.6 m. Pipes with a thickness of 7 cm and a width of up to 50 cm are sealed with a buckle technique (moss inserted between the edges of the seams pressed with a wooden strip and metal buckles). The buckles are strongly corroded and it is difficult to determine their shape. The sides and edge beams have not survived. Massive oak hull bottom elements are visible underneath. Only a small part of the structure protrudes from the sand, the remaining part remains in the sand. | XVII | wood | protected |
| **18** | Solen (W-6) | A galleon-type warship lying approx. 8 km north of the entrance to the port of Gdańsk at a depth of 14 m. The ship was purchased in the Netherlands (it was not clearly established whether originally as a merchant ship or from the beginning as a warship) in the second half of the 16th century, rebuilt and armed in a Swedish shipyard in Ålvsborg. The unit was owned by the Swedish Crown. The displacement of "Solen" is 150 lasts, its length - 17 m, and the width - 7 m. The ship (equipped and armed with 38 deck guns in the second half. 16th or at the beginning of the 17th century) was part of the Swedish naval fleet in 1624. The crew consisted of over 46 people (so many Swedish sailors survived from the ship and were taken prisoner). In the autumn of 1627, a squadron of Swedish warships, consisting of the "Solen", was sent to the Gulf of Gdansk in order to block the port of Gdansk as part of the ongoing Polish-Swedish war (1626–1629). Galeon took part in the naval battle at Oliwa on November 28, 1627. He sank in the late stage of the battle, surrounded by two ships of the Polish naval fleet – "Wodnik" (galleon) and "Biały Lew" (fluyt). Captain of the Solen, Alexander Foratt, unwilling to allow the galleon to be boarded, blew up the ship, detonating a powder chamber on the bow. | XVI | wood | protected |
| **19** | W-25 | Remnants of a wooden sailing vessel. The facility is located in the Gulf of Gdańsk, at a depth of 3 meters, approx. 280 m from the shore, in the area of Nowy Port in Gdańsk. The structure of the wreck consists of: an overhang with 3 mast sockets, frames, plankings and | XVIII | wood | protected |

| Item | Wreck name | Description | Built age | Material | Legal status |
|---|---|---|---|---|---|
| | | internal formwork. In the nest of the mainmast, a Swedish coin with a value of 1 öre was found, on which the year 1731 is depicted. It is very likely that the ship was built this year in one of the Swedish shipyards. Unit dimensions: 29 m - total length, 8.74 m – width, 2 m - height on the midship. | | | |
| **20** | West A | During the first inspection in 2010, it was found that on the bottom at a depth of 5.25 m there is a large fragment of a sailing ship from the turn of the 18th/19th century. Its dimensions are: 23.2 m (length) and 4.6 m (width). During the works in 2011, it turned out that half of the structure is covered with bottom sediments and, as a result, only a section of the structure over a length of 12.5 m was documented - the rest is located under a layer of sand of several dozen centimeters. | | | 20 |
| | West B | "West B" is a seventeenth-century sailing ship with a load of millstones from Scandinavia. In 2010, at a distance of 11 m to the north-west of the main part of the hull of the West A wreck, several round stones, probably semi-finished products for mill burrs with diameters of 40 to 100 cm and thickness of 7 to 15 cm, protruded from the sandy bottom at a depth of 4.7-4.8 m. In 2011, a survey excavation was made in the area of the discovered stones, in which the presence of a wooden hull was found at depths of 5-5.3 m. A 4.5 m long structure was uncovered, constituting a part of the side with a width of 2 m. | XVII | wood | protected |
| **21** | Zawisza Czarny (W-4) | Wooden fortified schooner made in Sweden, built in 1901 as a "Petrea" shipyard in the IE. Holma, A.K. Gustafssons in Raa, Sweden. "Zawisza Czarny" was the first large sea yacht belonging to the Polish Scouting Association. The sailing ship was purchased in Denmark in 1934, entirely from social contributions. The main initiator of the purchase of "Zawisza" was Witold Bublewski - the head of the Scouting Sailing Teams, and he served as the commandant until the war of gen. Mariusz Zaruski. | | | 21 |

*Source: https://www.nmm.pl/archeologia-podwodna/wraki-badane-przez-nmm,*

## 5.10 Maritime economy and material goods

The characteristics of maritime economy are presented in this chapter on the basis of statistical data developed and made available by GUS. Referring to the definition, resulting from maritime law, cited by GUS "Maritime Economy" is recognized as an activity undertaken in the marine environment by various categories of entities (natural persons, legal persons and other entities, including states and international organizations). The marine environment shall be deemed to be marine waters, waters connected to the sea and frequented by seagoing vessels, airspace over the sea and these waters, the seabed and the interior of the earth beneath the seabed. The term marine environment also includes certain elements of the coastal belt, e.g. port areas, seaports, shipyards, etc.

The fields of maritime measures covered in this way include in particular:

- economic measures, including shipping and related services, port operations, shipbuilding and ship repair, sea fishing and other living marine resources, maritime mining, maritime construction (artificial islands, structures and equipment, submarine cables and pipelines), etc.,
- the measures of certain public services, including the safety of shipping and ships, the proper use of maritime roads, ports and harbours, the protection of the environment, the saving of life, specialised technical and construction surveillance, fire protection, the protection of the sea shore, etc.,
- research and scientific, recreational, military, etc.

Each of the above-mentioned measures translates into the functioning of the marine water ecosystem, causing pressures on the marine environment.[133]

Below are presented selected important aspects related to maritime economy and material goods of high value important for the economy from sectors affecting the Baltic marine environment. The analysis was carried out in a sectoral approach. Maritime economy as a division is not distinguished in the Polish Classification of measures (PKD 2007) and does not occur in the general division of the economy into sections and classes of PKD. In GUS publications, maritime management is conventionally considered in the following thematic areas:

- seaports,
- maritime and coastal shipping,
- shipbuilding,
- sea fishing,
- fish processing,
- maritime education and research and development measures,
- maritime and coastal tourism.

The dominant centres of the maritime economy sector are Gdańsk and Gdynia and Szczecin, Świnoujście, and ports in these centres have over 97% share in national turnover (97.6% in 2019). In 2018, in the national register of entities of national economy REGON, there were 7,164 entities registered, whose main activity was the production and repair of ships and boats, i.e. by 27.3% more than in 2014.

The second largest group of entities operating in the field of maritime economy are entities engaged in the wholesale and retail sale of fish, crustaceans and molluscs. In 2018, 2,868 entities conducting

Maritime [133] Economy 2014, Statistical Office in Szczecin such measures were registered, i.e. an increase by 17.4% compared to 2014. At the end of 2018, 1 297 marine fisheries operators were registered, i.e. 14.1% more than in 2014.

### 5.10.1 Fishing

In 2019, the Polish fishing fleet caught 205 thousand tonnes of fish and marine invertebrates, most of which were caught in the Baltic fleet – nearly 165 thousand tonnes.

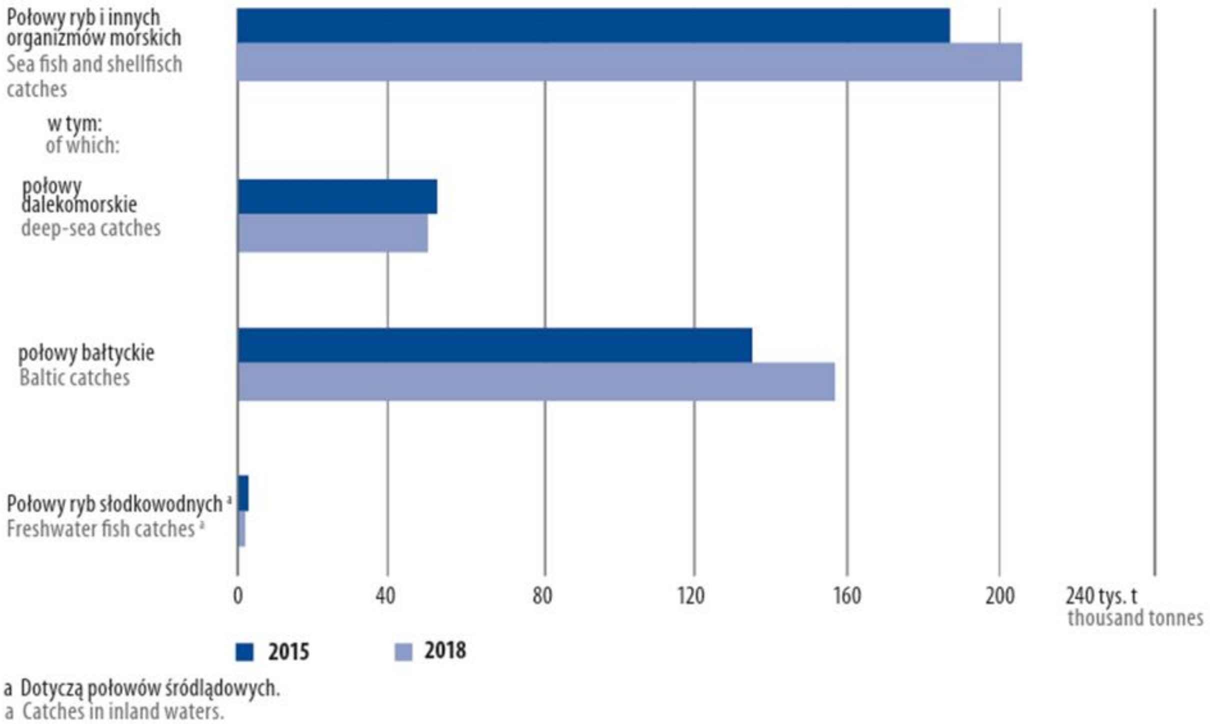



**Fig. 60 Structure of fish catches in the years 2015 – 2018**

*Source GUS Statistical Yearbook of Maritime Economy 2019*

In the overall species structure of the Baltic catches, in quantitative terms, the most important was the catches of small pelagic fish: sprat and herring, with the share in 2017-2018 exceeding 80%, were the most important. The total catch of fish in the Baltic Sea in 2018 amounted to nearly 156 thousand tonnes and was about 15% higher than in previous years. There is a noticeable decrease in cod catches, whose catch decreased from 13.6 thousand tonnes in 2015 to 6.6 thousand tonnes, and an increase in flat catches, including in particular flounder not subject to a catch limit.

**Table 51 Fishing in the Baltic Sea and the floods in the years 2015 – 2018**

| Specification | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|
| | Catch in tonnes | | | |
| **Diadromous fishes** | 231 | 317 | 344 | 431 |
| **Fish, freshwater** | 2869 | 3174 | 2650 | 2571 |
| **Sea fish, including** | 131625 | 135407 | 134727 | 152892 |
| **sprats** | 64175 | 60057 | 69972 | 75713 |
| **herring** | 39712 | 44056 | 43671 | 51703 |
| **cod** | 13617 | 10335 | 7442 | 6575 |
| **flatfish *** | 9616 | 15275 | 11561 | 15759 |
| **other marine fish** | 4505 | 5684 | 2081 | 3143 |
| **Total** | 134725 | 138898 | 137721 | 155894 |

*Source; GUS Statistical Yearbook of Maritime Economy 2019*

* The group of flatfish includes representatives of species of the Pleuronectidae family, caught in the Baltic Sea, i.e. plaice, flounder, turbot.

In 2019, 146.0 thousand tonnes of fish (representing 73.9% of the total weight of catches) were taken from the Baltic fisheries, i.e. 6.4% less compared to 2018. Deep-sea fisheries, which amounted to 51.6 thousand tonnes, were 4.1% higher than a year ago. As in previous years, the species structure of catches was dominated by sprats, which were caught only in Baltic fisheries. In 2019, 74.5 thousand tonnes of this fish were caught, which accounted for 37.7% of the total weight of the obtained organisms[134].

According to the data of the GUS, there were 3198 people employed in the fisheries sector in maritime waters in 2018. In total, according to the GUS data at the end of 2019, the Polish fishing fleet at the end of 2019 consisted of 2 trawlers, 124 fishing boats and 701 boats. Gdynia remained the home port for all trawlers. Most of the boats (72.6%) were stationed in the Pomeranian province, and the others – in the West Pomeranian province. Fishing boats were stationed in all coastal provinces: Pomorskie (47.1%), Zachodniopomorskie (43.3%) and Warmińsko-Mazurskie (9.6% of the total number of Polish fishing boats)[135].

The largest number of vessels (boats) registered in the years 2010-2018 were in the ports of Władysławowo and Ustka, then in Kołobrzeg and Jastarnia, while the smallest number were in the ports of Gdańsk and Świnoujście.

[134] GUS Maritime Economy in Poland in 2019
[135] GUS Maritime Economy in Poland in 2019

**Table 52 Fleet of boats of individual larger ports – comparison of changes**

| Specification | | 2010 | 2013 | 2016 | 2018 |
|---|---|---|---|---|---|
| **TOTAL** | Vessels | 139 | 139 | 126 | 124 |
| | Gross tonnage GTJ | 12.2 | 12.2 | 12.1 | 12.0 |
| **Świnoujście** | Vessels | 3 | 3 | 4 | 4 |
| | Gross tonnage GTJ | 0.2 | 0.2 | 0.4 | 0.4 |
| **Dziwnów** | Vessels | 6 | 6 | 7 | 7 |
| | Gross tonnage GTJ | 0.5 | 0.5 | 0.6 | 0.6 |
| **Kołobrzeg** | Vessels | 17 | 17 | 18 | 17 |
| | Gross tonnage GTJ | 2.3 | 2.3 | 2.5 | 2.3 |
| **Darłowo** | Vessels | 10 | 10 | 4 | 3 |
| | Gross tonnage GTJ | 0.4 | 0.4 | 0.1 | 0.1 |
| **Ustka** | Vessels | 27 | 27 | 20 | 20 |
| | Gross tonnage GTJ | 2.1 | 2.1 | 1.6 | 1.6 |
| **Leba** | Vessels | 10 | 10 | 9 | 8 |
| | Gross tonnage GTJ | 0.4 | 0.4 | 0.4 | 0.3 |
| **Władysławowo** | Vessels | 36 | 36 | 37 | 39 |
| | Gross tonnage GTJ | 4.2 | 4.2 | 4.4 | 4.5 |
| **Jastarnia** | Vessels | 14 | 14 | 12 | 12 |
| | Gross tonnage GTJ | 0.6 | 0.6 | 0.5 | 0.5 |
| **Hel** | Vessels | 8 | 8 | 9 | 9 |
| | Gross tonnage GTJ | 1.1 | 1.1 | 1.3 | 1.3 |
| **Gdańsk Górki Zachodnie** | Vessels | 4 | 4 | 2 | 2 |
| | Gross tonnage GTJ | 0.2 | 0.2 | 0.2 | 0.1 |
| **Gdańsk Górki Wschodnie** | Vessels | 1 | 1 | 1 | 1 |
| | Gross tonnage GTJ | 0 | 0 | 0.3 | 0.3 |
| **Gdańsk** | Vessels | 3 | 3 | 2 | 2 |
| | Gross tonnage GTJ | 0.3 | 0.3 | 0.6 | 0.6 |

*Source Yearbook of the GUS of Poland Maritime Economy 2014; GUS Statistical Yearbook of Maritime Economy 2019*

According to the data of the Maritime Fisheries Institute, the largest segment of the fishing fleet in terms of quantity was made up of fishing boats up to 12 m long. The average age of the Polish Baltic fishing fleet is constantly increasing, due to a very small number of registrations of new fishing vessels (which is the result of existing legal restrictions) and was 29 years at the end of 2016. At the same time, it should be noted that the age of the fleet is not a parameter clearly correlated with its modernity — in the last decade many fishing vessels have undergone a thorough modernization, which is not reflected in the age of the vessels[136]. Meanwhile, the average age of the fleet of boats as at the end of 2018 is 47.9 years (up from 46.4 years in 2015).

### 5.10.2 Transport by sea

According to the Act of 20 December 1996 on seaports and harbours, in Poland there are 4 seaports of fundamental importance for the national economy, i.e. located in Gdańsk, Gdynia, Szczecin and Świnoujście. They are managed by 3 companies, which are so-called managing entities in accordance with the above-mentioned act (respectively: The Management Board of the Maritime Port of Gdańsk S.A., the Management Board of the Maritime Port of Gdynia S.A. and the Management Board of the Maritime Ports of Szczecin and Świnoujście S.A.)[137] .

The basic economic function of Polish seaports of fundamental importance to the national economy remains the transport function. The volume of cargo turnover in Polish seaports (without taking into account the unladen weight of the transshipped cargo units) in the years 2000 – 2018 is presented in the chart below.

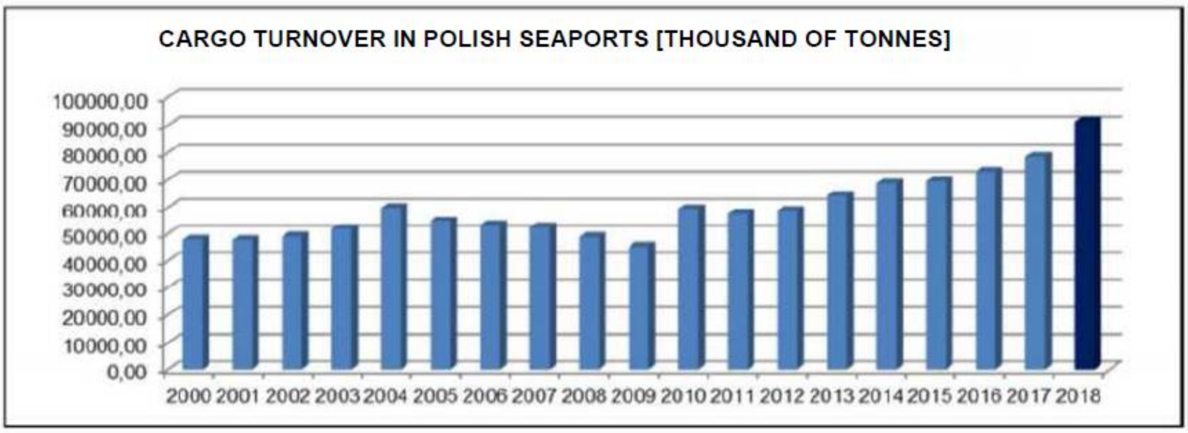



**Fig. 61 Cargo turnover in Polish seaports in 2000-2018**

*Source: Development programme of Polish seaports until 2030.*

After a noticeable reduction in transhipments in 2008-2009 during the global economic crisis, there is an upward trend in transshipment turnover. In 2019, cargo turnover in seaports amounted to 93.9 million tonnes. This meant an increase of 2.3% compared to 2018. The cargo turnover in each port is shown in the graph below.

[136] Maritime Fisheries Institute PIB, Maritime Fisheries Economy in the years 2015-2016, Gdynia 2017
[137] Resolution No. 100 of the Council of Ministers of 17 September 2019 on the adoption of the program entitled "Programme for the development of Polish seaports until 2030"

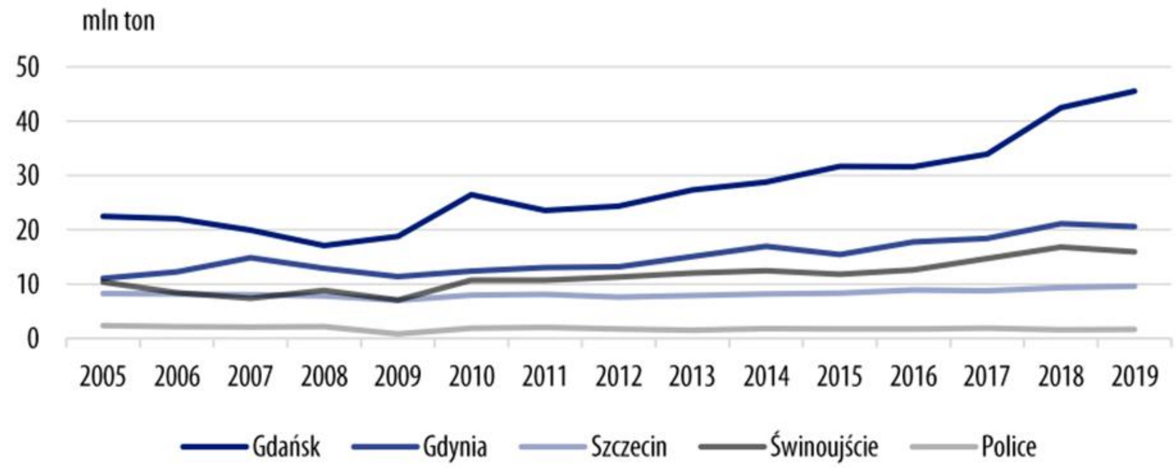



**Fig. 62 Load turnover in seaports 2005 – 2019**

*Source: GUS Maritime Economy in Poland in 2019*

The share of individual ports in national turnover in 2019 was as follows:

- Gdańsk – 48.5%,
- Gdynia – 21.9%,
- Świnoujście – 17.0%,
- Szczecin – 10.2%,
- Police – 1.8%
- other ports – 0.6%

The cargo turnover by cargo categories is shown in the chart below.

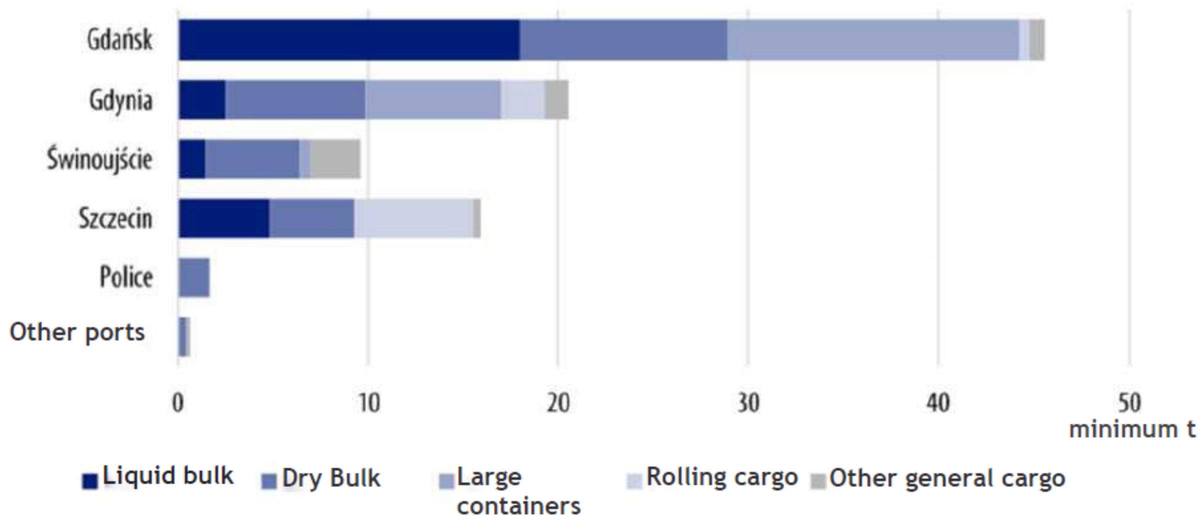



**Fig. 63 Cargo turnover by ports and cargo categories in 2019**

*Source: GUS Maritime Economy in Poland in 2019*

The transport function of seaports also includes passenger traffic handling. Polish ports are dominated by ferry traffic in relations with Swedish ports (Ystad, Trelleborg, Karlskrona, Nynäshamn) - Sweden's share in international passenger traffic amounted to 92.0% in 2019. The so-called cruise vessels, the most of which arrive in Gdynia and Gdańsk, are of less importance. According to GUS data, in 2019, 2787.2 thousand passengers started or ended their voyage on ships in seaports, i.e. 2.5% more than in

2018. In domestic traffic, 703.5 thousand people (25.2%) were transported, and in international traffic – 2083.7 thousand people (74.8%).

A comparison of international passenger traffic in seaports and passenger transport by seagoing coastal fleet in 2015 and 2018 is presented in the graphs below.


**Fig. 64 International passenger traffic in seaports**

*Source: GUS Statistical Yearbook of Maritime Economy 2019*

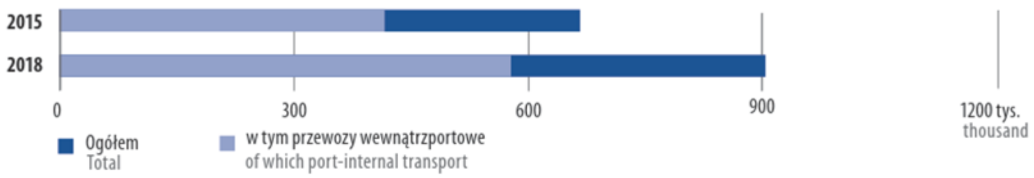



**Fig. 65 Carriage of passengers by seagoing coastal fleet**

*Source: GUS Statistical Yearbook of Maritime Economy 2019*

The development of ports and maintaining their competitiveness is primarily dictated by the need to handle increasing volumes of goods in short and long sea shipping. Access to Polish ports and their attractiveness is determined by the parameters of fairways and convenient connection with other means of transport – rail and road transport, as well as intermodal transport services.

According to the lists of seaports and harbours prepared by the Maritime Offices in 2020, 80 seaports and harbours were operated in Poland.

**Table 53 The list of ports and harbours in the areas of territorial jurisdiction of individual directors of Maritime Offices is presented in the table below.**

| Item | Ports and marinas | Territorial jurisdiction of the Maritime Office | Managing entity/ entity exercising the rights and obligations of the managing entity * |
|---|---|---|---|
| **1.** | Maritime port in Gdańsk | UM in Gdynia | Maritime Port Management Board Gdańsk S.A. |
| **2.** | Maritime port in Gdynia | UM in Gdynia | Management Board of Gdynia Maritime Port S.A. |
| **3.** | Seaport in Hel | UM in Gdynia | Zarząd Portu Morskiego Hel Koga Sp. z o.o. |

| Item | Ports and marinas | Territorial jurisdiction of the Maritime Office | Managing entity/ entity exercising the rights and obligations of the managing entity * |
|---|---|---|---|
| **4.** | Maritime port in Władysławowo | UM in Gdynia | Szkuner Sp. z o.o. |
| **5.** | Seaport in Elbląg | UM in Gdynia | Zarząd Portu Morskiego Elbląg Sp. z o.o. |
| **6.** | Puck seaport | UM in Gdynia | Puck Municipality * |
| **7.** | Sea port in Jastarnia | UM in Gdynia | Jastarnia commune * |
| **8.** | Seaport in Kąty Rybackie | UM in Gdynia | Director of the Maritime Office in Gdynia |
| **9.** | Seaport in Łysica (Krynica Morska) | UM in Gdynia | Municipality of Krynica Morska* |
| **10.** | Frombork seaport | UM in Gdynia | Municipality of Frombork* |
| **11.** | Tolkmicko seaport | UM in Gdynia | Municipality of Tolkmicko* |
| **12.** | Seaport in Pasłęka | UM in Gdynia | Director of the Maritime Office in Gdynia |
| **13.** | Mechelinki seaport | UM in Gdynia | Kosakowo commune * |
| **14.** | Maritime harbour Suchacz | UM in Gdynia | Municipality of Tolkmicko* |
| **15.** | Maritime Marina Cegielnia in Suchacz | UM in Gdynia | Municipality of Tolkmicko* |
| **16.** | Seaport Waterfront | UM in Gdynia | Municipality of Tolkmicko* |
| **17.** | Sea harbour of Kadyna | UM in Gdynia | Director of the Maritime Office in Gdynia |
| **18.** | Marina "Dalmor" in Gdynia | UM in Gdynia | Director of the Maritime Office in Gdynia |
| **19.** | Seaport Kąty Rybackie III | UM in Gdynia | Sztutowo commune * |
| **20.** | Marina "Gdańsk Shipping" in Gdynia | UM in Gdynia | Commune OF Gdynia* |
| **21.** | Marina Krynica Morska – Pool III – New Inn | UM in Gdynia | Director of the Maritime Office in Gdynia |
| **22.** | Marina Krynica Morska | UM in Gdynia | Director of the Maritime Office in Gdynia |
| **23.** | Marina Gdynia harbour | UM in Gdynia | Commune OF Gdynia* |
| **24.** | Sopot Pier | UM in Gdynia | Sopot Commune * |
| **25.** | Harbour Kuźnica II | UM in Gdynia | Director of the Maritime Office in Gdynia |

| Item | Ports and marinas | Territorial jurisdiction of the Maritime Office | Managing entity/ entity exercising the rights and obligations of the managing entity * |
|---|---|---|---|
| **26.** | Harbour Kamienica Elbląska | UM in Gdynia | Director of the Maritime Office in Gdynia |
| **27.** | Marina Leśniczówka in Krynica Morska | UM in Gdynia | Director of the Maritime Office in Gdynia |
| **28.** | Dębki harbour | UM in Gdynia | Director of the Maritime Office in Gdynia |
| **29.** | "Gdynia Oksywie" harbour | UM in Gdynia | Commune OF Gdynia* |
| **30.** | Port "Gdynia-Obłuże" | UM in Gdynia | Commune OF Gdynia* |
| **31.** | Sand harbour | UM in Gdynia | Director of the Maritime Office in Gdynia |
| **32.** | Harbour Fishing Angles I | UM in Gdynia | Director of the Maritime Office in Gdynia |
| **33.** | Harbour Fishing Corners II | UM in Gdynia | Director of the Maritime Office in Gdynia |
| **34.** | Stegna harbour | UM in Gdynia | Director of the Maritime Office in Gdynia |
| **35.** | Amber harbour | UM in Gdynia | Director of the Maritime Office in Gdynia |
| **36.** | Jelitkowo harbour | UM in Gdynia | Director of the Maritime Office in Gdynia |
| **37.** | Sopot harbour | UM in Gdynia | Sopot Commune * |
| **38.** | Orłowo harbour | UM in Gdynia | Commune OF Gdynia* |
| **39.** | Harbour Rewa I | UM in Gdynia | Director of the Maritime Office in Gdynia |
| **40.** | Harbour Rewa II | UM in Gdynia | Director of the Maritime Office in Gdynia |
| **41.** | Shielding harbour | UM in Gdynia | Director of the Maritime Office in Gdynia |
| **42.** | Swarzewo harbour | UM in Gdynia | Puck Commune * |
| **43.** | Chłapowo harbour | UM in Gdynia | Director of the Maritime Office in Gdynia |
| **44.** | Karwia harbour | UM in Gdynia | Director of the Maritime Office in Gdynia |
| **45.** | Harbour Cottage I | UM in Gdynia | Director of the Maritime Office in Gdynia |

| Item | Ports and marinas | Territorial jurisdiction of the Maritime Office | Managing entity/ entity exercising the rights and obligations of the managing entity * |
|---|---|---|---|
| **46.** | Harbour of the Cottage II | UM in Gdynia | Director of the Maritime Office in Gdynia |
| **47.** | Harbour Kuźnica I | UM in Gdynia | Director of the Maritime Office in Gdynia |
| **48.** | Jastarnia I harbour | UM in Gdynia | Director of the Maritime Office in Gdynia |
| **49.** | Harbour Jastarnia III | UM in Gdynia | Director of the Maritime Office in Gdynia |
| **50.** | Port Łeba | UM in Gdynia | Director of the Maritime Office in Gdynia |
| **51.** | Ditch Port | UM in Gdynia | Director of the Maritime Office in Gdynia |
| **52.** | Ustka port | UM in Gdynia | Zarząd Portu Morskiego w Ustce Sp. z o.o. |
| **53.** | Seaport in Szczecin | UM in Szczecin | Zarząd Morskich Portów Szczecin i Świnoujście S.A. |
| **54.** | Sea port in Świnoujście | UM in Szczecin | Zarząd Morskich Portów Szczecin i Świnoujście S.A. |
| **55.** | Seaport in Police | UM in Szczecin | Zarząd Morskiego Portu Police Sp. z o.o. |
| **56.** | Maritime port in Dziwnów | UM in Szczecin | Maritime Port Authority of Dziwnów |
| **57.** | Seaport in Kamien Pomorski | UM in Szczecin | Marina Kamień Pomorski Sp. z o.o. |
| **58.** | Sea port in Wolin | UM in Szczecin | Director of the Maritime Office in Szczecin* |
| **59.** | Maritime port in Mrzeżyn | UM in Szczecin | Mrzeżyno Seaport Authority |
| **60.** | The seaport in Nowy Warpno | UM in Szczecin | Municipality of Nowe Warpno* |
| **61.** | Seaport in Trzebieza | UM in Szczecin | Director of the Maritime Office in Szczecin* |
| **62.** | Seaport in Stepnica | UM in Szczecin | Stepnica commune* |
| **63.** | Seaport in Lubin | UM in Szczecin | Director of the Maritime Office in Szczecin* |
| **64.** | Sea fishing port in Przytor | UM in Szczecin | Municipality of Świnoujście* |

| Item | Ports and marinas | Territorial jurisdiction of the Maritime Office | Managing entity/ entity exercising the rights and obligations of the managing entity * |
|---|---|---|---|
| **65.** | Sea fishing port in Sierosław | UM in Szczecin | Wolin commune * |
| **66.** | Sea fishing port in Wapnica | UM in Szczecin | Międzyzdrojskie Towarzystwo Budownictwa Społecznego Sp. z o.o. |
| **67.** | Marina in Międzyzdroje (pier) | UM in Szczecin | Zarząd Przystani Morskiej w Międzyzdroje Sp. z o.o. |
| **68.** | Marina no. 1 in Międzyzdroje | UM in Szczecin | Municipality of Międzyzdroje* |
| **69.** | Maritime harbour in Niechorze | UM in Szczecin | Municipality of Rewal* |
| **70.** | Maritime harbour in Rewal | UM in Szczecin | Municipality of Rewal* |
| **71.** | Seaport in Świnoujście - Karsiborze | UM in Szczecin | WYSPIARZ Sports and Leisure Centre in Świnoujście |
| **72.** | Maritime harbour in Wolin | UM in Szczecin | Przystań Morska Wolin Sp. z o.o. |
| **73.** | Maritime harbour in Jarosławiec | UM in Szczecin | Director of the Maritime Office in Szczecin* |
| **74.** | Seaport in Peasants | UM in Szczecin | Director of the Maritime Office in Szczecin* |
| **75.** | Maritime harbour in Dąbki | UM in Szczecin | Director of the Maritime Office in Szczecin* |
| **76.** | Maritime harbour in Union | UM in Szczecin | Director of the Maritime Office in Szczecin* |
| **77.** | Maritime harbour in Ustronie Morskie | UM in Szczecin | Director of the Maritime Office in Szczecin* |
| **78.** | Seaport in Kołobrzeg | UM in Szczecin | Zarząd Portu Morskiego Kołobrzeg Sp. z o.o. |
| **79.l** | Seaport in Darłowo | UM in Szczecin | Zarząd Portu Morskiego Darłowo Sp. z o.o. |
| **80.** | Sea fishing port in Dzwirzyn | UM in Szczecin | Director of the Maritime Office in Szczecin* |

*Source: Own study based on the lists of Maritime Offices in Gdynia and Szczecin*

## 5.10.3 Shipbuilding

In Poland, there are production and repair yards dealing with shipbuilding, assembly of hull and superstructure elements, large steel and aluminium structures as well as repairs and reconstructions. According to GUS data[138] in 2019, 5 vessels with a total gross tonnage (GT) were built – 10.0 thousand of the Compensated gross tonnage (CGT), which is a measure of the productivity of the yard, amounting to 28.2 thousand The order book at the end of 2019 included 24 vessels with a total capacity (GT) of 76.4 thousand of the compensated capacity (CGT) – 75.9 thousand. In addition, 504 vessels with a total gross tonnage (GT) of 1.1 million were renovated in Polish shipyards in 2019.

The production of the shipbuilding industry in 2015-2018 is characterised in the table below.

**Table 54 Shipbuilding production in the years 2015 – 2018**

| Year | Production of vessels | | | Renovation of ships | |
|---|---|---|---|---|---|
| | Number of vessels | Gross tonnage (GT) in thousands | Compensated gross tonnage (CGT) | Number of repairs | Value in millions EUR |
| **2015** | 7 | 18.9 | 33.6 | 610 | 311.8 |
| **2016** | 12 | 38.9 | 68.0 | 537 | 237.5 |
| **2017** | 12 | 69.6 | 94.1 | 540 | 311.8 |
| **2018** | 6 | 11.4 | 27.4 | 527 | 282.0 |

*Source: GUS Statistical Yearbook of Maritime Economy 2019*

## 5.10.4 Wind farms:

The wind energy sector has been developing very dynamically in recent years, while most of the installed wind farms in the Baltic Sea area are located in Denmark, Germany, Sweden and Finland. On the Polish coast there are particularly favourable conditions for wind energy.[139] Currently, however, none of the offshore wind farm projects (currently in the project phase) has been implemented in the area of marine waters belonging to Poland. It is planned that the first Polish offshore wind farms will start to produce energy around 2025, and by 2040 it is planned to put into operation more than 10 GW of installed power in the Polish Exclusive Economic Zone.[140]

The EU Directive 2009/28/EC on the promotion of the use of energy from renewable sources ('the RED I Directive'), which is the main element of the EU's energy policy and a key enabler for the achievement of the 2020 renewable energy targets. At the same time, the 2020 targets are the first significant milestone serving as the basis for a more ambitious target to reduce greenhouse gas emissions by 55% by 2030, as foreseen in the European Green Deal Climate Action Plan. The Polish target for the share of renewable energy sources in gross final energy consumption is 15 %. On the other hand, Directive

---

[138] GUS Maritime Economy in Poland in 2019

[139] The map developed by prof. H. Lorenc, IMGW on the basis of measurement data from the years 1971-2000., source: Ministry of Environment, "Pilot implementation program for the renewable energy development strategy in the scope of increasing the production of electricity from renewable sources, with particular emphasis on wind energy for the years 2003-2005.

[140] The future of offshore wind energy in Poland. PWEA report. Polish Wind Energy Association, May 2019.

(EU) 2018/2001 on the promotion of the use of energy from renewable sources ('the RED II Directive') came into force on 24 December 2018. The new Directive establishes a framework for achieving the binding EU target of a share of at least 32% of gross final energy consumption by 2030. This framework, which is based mainly on the progress made on the RED I Directive, includes, inter alia, an obligation for Member States to use the 2020 targets as the base level for the national trajectories set in the national energy and climate plans. In which case the overall share of renewable energy in the EU will exceed the 32% target.

According to the data published by the Polish Wind Energy Association, at the end of 2018 there were 4543 offshore wind turbines operating in Europe, which operate within 105 offshore wind farms (11 countries). The total wind power from offshore wind farms in Europe reached 18,499 MW at the end of 2018. The leader in the development of offshore wind energy is the United Kingdom, where the installed capacity has exceeded 8 GW, and it is planned to reach 30 GW by 2030. Germany, Denmark, Belgium and the Netherlands are next. In Europe, 70% of the installed offshore wind power comes from the North Sea, while 16% from the Irish Sea, with the Baltic Sea accounting for 12% (2 218 MW).[141]

Polish maritime areas, in accordance with the existing law, can be used for wind energy only outside the territorial sea (under the Act on Maritime Areas of the Republic of Poland and the maritime administration, offshore wind farms can be located only in the area of the Exclusive Economic Zone – i.e. at a minimum distance of 22 km from the shore). The main criteria for the suitability of maritime space are wind, depth, distance from land and environmental conflicts.[142]

According to the calculations of experts, the installation of offshore wind farms with a capacity of 6 GW will create 77 thousand jobs throughout Poland, which will generate approx. PLN 60 billion of value added to GDP and PLN 15 billion of revenues from CIT and VAT taxes by 2030.[143]

[141] The future of offshore wind energy in Poland. PWEA report. Polish Wind Energy Association, May 2019.
[142] Study of Conditions for Spatial Development of Polish Maritime Areas
[143] The future of offshore wind energy in Poland. PWEA report. Polish Wind Energy Association, May 2019.

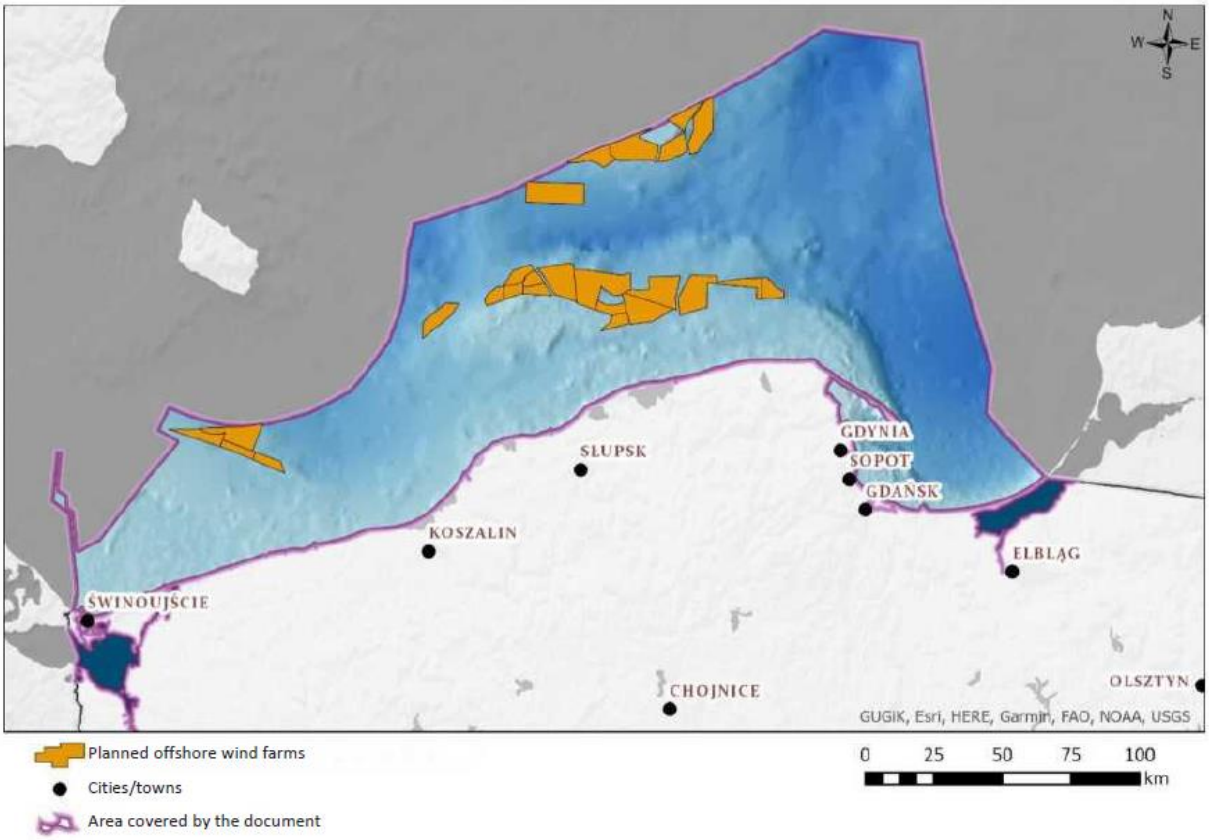



**Fig. 66 Map of potential locations for the location of wind farms**

*Source: Own elaboration on the basis of: Study of Conditions for Spatial Development of Polish Maritime Areas.*

## 5.10.5 Military activities

In the Polish area of the Baltic Sea, there are areas related to military activities. They are shown in the following figure.

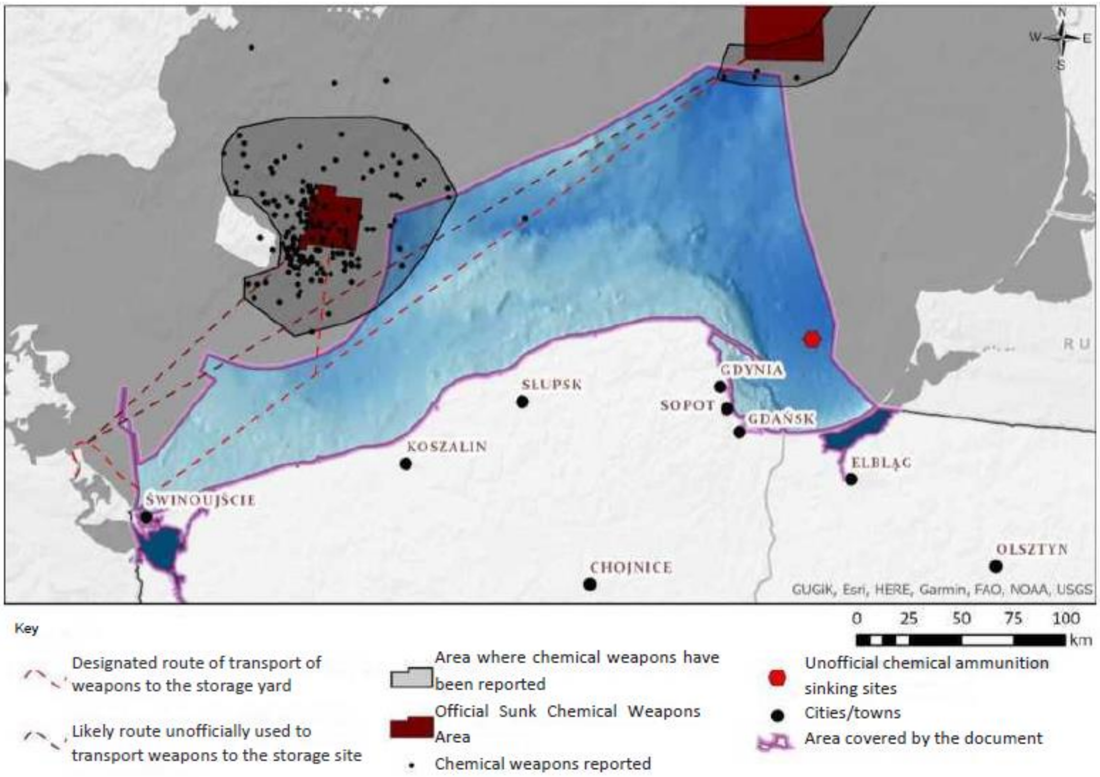



**Fig. 67 Map of areas related to military activities**

*Source: Own elaboration on the basis of: Study of Conditions for Spatial Development of Polish Maritime Areas.*

## 5.10.6 Extraction of crude oil and natural gas

The extraction of oil and natural gas from the bottom of the Baltic Sea is carried out by PPiEZRiG "Petrobaltic" sp. z o.o., which holds concessions covering 23 concession plots with an area of 8,625 $km^2$.

LOTOS Petrobaltic S.A. holds a concession for the extraction of crude oil and associated natural gas from two deposits located in the eastern part of the Polish maritime areas (shown in the illustration in the section on deposits) and shares in 2 concessions for the extraction of natural gas in the Polish economic zone of the Baltic Sea (through Baltic Gas Sp. z o.o.).

The company also has 2 exploration concessions and 4 exploration and exploration concessions for oil and natural gas, with a total area of 6,256.3 $km^2$. They are located in the eastern part of the Polish maritime area. Currently, one oil field is being exploited, the second one is in the development phase, and two gas fields are being prepared for development.

# 6 Environmental problems relevant to the implementation of the aPOWM draft - pressures

The projected and existing environmental problems resulting primarily from the implementation of the strategic documents are presented below.

The HELCOM has developed the Baltic Sea Pressvure Index, the main objective of which is to provide a spatial overview of the sum of pressures without taking into account their impact on specific ecosystem elements. This indicator was calculated by square units (1x1km) for the entire Baltic Sea.

They developed index is based on georeferenced datasets on human activity (36 datasets), pressures (18 datasets).[144]

Below is a map of the BSPI pressure index for Polish maritime areas.

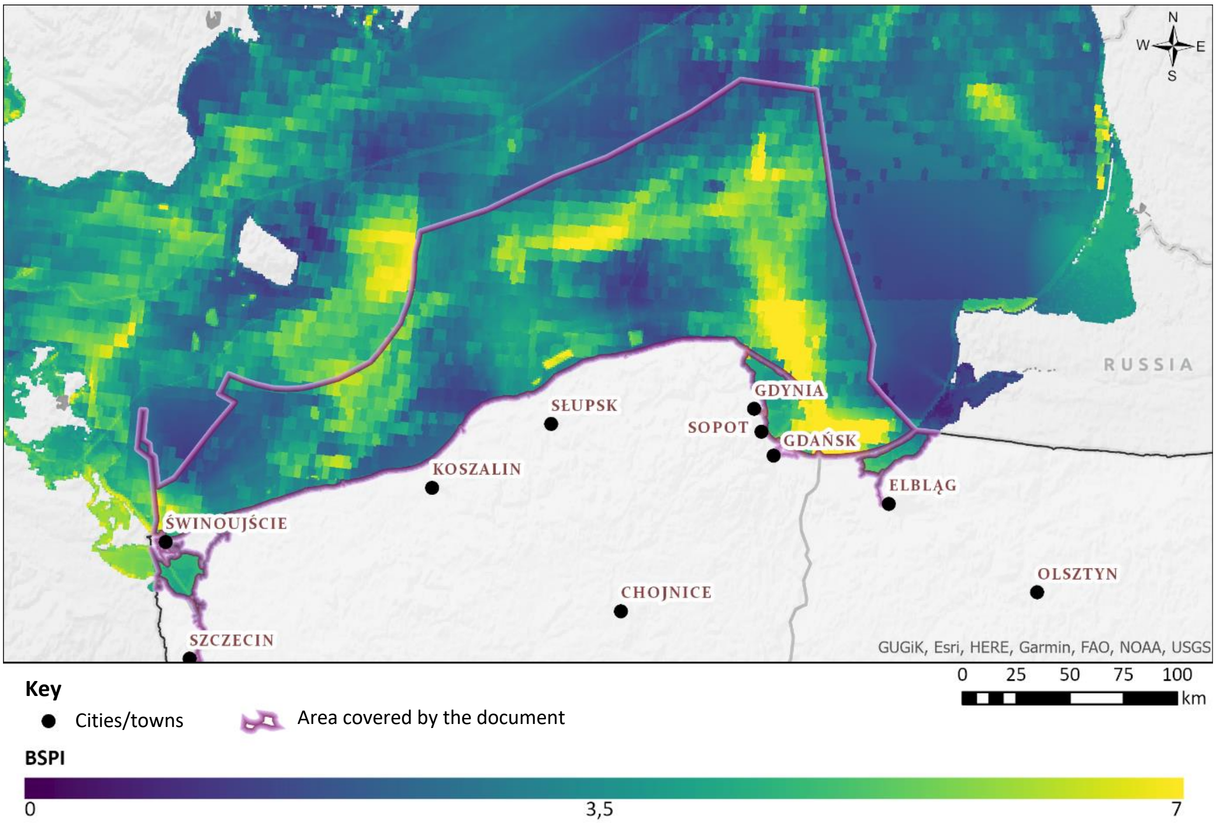



**Fig. 68 BSPI map for Polish maritime areas**

Source: own study based on HELCOM (HELCOM 2018E).

The map above shows Polish maritime areas under strong pressure. The highest values of the BSPI index are achieved in the area of the Gulf of Gdańsk, near large urban centres, in the estuary sections of large rivers carrying pollution.

The pressures relating to the impact area of the Plan were analysed, for maritime areas, in the context of:

144 http://metadata.helcom.fi/geonetwork/srv/eng/catalog.search#/metadata/98cc1b96-3469-46e1-8247-7ff924a9ef27

- The Marine Strategy Framework Directive,
- Water Framework Directive (for transitional and coastal waters)

The summary takes into account all types of pressures and impacts listed in Table 2 of Directive 2017/845 related to:

- physical loss,
- physical damage,
- disruptions of hydrological processes,
- contamination with dangerous substances,
- regular and/or intentional discharges of substances, including biogenic substances and organic matter,
- biological disturbances,

and Article 150 (3) (2) of the Water Law:

- jamming caused by artificial islands, structures and devices,
- submarine cables and pipelines or excavation from bottom dredging,
- Siltation, including caused by artificial islands, structures and devices,
- submarine cables and pipelines,
- reducing the transparency of marine waters, including that caused by discharges
- sewage and rainwater, dredging or removal of spoil from bottom dredging,
- abrasion, including that resulting from commercial fishing, recreational navigation and anchoring,
- extraction of inanimate natural resources as a result of exploration or exploitation of the seabed,
- submarine noise, mainly caused by shipping, artificial islands, structures and equipment, including underwater acoustic equipment and submarine cables and pipelines,
- waste discharged into the sea,
- introduction of synthetic compounds into the water, including antifouling agents used on ships,
- the introduction of non-synthetic substances and compounds, mainly heavy metals and hydrocarbons, including as a result of pollution of marine waters by ships, as well as the exploration and exploitation of minerals, oil and gas,
- the introduction of substances other than those mentioned above, whether solid, liquid or gaseous, as a result of regular or deliberate discharge, in accordance with the provisions governing the introduction of those substances into marine waters.

In order to identify areas particularly vulnerable to environmental problems for the purposes of the Environmental Impact Forecast of the draft plan for the spatial development of internal marine waters, territorial sea and the exclusive economic zone scale 1: 200 000, an inventory of the main sources of pressure resulting from the current and planned use of Polish maritime areas and the coastal strip was made on the basis of the Analysis of the Conditions of Spatial Development of Polish Maritime Areas.

Areas subject to pressure with varying degrees of intensity were distinguished, depending on the number of pressure sources (Table 55 and **Błąd! Nie można odnaleźć źródła odwołania.**). As a result of the spatial analysis, it was found that areas of intense pressure occur in protected areas and environmentally valuable areas, which is also a significant problem of environmental protection.[145]

When analysing the sources of pressure, the following elements were taken into account: existing technical infrastructure (cables, pipelines), concessions issued for maritime mining, projects related to coastal protection, port areas and marinas, designated navigation routes, waterways, access tracks to ports, anchorages, storage sites for spoil (dumping sites), zones used to ensure the security and defence of the state (closed zones and periodically closed to shipping and fishing), as well as investments planned in the near future related to wind and nuclear energy. In addition, areas were indicated where tourism, sport and recreation are an important source of pressure.[146]

**Table 55 Areas of natural value subject to intense pressure.**

| Item | Task | Pressure source |
|---|---|---|
| **1.** | Swina Delta | Marine mining (licences issued) |
| | | Marinas |
| | | Coastal protection |
| | | Port area |
| | | Tourism, sport and recreation |
| **2.** | Głazowisko Rowy | Coastal protection |
| | | Shipping lane |
| | | Port area |
| | | Access tracks to ports |
| **3.** | Bornholm Depth | Technical infrastructure (cables) |
| | | Shipping lane |
| **4.** | The depths of Gdańsk | Shipping lane |
| | | Closed and periodically closed zones for shipping and fisheries |
| **5.** | Ławica Słupska | Technical infrastructure (cables) |
| | | Shipping lane |
| **6.** | Middle Bar | Wind energy (decisions issued) |
| | | Marine mining (licences issued) |
| **7.** | Coastal waters of the Baltic | Nuclear energy (planned investment) |
| | | Marine mining (licences issued) |
| | | Technical infrastructure (cables) |
| | | Dumping sites |

[145] Forecast of the environmental impact of the draft plan for the spatial development of internal marine waters of the territorial sea and the exclusive economic zone on a scale of 1: 200,000 – Task 5, version v.3
[146] Forecast of the environmental impact of the draft plan for the spatial development of internal marine waters of the territorial sea and the exclusive economic zone on a scale of 1: 200,000 – Task 5, version v.3

| Item | Task | Pressure source |
|---|---|---|
| | | Anchorages |
| | | Coastal protection |
| | | Shipping lane |
| | | Port area |
| | | Technical infrastructure (pipelines) |
| | | Closed and periodically closed zones for shipping and fisheries |
| | | Access tracks to ports |
| | | Tourism, sport and recreation |
| **8.** | Rynna Słupska | Technical infrastructure (cables) |
| | | Shipping lane |
| **9.** | Słowiński National Park | Coastal protection |
| | | Tourism, sport and recreation |
| **10.** | Vistula River Mouth | Anchorages |
| | | Coastal protection |
| | | Port area |
| | | Shipping lane |
| | | Tourism, sport and recreation |
| **11.** | Wolin National Park | Marine mining (licences issued) |
| | | Marinas |
| | | Coastal protection |
| | | Port area |
| | | Tourism, sport and recreation |
| **12.** | Eastern Border Waters | Dumping sites |
| | | Tourism, sport and recreation |
| **13.** | Gulf of Pomerania | Marine mining (licences issued) |
| | | Technical infrastructure (cables) |
| | | Dumping sites |
| | | Anchorages |
| | | Coastal protection |
| | | Shipping lane |
| | | Port area |

| Item | Task | Pressure source |
|---|---|---|
| | | Technical infrastructure (pipelines) |
| | | Closed and periodically closed zones for shipping and fisheries |
| | | Access tracks to ports |
| | | Tourism, sport and recreation |
| **14.** | Bay of Puck | Marine mining (licences issued) |
| | | Technical infrastructure (cables) |
| | | Dumping sites |
| | | Anchorages |
| | | Marinas |
| | | Wastewater discharge points |
| | | Coastal protection |
| | | Marinas, wharves |
| | | Shipping lane |
| | | Port area |
| | | Technical infrastructure (pipelines) |
| | | Closed and periodically closed zones for shipping and fisheries |
| | | Access tracks to ports |
| | | Tourism, sport and recreation |

*Source: Forecast of the environmental impact of the draft plan for the spatial development of internal marine waters of the territorial sea and the exclusive economic zone on a scale of 1: 200,000 – Task 5, version v.3*

The most vulnerable areas (with the largest number of identified sources of pressure) are: the coastal zone (Natura 2000 area - PLB990002 Coastal Waters of the Baltic Sea) and the Gulf of Puck and the Gulf of Pomerania.

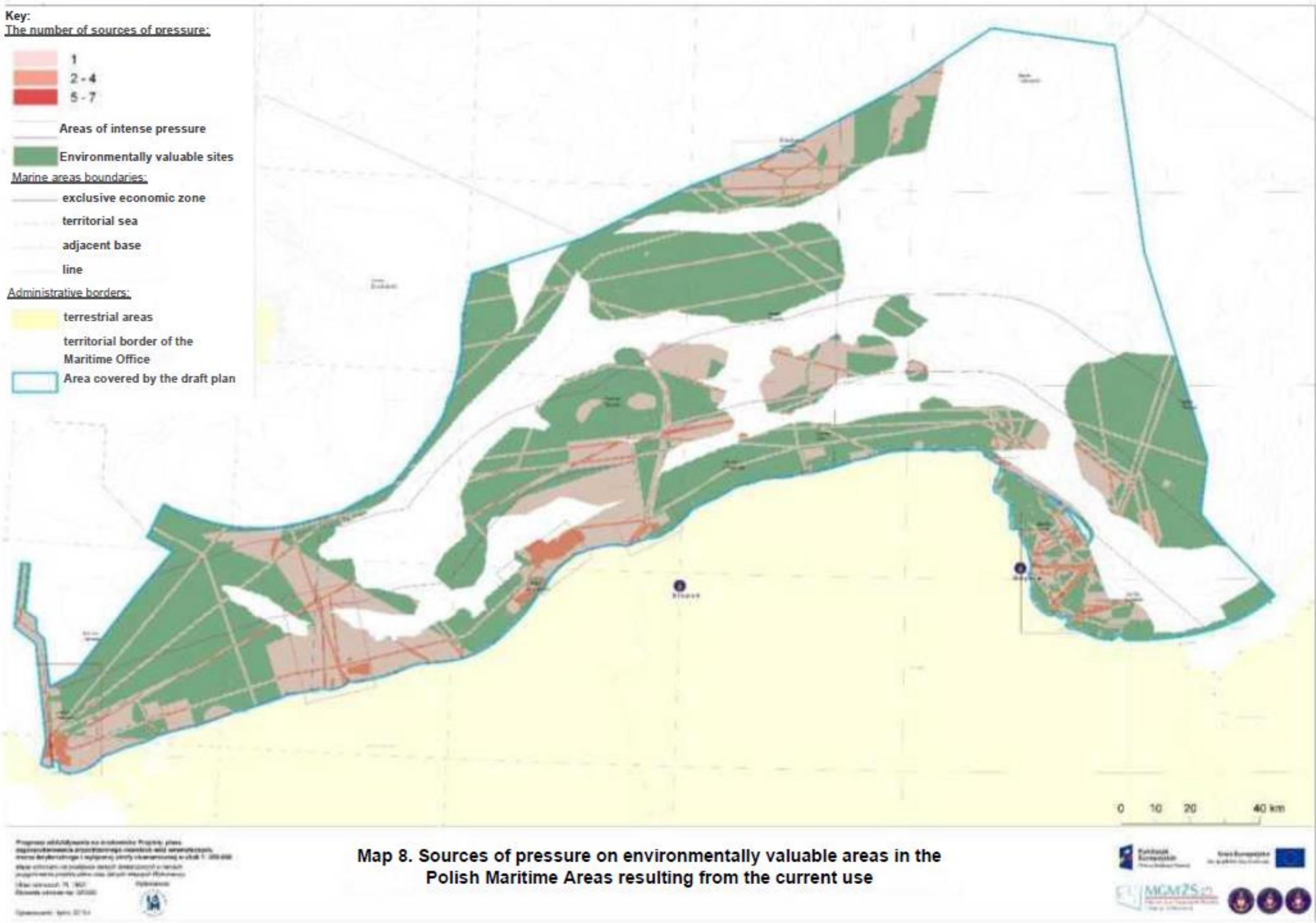



**Fig. 69 Sources of pressure on environmentally valuable areas in Polish marine areas resulting from current use**

*Source: Forecast of the environmental impact of the draft plan for the spatial development of internal marine waters, the territorial sea and the exclusive economic zone on a scale of 1: 200,000*

For the purposes of the Forecast, the pressures exerted on the aPOWM impact area are described by three groups of factors related to both the coastal zone and marine waters:

- physical/morphological – they concern transformations in the surface of the earth (shore and seabed), changes in physical properties of water and underwater noise,
- chemical – chemical pollution, waste, including contamination with hazardous substances,
- biological – changes in the species composition of flora and fauna resulting from selective exploitation, introduction of invasive species, organic matter, fertilizers and pathogens.

One factor can exert many types of pressure at the same time.

**Physical pressures**

The physical disturbance of the seabed is defined as a change in the seabed that can be restored if the disturbing activity ceases. measures likely to cause physical disturbance to the seabed shall be deemed to include offshore or shoreline construction, sand and gravel extraction, dredging and storage of spoil, as well as maritime transport and trawling. Seabed physical loss is defined as a change in the subsoil or morphology of the seabed that has lasted or will continue for two or more seabed strategy cycles (12 years) under Decision 2017/848.[147]

Physical pressures occurring in Polish maritime areas consist in:

- the conversion of coasts and seabed,
- change in the lithology of sediments and sea shores,
- the emission of underwater noise and
- change in physical properties of water.

**1. Changing the surface shape by deepening the fairways, underwater exploitation of aggregates and storage of the associated spoil, as well as the implementation of the investment.**

Maintenance and dredging of waterways causes various types of impact on the seabed, in particular, the removal of spoil changes physical conditions by changing the topography of the seabed, increases the turbidity of water due to picking up sediment particles from the bottom, may also cause backfilling of the bottom with previously raised sediment. Habitat loss is limited to the dredging site, while disturbances due to sedimentation may have a wider spatial extent. The results of the conducted research indicate that disturbances caused by sedimentation may affect animals and vegetation within a few kilometers of the basic activity. Deposition of dredging matter, which may lead to weakening of benthic organisms and loss of habitat. In addition, the deposited material may contain higher concentrations of hazardous substances and nutrients than the storage site. Remobilisation of sediments may contribute to the release of contaminants contained therein and the eutrophication effect[148].

The map below presents current and potential sources of pressure on the seabed, including the distribution of natural aggregate deposits located in the Central Geological Database and prospective sand deposits, used to protect the seabed from erosion (Study of Conditions and Spatial Development of Polish Marine Areas), as well as the place of storage of dredging spoil. There is no spatial data about the locations where the dredging is carried out.

[147] Update of the preliminary assessment of the status of marine water environment, Warsaw 2018
[148] Update of the preliminary assessment of the status of marine water environment, Warsaw 2018

Changes in the shape of the bottom may result from the implementation of planned projects, such as: underwater gas transmission systems, e.g. Baltic Pipe, implementation of offshore wind farms (including the power cable to land), expansion of sea ports and others, as well as the currently performed excavation of the Vistula Spit or deepening of the Szczecin – Świnoujście waterway.

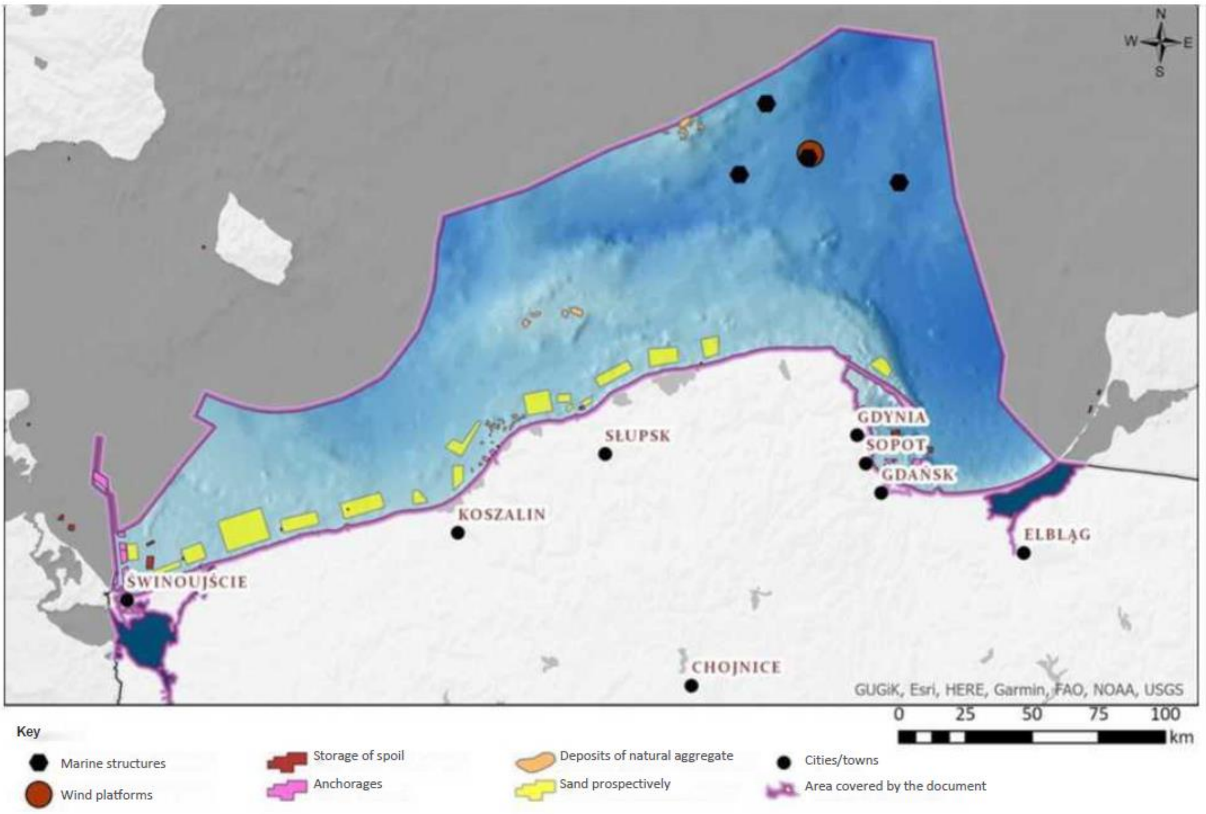



**Fig. 70 Selected measures transforming the bottom surface of Polish maritime areas**

*Source: Own elaboration on the basis of data from PIG (CBDG), HELCOM), and the Study of the determinants of spatial development of Polish maritime areas.*

**2. Change of silting by sewage discharge or works related to dredging and discharging dredging spoil.**

The extraction of sand and gravel from the seabed associated, for example, with hydro-building or silting may cause habitat loss (partial or total, depending on how much sand or gravel is extracted and what the extraction technique is), usually through changes in the topography of the seabed, increased turbidity, suppression of nearby areas (covering with settling slurry). Usually, the total loss of habitats occurs directly at the extraction site (the habitat is removed along with the bottom material), and the disturbance – in the area of the extraction site, where the impacts are weaker.[149]

**3. Seabed erosion and hydrodynamic imbalances through the construction of wind farms and drilling platforms as well as fishing and anchoring.**

Interference in the bottom layer related to hydro-building (e.g. construction of ports, wind farms, installation of cables and pipelines at the bottom of the sea). The extent of bottom loss and/or disturbance depends on local hydrological conditions, the type of habitats in the area of the structure, and the type of structure. It is important that the impacts are different during the construction phase

[149] Update of the preliminary assessment of the status of marine water environment, Warsaw 2018

and after its completion. Depending on the measures carried out, not only the existing habitats may be destroyed, but also new ones may be created (as a result of changing the properties of the substrate in the area of the structure). Cables and pipelines can be placed in the excavation and then covered with sludge extracted elsewhere, the composition of which is usually different, resulting in local environmental changes[150]. Schwarzer et al. (2014) stated that natural regeneration of the environment is possible over decades.[151]

4. **Emission of underwater noise, e.g. by ships, wind farms, drilling platforms, low-flying aircraft (including military aircraft), cruise ships, motor boats and others.**

The level of underwater noise in the Baltic is likely to increase as human activity at sea have increased over the last few decades. Anthropogenic sources of underwater noise include, among others: work of engines of boats, ships and ships, dredging work and construction of facilities (wind farms), work of underwater hydrotechnical devices (drills, dredgers, piledrivers), sonars and echo probes, geological explosive explosions, training detonations on naval military training grounds, underwater explosions in the destruction of ammunition. The sound from these sources can spread over long distances.

Marine animals use underwater sounds in the process of communication and navigation, during hunting, determining the position of their companions, escaping from a predator. Anthropogenic underwater noise can cause damage to their body shells or even death, lead to changes in behaviour or mask other sounds that may be important for marine organisms. These factors may lead to negative changes at the level of the individual and the entire population. Reducing underwater noise is particularly important for the protection of the critically endangered porpoise population in the Baltic Sea.

On the Polish coast, underwater noise may scare marine mammals (in particular grey seals) away from places abundant in food, and thus affect the weakening of their condition, which is already reduced, among others, due to environmental pollution[152]

5. **Strengthening the banks, thus disturbing the natural balance between erosion and accumulation processes in the bank zone, forcing the artificial accumulation of sediments near breakwaters, spurs, moles.**

Changes in anthropogenic hydrological conditions may be associated primarily with changes in temperature, salinity, sea water reaction, as well as mixing and exchange of water, changes in the characteristics of the sea currents field and wind waves. Most of these elements are the result of anthropogenic pressures of land origin (mainly discharges of water from land, e.g. waters heated as a result of cooling the power plant). Anthropogenic pressures of marine origin include offshore structures (wind farms, drilling platforms) and modifications to fairways and the construction of fairways that may cause local changes in hydrodynamic conditions. In connection with the implementation of the measures indicated in the strategic documents on the development of transport and energy, it is necessary to assume the intensification of anthropogenic pressures.

**Chemical pressures**

In many cases, the sources of chemical pressures are common with the sources of physical and biological pressures, e.g. in the case of sewage disposal, which may cause an increase in silting, but

[150] Update of the preliminary assessment of the status of marine water environment, Warsaw 2018
[151] Schwarzer K., Bohling B., Heinrich C. (2014): Submarine hard bottom substrates in the western Baltic Sea – human impact versus natural development. Journal of Coastal Research SI 70: 145–150;
[152] Gójska A. ed. 2012, Grey Seal Protection Programme – draft, WWF Poland Foundation

also the emission of pollutants, which in turn also causes pressure on living organisms. Chemical pressures exerted on marine areas can be divided into those whose source:

- is located inside the body of water,
- located outside any part of the Baltic Sea.

External pressures, in the form of pollutants, are largely transmitted by rivers, but also partly by air (dust).

In the context of the BSPI/BSII, hazardous substances should be understood primarily as heavy metals and persistent (difficult to break down) synthetic or non-synthetic organic compounds, capable of causing severe poisoning, malignancies and other potentially fatal or hazardous changes in living organisms even at low doses.

Heavy metals (cadmium, mercury) are emitted to the air along with exhaust gases, which are generated by the operation of maritime transport (Fig. 72). They enter the sea either directly with precipitation, or indirectly, migrating with precipitation water to rivers. In a similar way, many dangerous organic compounds enter the sea as products of incomplete combustion of fossil fuels, waste, etc. This category includes, among others, dioxins and benzo-a-pyrenes. The source of hazardous substances may also be shipwrecks located on the seabed, not removed after World War II, and ammunition (Fig. 71).

In terms of monitoring heavy metals in living organisms and bottom sediments, the values are more diverse in space. The assessment of the state of the southern Baltic environment in 2019 in terms of heavy metal contamination was carried out on the basis of the limit values of heavy metal concentrations – cadmium (Cd), lead (Pb) and mercury (Hg) – in organisms[153]. The highest concentration of cadmium in fish livers was recorded in the basin of the eastern Gotland Basin and the Bornholm Basin. Lead concentrations in the livers of herring, flounder and perch, irrespective of the species and region of origin of the fish, were similar in each body of water. In the case of mercury, the muscular tissues of perch and perch were characterised by relatively high concentrations of mercury.[154]

Radionuclide monitoring includes $^{137}Cs$ and $^{90}Sr$. These are isotopes of anthropogenic origin, characterised by a relatively long half-life of 30 and 28 years respectively, which are mainly responsible for shaping the level of anthropogenic radioactivity in the waters of the Baltic Sea. The main sources of monitored isotopes are nuclear weapons tests, intensified in the 1950s and 1960s, and the Chernobyl failure in 1986. Changes in their radioactive activity in the marine environment are mainly influenced by radioactive decay, sedimentation processes, exchange of waters with the North Sea and, to a negligible extent, bioaccumulation processes in organisms of marine fauna and flora.[155] In 2019, average concentrations of $^{137}Cs$ in three areas: The Bornholm Basin, the Eastern Gotland Basin and the Gdańsk Basin were at a similar level to the activity from 2018. Only within the area of coastal waters of the Gdańsk Basin, there was a decrease in activity by about 20% compared to the previous year,

[153] Assessment of the State of the Environment of Polish Maritime Areas on the basis of monitoring data from 2019 against the background of the decade 2009-2018, Warsaw 2020
[154] Assessment of the State of the Environment of Polish Maritime Areas on the basis of monitoring data from 2019 against the background of the decade 2009-2018, Warsaw 2020
[155] Zalewska T., Jakusik E., Meteorological and hydrological conditions and characteristics of the physical, chemical and biological elements of the southern Baltic Sea in 2018, Institute of Meteorology and Water Management
National Research Centre, Warsaw 2020

which was caused by the greater impact of the Vistula River during the period of water sampling. In the case of $^{90}Sr$., there are no clear trends of changes during the period under assessment in any of the bodies of water. The smallest average concentration characterized the waters of the Bornholm Basin. In three other areas: in the eastern Gotland Basin, in the coastal waters of the Gdańsk Basin and in the Gdańsk Basin, the values were similar.

It can be expected that this trend may change as a result of the implementation of the nuclear power plant, but this will be the subject of an environmental impact assessment for this project. According to the Polish Nuclear Energy Programme, nuclear start-up and synchronisation of the first unit of the EJ1 power plant will take place after 2030.

For persistent organic pollutants, monitoring shall be carried out taking into account the full list of organic compounds determined in the appropriate matrices. The state of the pool environment in open water areas was assessed in 2019 on the basis of analyses of the following compounds: bromoorganic (polybrominated defenyl ethers - the sum of 6 PBDEs and hexabromocyclododecane - HBCDD), perfluorooctane sulfonate (PFOS), organochlorine compounds (hexachlorocyclohexane - HCH, hexachlorocyclobenzene – HCB, the sum of six congeners of polychlorinated biphenyls – CB 28, CB 101, CB 138, CB 153, CB 180 and congeners CB 118, tributyltin – TBT determined in fish muscles and PAH metabolites (1-hydroxypiren and 1-hydroxyphenanthrene) determined in fish bile. In all three areas (the eastern Gotland Basin, the Bornholm Basin and the Gdańsk Basin), the state of the environment in terms of contamination with persistent organic compounds was considered inadequate. The state of the Vistula Lagoon was considered good because the concentrations of all test substances, including PBDE, remained below the limit value. In the Szczecin Lagoon, the concentrations of compounds determining the boundary between good and inadequate state were exceeded.[156]

Deliberate discharges of substances concern in particular:

- treated and untreated municipal and domestic wastewater,
- rainwater,
- surface runoff (agriculture, fertilizers),
- manure ammonia evaporation,
- emissions of pollutants and dusts to the atmosphere.

Concentrations of such pollutants occur at estuaries. The problem is discussed below in the context of biological pressures.

[156] Assessment of the State of the Environment of Polish Maritime Areas on the basis of monitoring data from 2019 against the background of the decade 2009-2018, Warsaw 2020

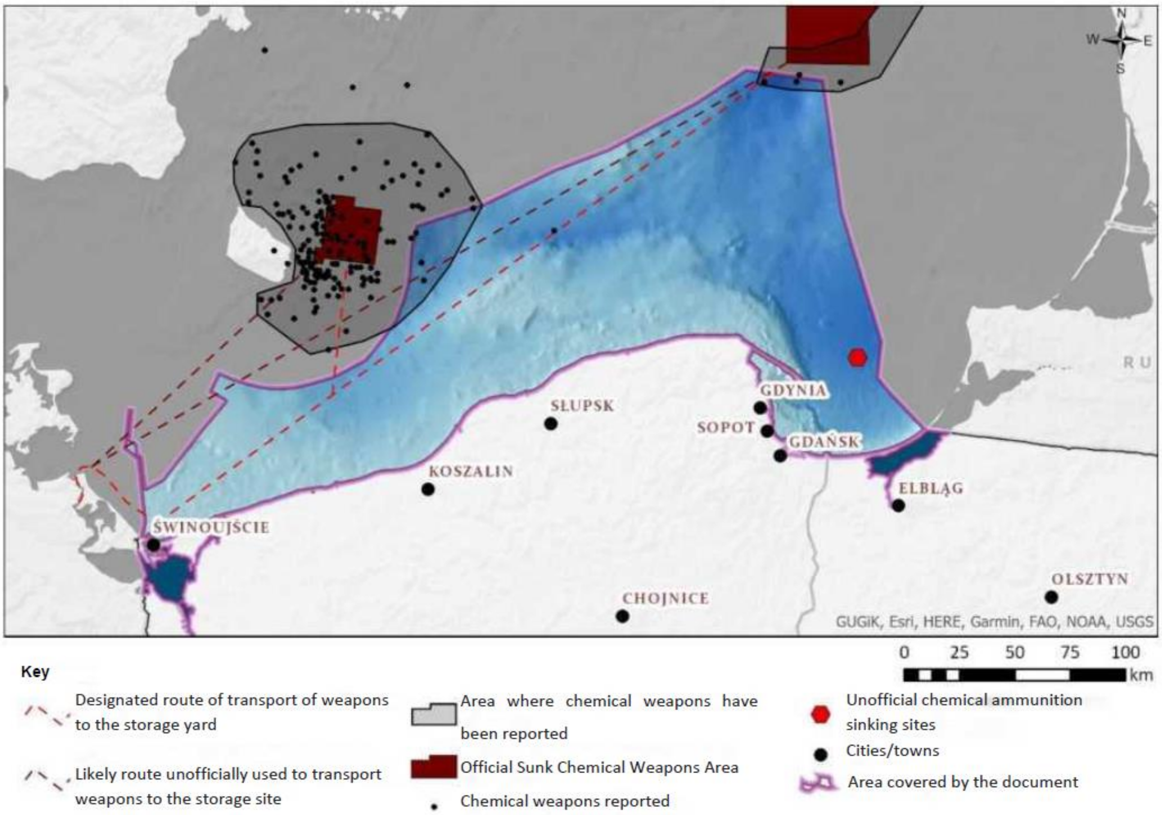



**Fig. 71 Location of sunken ammunition and chemical weapons**

*Source: Study of the conditions for the spatial development of Polish maritime areas.*

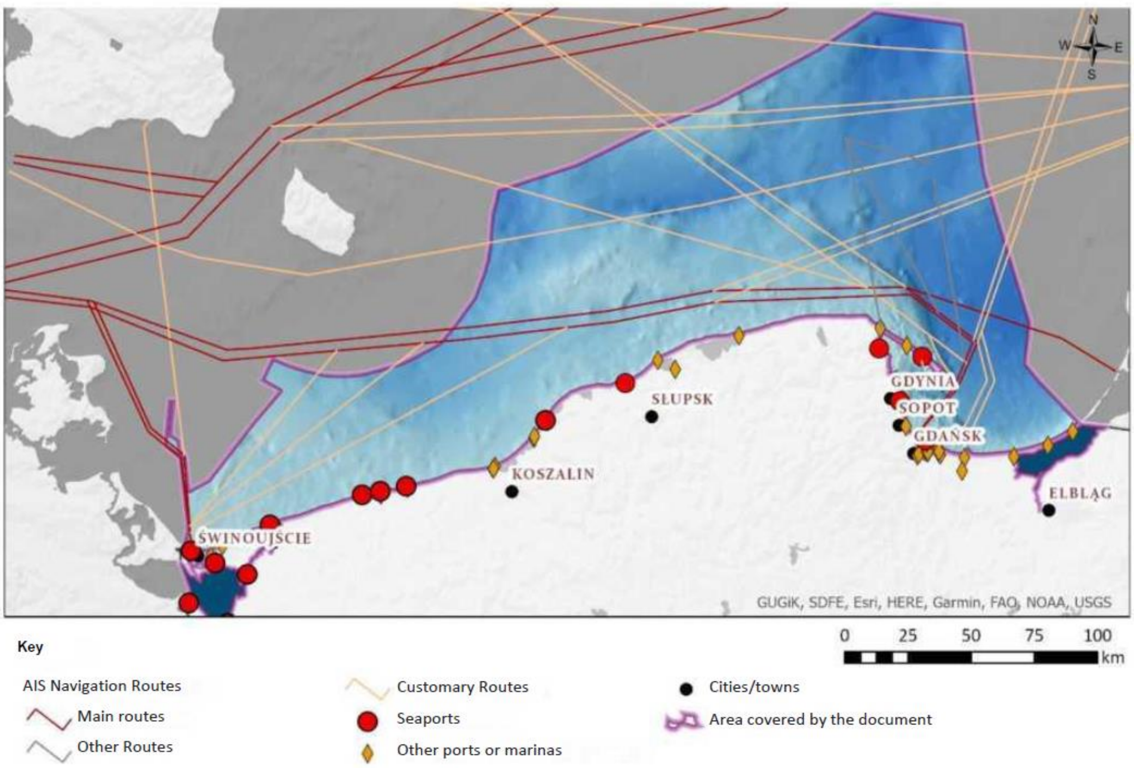



**Fig. 72 Location of ports and navigation routes**

*Source: Study of the conditions for the spatial development of Polish maritime areas and (ports) BDOT.*

**Biological pressures**

Biological pressures in Polish marine areas are exerted by:

1. **Agriculture**

Nitrates and phosphates are compounds of agricultural origin that can enter waters. One of the sources of emissions of these compounds to water may be the use of fertilisers. Harmful substances from agriculture that can enter the waters and then reach the Baltic Sea are also organochlorine pesticides or polycyclic aromatic hydrocarbons. Such pollutants flow from all over the Baltic Sea basin and are delivered to it in large quantities at a point in the mouths of rivers. The largest amounts of phosphorus and nitrogen and organic matter are transported and delivered to the Baltic Sea at the mouth of the Vistula (Helcom[157]). The result of this situation is an increase in the content of chlorophyll in sea water, as evidenced by the development of phytoplankton. Polish marine waters are subject to strong pressure, which is eutrophication caused by human activity. This process causes a decrease in biodiversity and hypoxia of the bottom parts of the reservoir.

2. **Introduction of microbial pathogens**

In Poland, microbiological monitoring of water is carried out regularly only in waters designated as bathing sites. In 2019, there were 163 temporary and coastal bathing sites within the SWB. The 2019 bathing season was characteristic in terms of the number of temporary bathing bans issued due to the mentioned cyanobacteria bloom.[158]The source of microbial contamination is man (including municipal sewage), animals bred by man (pollutants flowing into surface waters).

3. **Selective exploitation of species – commercial and recreational fishing**

Selective fishing, exploiting the living resources of the Baltic, which are certain fish species, is an important pressure on the marine environment.

Fishing in transitional and coastal waters is characterised by the greatest diversity of species, due, among other things, to the high proportion of freshwater fish, which are largely dominated by flounder, bream, perch and zander.

Fishing pressure across the Baltic Sea, including the pom, is rather high and affects not only the fish caught, but also the entire marine ecosystem, including mainly non-market fish, fish under protection, birds and invertebrates of the seabed. The environmental impact of fishing depends on both fishing gear and fishing effort. High seas fisheries use mainly active (bottom trawls and pelagic trawls) and passive fishing gears (bottom trawls, bottom trawls, seines), while coastal and shallow-water fisheries use mainly passive gear. The threat to the Baltic Sea ecosystem is overfishing, which occurs when the volume of catches exceeds the natural reproductive capacity of fish stocks.

The development of the fisheries sector depends to a large extent on the condition of the fish stocks, their development and, consequently, a healthy ecosystem, not subject to overexploitation.[159]

4. **Non-native species**

At present, alien species are perceived as one of the greatest threats to ecosystems on earth, because their introduction and spread are the least predictable and are among the most dynamic natural processes occurring under the influence of human activity.

[157] http://maps.helcom.fi/website/Biodiversity/index.html
Sanitary [158] Condition of the Country, GIS 2019
[159] Update of the preliminary assessment of the status of marine water environment, Warsaw 2018

According to the data contained in the HELCOM report[160], an increase in alien species has been observed in the Baltic Sea since the beginning of the 19th century. Currently, the number of alien species, including species with an unknown introduction vector, that have appeared in the Baltic Sea since the 19th century is estimated at about 140. This figure includes 14 new alien species identified in the period 2011–2015[161].

The Baltic Sea is prone to new species. In the Baltic Sea, domesticated alien species constitute 59% of the total number of introduced species and about 30% of the total number of macrofauna taxa in the brackish coastal waters of the Gulf of Gdańsk[162].

An additional source of data were scientific publications resulting from the work carried out as part of the Baltic Sea Pilot Project BALSAM aimed at testing methods of monitoring alien species in the port of Gdynia[163]. On the basis of the literature data, a list of alien species recorded within the Polish Maritime Areas was prepared. There were 30 non-native species belonging to the following groups: phytoplankton, zooplankton, macrophytes, zoobenthos and avifauna and 26 species of ichthyfauna[164]. In the period 2011-2016, 4 new alien species were identified in the pom region, *i.e. Dreissena bugensis, Melita nitida*, *Palaemon* macrodactylus, *Rankia cuneata*. Only *Palaemon macrodactylus is* a new species for the Baltic. The remaining taxa have already been observed in other sea areas[165].

[160] HELCOM 2009 Biodiversity in the Baltic Sea – An integrated thematic assessment on biodiversity and nature conservation in the Baltic Sea: Executive Summary. Balt. Sea Environ. Proc. No. 116A

[161] HELCOM 2017d Implementation of the Baltic Sea Action Plan, Activity Report 2017 — BESP 154

[162] Ojaveer, H., S. Olenin, A. Narscius, A.-B. Florin, E. Ezhova, S. Gollasch, K.R. Jensen, M. Lehtiniemi, D. Minchin, M. Normant-Saremba & S. Strake, 2016, Dynamics of biological invasions and pathways over time: a case study of a temperate coastal sea. Biological Invasions 19:799-813.

[163] Marszewska L., Dumnicka E., Normant-Saremba M., 2017. New data on benthic Naididae (Annelida, Clitellata) in Polish brackish waters. Oceanology 59 (1) 81-84

[164] Preliminary assessment of the status of marine waters environment of the Polish Baltic Sea zone. Report to the European Commission, GIOŚ

[165] Update of the preliminary assessment of the status of marine water environment, Warsaw 2018

# 7 Forecast of the state of the environment in the absence of aPOWM implementation

The programme for the protection of marine waters shall define the measures necessary to achieve or maintain good environmental status of marine waters (including legal, administrative, economic, educational and control measures), which shall in particular:

- affect the permissible intensity of human activity, the permissible degree of disturbance in marine ecosystems and the location and date of implementation of planned projects,
- for restoring damaged elements of marine ecosystems,
- contribute to the identification of marine pollution.

Therefore, the lack of implementation of aPOWM weakens the effect of implementing all existing and planned, measures aimed at improving the environment of marine waters contained in strategic documents.

The methodology adopted for the development of aPOWM is based on the approach of identifying and determining the limit values for each of the features (D1-D11), and then searching for such solutions (measures) that will enable achievement or improvement and then assessing the effectiveness of the proposed measures with the assumed scenarios/variants of the implementation of the measures. One of the analyzed options was the baseline scenario, also called the zero variant (the equivalent of the so-called Business as Usual (BaU) option, i.e. the lack of implementation of measures resulting from aPOWM. Therefore, Annex 3 to the aPOWM ('Gap Analysis') presents a forecast of the development of the situation in the BaU scenario.

In the "BaU" scenario, in particular, reference was made to the lack of implementation of aPOWM measures leading to the reduction of the inflow of biogenic compounds from land-based sources to the Baltic Sea. The analyzes presented in aPOWM show that in the case of nitrogen, the implementation of KPOWM from 2017 (without the implementation of aPOWM measures) will not offset in 2050 the increases related to the socio-economic development of the country – nitrogen river loads will increase on average by about 4%, from about 3% in the Vistula river basin to about 6% in the Przymorze rivers. As regards phosphorus, in the perspective of 2050 an overall decrease of about 8% can be expected compared to 2018, with considerable regional diversity – in the Vistula and Odra river basins the decrease will be about 10%, Neman and Pregoła - 3%, and in the Vistula Region an increase of 2% can be expected.

In turn, according to aPOWM, it is estimated that the full implementation of aPOWM (new measures included in aPOWM and continued measures with KPOWM) may result in a reduction of nitrogen loads by more than 60,000 tonnes and phosphorus by more than 5000 tonnes. For standard loads from 2018, this would mean a 29% and 54% decrease in nitrogen and phosphorus loads, respectively, to HELCOM's National Load Ceilings (NICS)[166]. Thus, the lack of implementation of aPOWM means a lack of reduction of the burden of biogenes of a very significant nature, both for inland waters (in order to achieve a good state in terms of eutrophication indicators by the vast majority of river and lake water bodies, the state of which is currently classified as below good), and marine waters. However, it should be stressed that this reduction will be significantly extended in time, mainly due to the timetable for the implementation of the largest of the measures, i.e. N_21 "Catchment programmes for the reduction

[166] HELCOM Copenhagen Ministerial Declaration. Taking Further Action to Implement the Baltic Sea Action Plan - Reaching Good Environmental Status for a healthy Baltic Sea. 3 October 2013, Copenhagen, Denmark

of agricultural pollution", the full implementation of which is planned for 2036. Due to the distant (2036) deadline for full implementation of measures and the long response time of the ecosystem to the reduction of loads (the time of water exchange in the Baltic Sea is 25 years), no significant improvement is expected by 2027, while the achievements of GES in the perspective of 2050 can be expected mainly in transitional waters, where water exchange times are shorter, water mixes regularly to the bottom and the influences of loads from other countries are small. In open waters, it is to be expected that even with the reduction of cargo to NIC by other countries, GES will be achieved after 2050 due to a very slow improvement in oxygen conditions under the halocline.

Considering the trends in biogenic loads discharged by Poland, it is to be expected that the potential of the measures already fully implemented has been fully exploited and, consequently, their maintenance alone will not be sufficient to sustain the downward trends in biogenic emissions to the Baltic Sea. The lack of implementation of aPOWM precludes the achievement of GES even in the above-mentioned distant perspective and will contribute to the further deterioration of habitats in transitional and coastal waters, as well as to the extension of the range of anaerobic zones in open marine waters.

In addition, the lack of implementation of aPOWM measures will result (among others) in:

- An unbridled increase in the level of pressure from alien species in the coming decades, including in relation to alien species present in Polish inland waters and potentially invasive in brackish waters, which are only on the threshold of invasion of Polish transitional and coastal waters (these include, among others, fish of the Gobiidae family).
- reduction of the population of marine mammals in the Baltic Sea in the next decades (in particular porpoise, which is on the list of endangered HELCOM species, as a critically endangered and endangered species, due to its very small population size).
- Leaving unchanged the current monitoring system for marine habitats in POMs will perpetuate the gap in knowledge about the state of coastal waters and fish habitats in these waters.
- The problem of by-catch of protected or prohibited fish species will continue and, with the use of standard fishing gear and techniques, this will not change the scale or reduce the adverse impact on these species.
- Continued fishing in transitional waters, targeting valuable species, including predatory species, in the absence of systematic restocking, will contribute to the consolidation of the adverse status of ichthyofauna, particularly in relation to the persisting pressure of eutrophication.
- In the absence of corrective measures, the risk of leaks of hazardous substances from wrecks and flooded chemical weapons will increase as a result of corrosion and unsealing of tanks and containers.
- In the absence of aPOWM measures in the field of active protection of bird species, the increase in anthropogenic pressures may be associated with the progressive disappearance of marine bird habitats, and thus affect the range and species composition. The increase in pressure is related to the development of offshore wind energy and the Baltic mining industry, the development of coastal tourism and increased human penetration of coastal areas.

# 8 Anticipated significant impact of aPOWM

## 8.1 Introduction

In accordance with the methodology presented in Chapter 3, the analysis of the impact of aPOWM on the implementation of strategic objectives of environmental protection was carried out at the level of specific groups of measures. For the purposes of the assessment, the following groups of measures, determined according to the leading characteristic of GES, are listed and assigned to the corresponding KTM[167]:

**A. Conservation and restoration measures (KTM 14, 18, 19, 20, 27, 28, 35, 36, 37, 38, 39)**

Within this group, measures were listed for extending the number of protected species, ensuring active protection of selected bird species, limiting anthropogenic measures related to noise emissions in Natura2000 areas where marine mammals are protected. In addition, additional measures to the protection of the porpoise were indicated (adding as a subject of protection in the Natura2000 area - Słupsk Bank or limiting by-catches of porpoises in POM) and seals (limiting the disturbance of seals by people at the place of their reproduction). Measures to improve monitoring of breeding birds (silver seagull not yet monitored on the Polish coast) and monitoring and control of land predator populations (raccoon dog, mink, raccoon, fox) were also programmed.

For the purposes of this evaluation, new measures were included in Measure Group A: N1 – N11, **N26, N37** and continued measures with KPOWM: BALPL-M002, BALPL-M004 - BALPL-M006, BALPL-M054, BALPL-M055. A detailed description of the measures is included in the aPOWM in the activity sheets, developed individually for each activity and included in Attachment 4 of the aPOWM draft document.

**B. Measures to reduce eutrophication (KTM 1, 2, 14, 16, 22, 23, 33, 37, 39)**

Measure group B specifies measures related to limiting the supply of biogenes, in particular from agricultural sources as well as municipal economy. These are measures aimed at reducing biogenes from agriculture and forestry, such as the introduction of catchment programmes to reduce agricultural pollution, changing the rules of manure management, the use of drainage channels for water retention or limiting the use of forests in the vicinity of waters. This group includes tasks stimulating the increase in the removal of biogens in sewage treatment plants, such as: expanding monitoring and increasing the requirements for the removal of biogens in sewage treatment plants, introducing fees for biogens in wastewater or differentiation of increased fees for biogens.

For the purposes of this evaluation, the following new measures were included in Measure Group B: N15 – N25 and continued measures with KPOWM: BALPL-M017, BALPL-M020, BALPL-M021, BALPL-M023, BALPL-M025 - BALPL-M027. A detailed description of the measures is included in the aPOWM in the activity sheets, developed individually for each activity and included in Attachment 4 of the aPOWM draft document.

**C. Measures to reduce invasive species (KTM 14, 18, 34, 37)**

As part of this group of measures, the continuation of educational and legal measures indicated in KPOWM (along with their modification) in the scope of preventing the release of alien species into the environment, as well as control and management of vegetation organisms were programmed. New measures indicated to the reduction of the population of invasive Gobiidae species in transitional

[167] KTM - Key Types of Measures designated for reporting under the WFD and MSFD (see chapter 2.1.). The assignment of measures to KTM in this Forecast is indicative.

waters by biomanipulation with the use of predatory fish and the reduction of the population of the Chinese mitten crab in the area of the Szczecin Lagoon were also indicated. In addition, it was assumed to develop methods of reducing invasive species of cancers, on the basis of a pilot program on the Vistula Lagoon and the reduction of the population of the Chinese mitten crab in marine and inland waters in the west of the country, and to develop optimal methods of combating this species.

For the purposes of this evaluation, the following new measures were included in the action group C: N12 – N14 and continued operations with KPOWM BALPL-M009, BALPL-M010. A detailed description of the measures is included in the aPOWM in the activity sheets, developed individually for each measure and included in Attachment 4 of the aPOWM draft document.

**D. measures aimed at preserving and improving the integrity of the seabed (KTM 6, 14, 26, 27, 39)**

Within this group of measures, new measures related to the legal limitation of setting the maximum scale and scope of permanent transformations of coasts and seabed and increasing the knowledge base on the environmental impacts of trawling (study of the impact of bottom dredging on benthic communities, release of matter from sediments and bottom water chemistry) were specified. In addition, an action on the principles of the use of waste from dredging and rational management of spoil is specified.

For the purposes of this evaluation, the following new measures were included in the action group D: **N27 – N29** A detailed description of the measures is included in the aPOWM in the activity sheets, developed individually for each activity and included in Attachment 4 of the aPOWM draft document.

**E. Pollutant reduction measures (KTM 14, 15, 16, 21, 31, 32)**

As part of this group of measures, the continuation of educational and legal measures indicated in KPOWM (along with their modification) was programmed in terms of increasing the effectiveness of combating pollution at sea and examining the scale of environmental threats resulting from the deposition of wrecks on the seabed. The above measures, after modification under aPOWM, concern the construction, modernization and purchase of new units for combating pollution at sea and the tasks of the Interministerial Team for Hazards arising from hazardous materials in the maritime areas of the Republic of Poland and the implementation of recommendations developed by the Team (modified BALPL-M034 - Examination of the scale of environmental hazards resulting from the deposition of wrecks on the seabed). A control action was also proposed, including inspections of installations emitting heavy metals to air and water.

For the purposes of this evaluation, the following new measures were included in the action group E: N30 and continued measures with KPOWM: BALPL-M037, BALPL-M034, BALPL-M038, or BALPL-M041. A detailed description of the measures is included in the aPOWM in the activity sheets, developed individually for each activity and included in Attachment 4 of the aPOWM draft document.

**F. measures aimed at reducing the amount of waste, including micro and nanoparticles of plastics (KTM 14, 29, 31)**

Action Group F specifies measures to reduce the supply of solid waste to the marine environment and to reduce the amount of existing litter. The implemented action of cleaning sea beaches was extended by taking into account the cleaning of the banks of rivers and beaches on lakes. In addition, the municipalities were equipped with modern equipment for cleaning beaches. Lobbying is also envisaged to ban the use of micro- and nanoparticles of plastics. In addition, a continuation of measures in the field of "Fishing for litter" - sea cleaning and action aimed at implementing an effective system of marking fishing nets (preventing the emergence of spectrum networks) was assumed.

For the purposes of this evaluation, the following new measures were included in the action group F: **N31 - N36** and continued operations with KPOWM BALPL-M048, BALPL-M051. A detailed description of the measures is included in the aPOWM in the activity sheets, developed individually for each activity and included in Attachment 4 of the aPOWM draft document.

**Table 56 Identification of significant environmental impacts of individual groups of measures, including in particular on legally protected areas**

| Group of measures | Characteristics of impacts |
|---|---|
| **A. measures aimed at conserving and restoring biodiversity** | With regard to the proposed new measures of this group, it is necessary to indicate, first of all, positive impacts, such as:<br>• Stabilization of the situation of breeding species on the Polish coast by, among others, reducing hunting pressure on the population of both breeding and wintering Tufted duck and pochard, reducing predatory pressure, including in particular from non-native species of land predators - American mink, raccoon dog, raccoon.<br>• Reduce the acoustic impact on marine mammals through the introduction of underwater noise reduction in Natura 2000 sites where these animals are subject to protection, the introduction of a limitation on the maximum speed of passing vessels, and a ban on scooters.<br>• Minimization of interactions (sound waves of great strength causing damage and death of, among others, porpoises) related to the disposal of unexploded ordnance on the sea floor by detonation through the development of methods of using air curtains and deflagration for the disposal of explosives and guidelines and procedures for the implementation by Polish Armed Forces units dealing with the disposal of explosives in the sea.<br>• Support for the protection of critically endangered porpoise species in the Baltic Sea by adding porpoise as a subject of protection in the Natura2000 - Ławica Słupska (PLC990001) area (provided that the seasonal preference for the presence of this species in this area is confirmed) and recommending measures limiting the by-catch of porpoise (e.g. a prohibition on fishing with static nets in Natura 2000 areas in the Pomeranian Gulf in periods of increased detection of porpoises were recorded in the Gulf area).<br>The positive impact described concerns Natura 2000 sites where porpoise and grey seals are protected: Puck Bay and Hel Peninsula PLH220032, Pomeranian Bay Ostoja PLH 990002, Słowińska Ostoja PLH 220023 and Wolin and Usedom PLH 320019, Vistula Lagoon and Vistula Spit PLH280007, Ostoja in Vistula River Mouth PLH220044 and Trzebiatowsko-Kołobrzeski Nadmorski Belt PLH320017. Measure related to the addition of porpoise as a subject of protection in the Natura2000 area - Ławica Słupska (PLC990001), will support the protection of the species of porpoise critically endangered in the Baltic Sea. |

As regards the protection of birds, in particular tufted duck, porchard, gull, sandwich tern, positive effects will occur in the Vistula Mouth, in port areas, within the Baltic coastal lakes located, among others, in the Słowiński National Park, Woliński National Park, Vistula Spit Landscape Park, Seaside Landscape Park and Natura 2000 areas indicated above.

Given the interrelationship between biodiversity and climate change, measures to enhance biodiversity should be seen as mitigation and adaptation measures in the context of climate change. With regard to climate change, these are no-regret measures that bring benefits even in the absence of climate change.

No significant negative impacts were identified. The implementation of selected technical measures related to the active protection of birds by predatory mammals and humans and the restoration of habitats suitable for nesting (the implementation of earth islands or breeding platforms on coastal lakes and floodplains, breaking of connections between bars and the mainland, etc.) will be associated with some environmental impact. However, it should be emphasized that protective measures in the scope of increasing the breeding success of water-mud birds by creating safe nesting places, limiting the level of predation by limiting the access of predators to breeding places or controlling the number of predators, are within the limits of standard protective measures for water-mud birds. In accordance with the assumptions presented in the aPOWM, these measures are coordinated by the bodies managing Natura 2000 sites (OSOP), GIOŚ, Maritime Offices, with the Polish Hunting Association, RDOŚ, GDOŚ, National Parks.

It should be noted that the implementation of Group A measures is not related to the implementation of measures of a technical nature, causing significant impacts in terms of, in particular:

- transformation of the earth's surface (except as required for the introduction of protective measures for ornithofauna),
- emission of pollutants to air, including $CO_2$,
- noise emission,
- discharging pollutants to surface and ground water and ground,
- waste generation,
- the use of natural resources,

Therefore, in connection with the implementation of the measures, the following were not found:

- threats to water intakes used for providing water for human consumption, together with the areas of protection zones of these intakes;
- risks to transitional, coastal and inland waters in respect of the parts of waters intended for leisure purposes, i.e. the organisation of bathing areas and bathing sites on an occasional basis;
- the occurrence of hazards caused by noise (in particular the maintenance of permissible noise levels in acoustically protected areas, especially in residential areas/human habitats, buildings related to the permanent or temporary stay of children and young people and recreational areas),

| | |
|---|---|
| | vibration and air pollution (including ensuring appropriate air quality standards);<br>• the risk of adverse effects on human health and life.<br><br>No negative transboundary impacts have been identified. |
| **B. measures aimed at reducing eutrophication** | With regard to the proposed measures of this group, it is necessary to indicate primarily positive impacts, both within marine and inland waters, related to the limitation of the supply of nitrogen and phosphorus compounds to waters from sewage treatment plants and agricultural sources. It should be stressed, however, that achieving the effect of reducing pressure, and in particular achieving the effects in the Baltic Sea, is postponed far beyond the current planning period of the marine strategies. Achievement of full effects of the implementation of measures in the Baltic Sea is estimated after 2050 – 2060.<br><br>Reducing eutrophication will contribute to the preservation or enhancement of biodiversity by improving abiotic conditions conducive to the restoration of habitats of species living in the Baltic Sea sub-Aquasus. The planned action to reduce nitrogen use in fertilisers falls directly within the scope of mitigation and mitigation measures related to climate change mitigation and adaptation.<br><br>No negative environmental impacts on the marine environment have been identified. With regard to land-based interactions, the consequence of aPOWM measures postulating an increase in legal requirements for the disposal of biogens in sewage treatment plants or an increase in fees for biogens in sewage may be the need to implement modernization works in part of sewage treatment plants. Environmental impacts will be local, mostly limited to the area of existing sewage treatment plants.<br><br>It should be noted that the implementation of Group B measures does not directly concern the implementation of measures of a technical nature, causing significant negative impacts in terms of, in particular:<br><br>• transformation of Earth surface,<br>• emission of pollutants to air, including $CO_2$,<br>• noise emission,<br>• discharging pollutants to surface and ground water and ground,<br>• waste generation,<br>• the use of natural resources.<br><br>As indicated above, in the future, some impacts may occur in the area of modernized wastewater treatment plants in the technological scope (land take, potential increase in specific energy or raw materials consumption, local noise emissions).<br><br>In connection with the implementation of the measures, the following are not expected:<br><br>• threats to water intakes used for providing water for human consumption, together with the areas of protection zones of these intakes; |

| | |
|---|---|
| | • risks to transitional, coastal and inland waters in respect of the parts of waters intended for leisure purposes, i.e. the organisation of bathing areas and bathing sites on an occasional basis;<br>• in addition to possible individual cases, the occurrence of hazards caused by noise (in particular the maintenance of permissible noise levels in acoustically protected areas, especially in residential areas/human habitats, buildings related to the permanent or temporary stay of children and young people and recreational areas), vibrations and air pollution (including ensuring appropriate air quality standards);<br>• the risk of adverse effects on human health and life.<br><br>No negative transboundary impacts have been identified. The technical measures that may result from the implementation of aPOWM measures in the scope of limiting the supply of biogens to the aquatic environment from sewage treatment plants and agricultural measures will only concern the territory of the Republic of Poland. |
| **C. Reduction measures for invasive species** | The primary objective of Group C measures is to minimise one of the main threats to biodiversity posed by the introduction of invasive species into the environment.<br><br>The measures concern in particular:<br><br>• Reduction of the population of Orconectes limosus in the Vistula Lagoon and the population of Chinese mitten crab in the area from Lake Dąbie to the Gulf of Pomerania. In the current aPOWM, these measures are of a pilot nature and include, among others, the identification of effectiveness and improvement of the effectiveness of methods of reducing the population of these species in Polish waters.<br>• Reduction of the population of invasive Gobiidae species in transitional waters by biomanipulation with the use of predatory fish – the action includes, in particular, the preparation and implementation of a programme of stocking of predatory species (zander, pike, eel) for each of the uniform parts of transitional waters, with detailed analyses of the effectiveness of the implementation of the measures including the Vistula Lagoon and the Kamieński Lagoon.<br>• Continuation of the measures of KPOWM in the field of developing the practice of control and handling of growing organisms on ships.<br><br>With regard to the implementation of measures in the current aPOWM, the greatest positive environmental impact will result from the implementation of measures to reduce the population of bulls. The main expected effect is to reduce the population of the Round goby and to limit the expansion of other invasive species from the goby family in transitional waters. In addition, it is expected to improve the structure of the ichthyofauna complexes of transitional waters by increasing the share of predatory species. In addition, biomanipulation will contribute to reducing the rate of water eutrophication and algal blooms by reducing the number of zooplankton-eating fish and, consequently, increasing the pressure of zooplankton on phytoplankton. The positive impacts indicated above will apply to all transitional water bodies. |

Given the interrelationship between biodiversity and climate change, measures to enhance biodiversity should be seen as mitigation and adaptation measures in the context of climate change. With regard to climate change, these are no-regret measures that bring benefits even in the absence of climate change.

The occurrence of significant negative impacts of the proposed measures on other species of fauna and flora, in particular legally protected species, is not predicted. Potential for research into the selective harvesting of invasive species of loss in other species. The measures in the field of diagnosis and reduction of the population of Orconectes limosus and Chinese mitten crab concern in particular the Natura 2000 habitat areas PLH320018 Odra River and Szczecin Lagoon and PLH280007 Vistula River and Vistula River Spit. The protected areas do not include protected invertebrates which may fall into the trap of alien crustacean species. In particular, there are no native species of crayfish or other protected crustaceans. Some types of traps used to catch crayfish may catch small fish. The research will use only such traps on a larger scale, which are known from experience to be selective, and such new types of traps, the construction of which ensures high selectivity of catch (small by-catch of fish). Potential protected species that can be trapped are rosehip and, to a lesser extent, goat. If, at the stage of detailed planning of the operation, the risk of harvesting these species is not eliminated, an application for derogation from the bans concerning these species shall be submitted to the competent RDOŚ. In addition, the design of the traps will allow the release of these fish species back into the environment during regular inspections, which should significantly reduce possible losses.

Negative impacts are not predicted with regard to the control of biofouling on vessels. It can be pointed out that none of the species of animals protected by Polish law are present on the hulls of ships. On the other hand, the hulls of ships arriving in Poland from around the world may potentially contain a number of alien species for the Baltic Sea, posing a threat to its biodiversity.

It should be noted that the implementation of Group C measures does not concern the implementation of measures of a technical nature, causing significant negative impacts in the scope, in particular:

- transformation of Earth surface,
- emission of pollutants to air, including $CO_2$,
- noise emission,
- discharging pollutants to surface and ground water and ground,
- waste generation,
- the use of natural resources.

In connection with the implementation of the measures, the following are not expected:

- threats to water intakes used for providing water for human consumption, together with the areas of protection zones of these intakes;
- risks to transitional, coastal and inland waters in respect of the parts of waters intended for leisure purposes, i.e. the organisation of bathing areas and bathing sites on an occasional basis;

| | |
|---|---|
| | <ul><li>the occurrence of hazards caused by noise (in particular the maintenance of permissible noise levels in acoustically protected areas, especially in residential areas/human habitats, buildings related to the permanent or temporary stay of children and young people and recreational areas), vibration and air pollution (including ensuring appropriate air quality standards);</li><li>the risk of adverse effects on human health and life.</li></ul>No negative transboundary impacts have been identified. |
| **D. Measures aimed at preserving and improving the integrity of the seabed** | With regard to the measures of group D, a positive impact will be the limitation of the spatial scope of the transformations of the seabed and the banks of the Baltic Sea.<br><br>There are currently no provisions establishing the maximum scale and scope of coastal and seabed transformations. The aPOWM postulates the introduction of appropriate provisions - the determination of upper limits of the transformed bottom in individual waters and upper limits of the transformed sea shores - as part of the statutory work on the plans for the development of sea areas and the plan for the protection of sea shores. The development of these provisions will be supported, among others, by the proposed studies of the effects of trawling, including the use of different types of bottom gears.<br><br>Reducing the scale of potential future anthropogenic transformations will have a definite positive impact on the state of the marine environment. The measures proposed in the aPOWM can be understood as recommendations for solutions to prevent negative impacts.<br><br>No significant negative impacts are forecast, in particular for protected areas, including Natura 2000 sites. Negative impacts may be associated with the study of the impact of bottom dredging on benthic communities. However, the most intrusive way to implement the measure will be to fish with commercially used bottom gear. Such commercial fisheries are carried out in POM in bulk. <u>In aPOWM, it is assumed that the research will be carried out outside protected areas and outside protected natural habitats</u>. The scale of research (spatial extent) will be insignificant in relation to the scale of commercial fishing, therefore the cumulative impact of bottom dredging will be negligible and commercial fishing will be virtually identical to the previous impact of commercial fishing itself.<br><br>The aPOWM also proposed an action entitled "Exploitation of dredging waste and rational management of spoil". However, the activity is a study study and does not constitute a technical activity in the area of the seabed and will not contribute in any way to the transformation of the seabed and shores. The action concerns the preparation of comprehensive guidelines for the management of bottom sediments, which will facilitate the interpretation of legal provisions and decision-making related to the management of sediments of various origin and nature by investors and architectural and construction administration bodies and environmental protection. In the assumptions of aPOWM, the Guidelines are to take into account the experience of completed research projects and updated and translated HELCOM guidelines. The need to analyse the legal situation and the necessary changes in the legislation was also indicated. According to the |

| | |
|---|---|
| | description of the operation in aPOWM, the effect of the implementation of the operation will ultimately be to reduce the amount of the resulting spoil requiring disposal. The use of recovery processes allowing the use of waste instead of primary raw materials during construction works, including the expansion of ports. The potential effect will be to limit the flow of spoil moved within waters, including those directed to dampers.<br><br>It should be noted that the implementation of Group D measures does not concern the implementation of measures of a technical nature, causing significant negative impacts in the scope, in particular:<br>• transformation of Earth surface,<br>• emission of pollutants to air, including $CO_2$,<br>• noise emission,<br>• discharging pollutants to surface and ground water and ground,<br>• waste generation,<br>• the use of natural resources.<br><br>In connection with the implementation of the measures, the following are not expected:<br>• threats to water intakes used for providing water for human consumption, together with the areas of protection zones of these intakes;<br>• risks to transitional, coastal and inland waters in respect of the parts of waters intended for leisure purposes, i.e. the organisation of bathing areas and bathing sites on an occasional basis;<br>• the occurrence of hazards caused by noise (in particular the maintenance of permissible noise levels in acoustically protected areas, especially in residential areas/human habitats, buildings related to the permanent or temporary stay of children and young people and recreational areas), vibration and air pollution (including ensuring appropriate air quality standards);<br>• the risk of adverse effects on human health and life.<br><br>No negative transboundary impacts have been identified. According to the above information, the measures are aimed at limiting the anthropogenic activity in the ROOM |
| **E. measures to reduce pollutants** | The proposed measures of this group do not generally cover technical measures.<br><br>They concern in particular:<br>• studies, the results of which will be the basis for improvements in the field of reducing emissions of heavy metals into the environment from the installation;<br>• research measures in the scope of determining the scale of environmental hazards resulting from the deposition of wrecks on the seabed (continued operation of KPOWM), the scope of which, after modification, includes the tasks of the Interministerial Team for Risks resulting from hazardous materials remaining in maritime areas of the Republic of Poland and the implementation of recommendations developed by the Team); |

- measures to develop and implement a plan for combating pollution at sea and to increase the effectiveness of the fight against pollution at sea (KPOWM measures continued).

Positive impacts related to the reduction of pollution of the Baltic Sea by hazardous substances and thus reducing the negative impact on aquatic organisms concern potentially the entire POM area, and in terms of the future effects of the action related to the reduction of emissions of heavy metals from installations, including inland waters.

The occurrence of the negative impacts proposed as part of the aPOWM measures may be considered only in relation to the accidental release of hazardous substances during research works within the wrecks. As part of the current aPOWM, the activity related to the determination of the scale of environmental hazards resulting from the deposition of wrecks on the seabed includes the tasks of the Interministerial Team for Hazards resulting from hazardous materials in maritime areas of the Republic of Poland and the implementation of recommendations developed by the Team. In aPOWM, without prejudging the results of the team's work, it was initially assumed that:

- the work will use the achievements of the HELCOM SUBMERGE team and the previous experiences of the Baltic countries, including Poland;
- the rules for the prioritisation of research will be defined on the basis of the existing knowledge of the location and nature of the risks;
- on the basis of the established hierarchy of priorities, successive objects and areas will be successively examined;
- monitoring studies shall cover, inter alia, the condition of the facilities and the risk of sudden releases, the distribution of toxic concentrations around the facilities, the risk of migration of the substances, the concentration of the substances and their impact on living organisms;
- the results of the tests will each time be recommendations for further handling of the facilities, including determining the maximum permissible dates for conducting further tests;
- annually, amounts will be allocated to monitoring studies to ensure that, over a period of several years, a thorough analysis can be made of all potential risks associated with the deposition on the seabed of petroleum-derived substances, conventional ammunition and chemical weapons.

One of the basic tasks of the Interministerial Team will be to prepare the assumptions of the system for monitoring the risks associated with the presence of combat toxic substances and their breakdown products in the maritime areas of the Republic of Poland, conventional weapons and fuel and petroleum substances remaining in wrecks. It should be assumed that the monitoring system will take into account the need to minimize the risk of emergency situations, consisting in the release of toxic substances during research, including:

- It will generally be based on non-invasive methods (i.e. in general, monitoring should not puncture, raise or move objects potentially containing toxic chemicals or other hazardous substances. The research will consist in identifying objects posing a threat and assessing their condition with the use of sonars, echo probes, robots equipped with cameras, and chemical analyses of water samples, sediments and organisms in the vicinity of such objects).

- Procedures will be developed for securing tests by vessels specialised in taking and/or disposing of chemical weapons on site.
- Test facilities shall be equipped with appropriate equipment to minimise the effects of the release of toxic substances (e.g. cut-off barriers from the environment of the installation from which the release occurred).

As a result, the risk of emergency situations, consisting in the release of toxic substances during the research works, will be limited to a minimum. The subject of the action, described in aPOWM, are not measures consisting in the disposal of chemical weapons, removing fuels from wrecks or taking objects from the bottom, which may result in a significant release of hazardous substances into the environment.

Therefore, it is not expected that significant negative impacts will occur in connection with the implementation of the above measures.

It should be noted that the implementation of the measures of group E does not concern the implementation of measures of a technical nature, causing significant negative impacts in the scope, in particular:

- transformation of Earth surface,
- emission of pollutants to air, including $CO_2$,
- noise emission,
- discharging pollutants to surface and ground water and ground,
- waste generation,
- the use of natural resources.

In connection with the implementation of the measures, the following are not expected:

- threats to water intakes used for providing water for human consumption, together with the areas of protection zones of these intakes;
- risks to transitional, coastal and inland waters in respect of the parts of waters intended for leisure purposes, i.e. the organisation of bathing areas and bathing sites on an occasional basis;
- in addition to possible individual cases, the occurrence of hazards caused by noise (in particular the maintenance of permissible noise levels in acoustically protected areas, especially in residential areas/human habitats, buildings related to the permanent or temporary stay of children and young people and recreational areas), vibrations and air pollution (including ensuring appropriate air quality standards);
- the risk of adverse effects on human health and life.

No negative transboundary impacts have been identified. As indicated above, the risk of emergency situations involving the release of toxic substances during the research work related to the determination of the scale of environmental hazards resulting from the deposition of wrecks on the seabed will be kept to a minimum.

| | |
|---|---|
| **F. measures to reduce waste, including micro- and nanoparticles of plastics** | With regard to the measures from group F, no negative impacts related to the implementation of the measures were identified. measures will directly contribute to reducing the amount of solid waste occurring along the coastline of rivers and inland water reservoirs, which will contribute to reducing the potential amount of waste transported by rivers to the sea.<br><br>In the long term, measures related to lobbying for a ban on the use of micro- and nanoparticles of plastics in products may contribute to limiting the amount of these particles in marine waters as a result of reducing their input to the sea from land-based sources. Similarly, the proposed inclusion in national and provincial waste management plans of provisions on measures to prevent waste from entering the marine environment may result in a reduction in the supply of waste to the marine environment.<br><br>Positive impacts related to the improvement of the cleanliness of the Baltic waters and the coastal zone, important for the preservation of biodiversity, may cover the entire POM, in particular coastal and transitional waters.<br><br>It should be noted that the implementation of the measures of group E does not concern the implementation of measures of a technical nature, causing significant negative impacts in the scope, in particular:<br>• transformation of Earth surface,<br>• emission of pollutants to air, including $CO_2$,<br>• noise emission,<br>• discharging pollutants to surface and ground water and ground,<br>• waste generation,<br>• the use of natural resources.<br><br>In connection with the implementation of the measures, the following are not expected:<br>• threats to water intakes used for providing water for human consumption, together with the areas of protection zones of these intakes;<br>• risks to transitional, coastal and inland waters in respect of the parts of waters intended for leisure purposes, i.e. the organisation of bathing areas and bathing sites on an occasional basis;<br>• in addition to possible individual cases, the occurrence of hazards caused by noise (in particular the maintenance of permissible noise levels in acoustically protected areas, especially in residential areas/human habitats, buildings related to the permanent or temporary stay of children and young people and recreational areas), vibrations and air pollution (including ensuring appropriate air quality standards);<br>• the risk of adverse effects on human health and life.<br><br>No negative transboundary impacts have been identified. |

*Source: own study*

## 8.2 Assumed impacts and effects in relation to the objective 'Assuring human health and safety'

The protection of human health and safety is a particularly important objective that should be achieved through the implementation of measures resulting from the implementation of strategy papers. The achievement of this goal is directly related to the numerous measures proposed in the aPOWM. With regard to the objective "Assuring human health and safety", the measures proposed in the aPOWM will contribute to the achievement of the objective, in particular related to the following features: D5 Eutrophication, D8 Pollutants and pollutant effects, D9 Harmful substances in fish and seafood, D10 Waste (litter) in the marine environment.

The risks to human health are related to the use of marine waters directly for recreational purposes and through the consumption of marine organisms exposed to marine pollution. Thus, the risks to humans as a consequence of marine pollution may be direct or indirect. The concentration of marine pollution affects the quality of bathing sites and the safety of use of beaches, as well as the quality of fish harvested from the Baltic and destined for consumption. Effects on humans are those that will contribute to reducing the release of irritants, harmful, toxic, infectious and sensitising, mutagenic, carcinogenic, ecotoxic substances into the environment. Therefore, they will affect health safety and sanitary-epidemiological safety. Measures affecting the public safety of a population are such as to reduce the threat in a significant area and, at the same time, to protect a significant number of the population from death, permanent and serious damage to health. It is predicted that the proposed measures in aPOWM will have a limited impact on public safety.

**Table 57 Assessed impacts on the achievement of the objective "Assuring human health and safety"**

| Type of measures foreseen in the aPOWM / impact | Overall assessment of impacts on the achievement of the objective | direct | indirect | secondary | cumulative | short-terminal | medium-terminal | long-terminal | Permanent | momentary | positive | negative |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. measures to conserve and restore biodiversity** | **0** | - | - | - | - | - | - | - | - | - | - | - |
| **B. measures to reduce eutrophication** | **++** | - | x | x | x | - | - | x | x | - | x | - |
| **C. Measures to reduce invasive species** | **0** | - | - | - | - | - | - | - | - | - | - | - |
| **D. measures aimed at preserving and improving the integrity of the seabed** | **0** | - | - | - | - | - | - | - | - | - | - | - |
| **E. measures aimed at reducing pollutants** | **++** | x | x | x | x | - | - | x | x | - | x | - |
| **F. measures aimed at reducing the amount of waste, including micro and nanoparticles of plastics** | **++** | x | x | x | x | - | - | x | x | - | x | - |

(x) – impact occurs

(-) – impact does not exist

**Explanations of the table**

| | | |
|---|---|---|
| **++** | **Favourable** | **The program significantly supports the possibility of achieving the goal or avoids the risks related to limiting the possibility of achieving the goal** |
| **0** | **Neutral** | no significant influence has been found or positive and negative influences are balanced |

**Type:**

- direct interactions that may occur as a result of direct interaction between the measure itself and the environment (receptor), e.g. improvement of the visual qualities of the landscape as a result of the reconstruction/modernization of the objects, or reduction of the visual qualities by the appearance of new anthropogenic objects in the space, clearly distinguished from the landscape,
- indirect impacts that may arise as a result of measures not directly related to measures in aPOWM, e.g. improving the attractiveness for tourism in connection with improving the quality of sea water,
- secondary, are impacts resulting from direct and indirect interactions resulting from subsequent interactions with the environment, e.g. improvement or deterioration of the visual value of the landscape as a result of the manner of development resulting from secondary measures,
- cumulated, is the accumulation of changes in the same landscape/space due to the implementation of at least two types of measures.

**Duration**

- short-term impacts occurring during the construction/implementation period of a given activity,
- medium-term are impacts occurring within a period of up to 6 years (current planning cycle),
- long-term effects may occur for more than 6 years,

**Reversibility:**

- permanent are impacts resulting from the implementation of types of measures, the effects of which are lasting for many years and setting new conditions in the landscape, without the possibility of spontaneous return to the original state,
- temporary, transient, reversible, of short duration, which may recur with high frequency or occur incidentally, such as temporary changes in the landscape as a result of the location of the construction site facilities, the movement of ships during construction, etc.

**Nature:**

- positive impact contributing to the protection and even improvement of landscape values and increasing attractiveness for tourists,
- **negative,** is the impact causing adverse changes in the landscape, e.g. the emergence of dominants adversely affecting the visual qualities of the space

*Source: Own study*

It is predicted that the measures indicated in the activity group B will potentially reduce the supply of biogenic compounds and bacteriological contaminants, which in turn will contribute to the reduction of blooms and the development of harmful E-coli bacteria in areas intended for recreational purposes such as: basins, beaches. Reducing biogenic compounds will consequently also affect the quality of groundwater, which has an impact on the development and quality of fish intended for consumption.

The measures indicated in the group of measures E and F are measures related to limiting the risk resulting from the spread of harmful substances and waste in the environment. These measures will contribute to the reduction of harmful substances in marine waters which pose a risk to human health and the state of the marine environment. The ability of fish and other marine organisms to accumulate contaminants can pose hazards to human life and health. Attention is paid to maintaining special care in measures related to research or identification of sources of pollutants (e.g. wrecks posing a risk of release of fuels and other chemicals). They should be carried out in such a way as to avoid the formation of secondary pollutants that could contribute to the contamination of the marine environment.

However, it is important to emphasise the relatively distant time perspective of achieving the full or partial effect of the measures in the Baltic Sea, both with regard to the content of biogenic substances and pollutants in marine waters, including micro- and nanoparticles of plastics.

In addition, the negative impact of aPOWM on water intakes used to supply water intended for human consumption along with the areas of protection zones of these intakes or for groundwater, in particular the Main Groundwater Reservoirs, has not been determined. The proposed measures will not adversely affect the status of transitional, coastal and inland waters for the recreational parts of the waters, i.e. the organisation of bathing sites and bathing sites on an occasional basis. At the same time, the measures will not affect the increased exposure to noise, vibration or air pollution.

**Summary and conclusions**

The impact of individual measures designed in the aPOWM on the objective of "Assuring human health and safety" will be positive, in particular in the group of measures related to the reduction of eutrophication, reduction of pollutants or reduction of the amount of waste, including micro and nanoparticles of plastics. However, the period of occurrence of the impact will be both permanent and long-term.

## 8.3 Expected impacts and effects for the biodiversity objective

The Convention on Biological Diversity defines biodiversity as' the diversity of *all living organisms on Earth in the terrestrial, marine and freshwater ecosystems and ecological communities of which they are part; this applies to diversity within species, between species and within ecosystems*'. Preserving the biodiversity of the marine areas of the European Union is one of the basic objectives pursued by the measures set out in the Marine Strategy Framework Directive (MSFD) and the Habitats and Birds Directives, which are the basis of the European Natura 2000 programme. The sub-basins of the Polish maritime coastal waters are covered by the provisions of the water Law, resulting from the Water Framework Directive. Biodiversity is included in the set of environmental objectives for marine waters developed on the basis of this Act.

The Baltic Sea, compared to other areas, is characterised by a low degree of biodiversity. The marine ecosystem of the Baltic Sea is vulnerable to external pressures caused, among other things, by the fact that the ecosystem and its ecological interactions are based on a relatively small number of species. The Baltic Sea ecosystem has been significantly degraded, and the main reason for this is the continuous introduction of pollutants into the catchment areas (in which about 85 million people live).

The objective of protecting biodiversity should be achieved through the implementation of measures resulting from the implementation of strategy papers. Achieving this goal is associated with reducing or maintaining anthropogenic pressure, at a level that will ensure the maintenance of natural habitats (with preserved natural biodiversity, occurring biological elements, also in fisheries). The measures proposed in the aPOWM will contribute to the achievement of the goal, in particular related to such features as: D1 Biodiversity, D4 Food chains, D5 Eutrophication, D11 Underwater noise and other energy sources, and others.

**Table 58 Identified impacts on the implementation of the biodiversity protection objective**

| Type of measures foreseen in the aPOWM / impact | Overall assessment of impacts on the achievement of the objective | direct | indirect | secondary | cumulative | short-terminal | medium-terminal | long-terminal | Permanent | momentary | positive | negative |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. measures to conserve and restore biodiversity** | +++ | x | x | - | x | - | - | x | x | - | x | |
| **B. measures to reduce eutrophication** | +++ | - | x | x | x | - | - | x | x | - | x | |
| **C. Measures to reduce invasive species** | ++ | x | x | x | x | - | - | x | x | - | x | - |
| **D. measures aimed at preserving and improving the integrity of the seabed** | + | x | - | - | x | x | x | x | x | - | x | - |
| **E. measures aimed at reducing pollutants** | ++ | - | x | x | x | - | - | x | x | - | x | - |
| **F. measures aimed at reducing the amount of waste, including micro and nanoparticles of plastics** | ++ | x | x | x | x | - | - | x | x | - | x | - |

(x) – impact occurs

(-) – impact does not exist

**Explanations for the table**

| | | |
|---|---|---|
| +++ | **Strengthening** | **The program is directly used to achieve the goal** |
| ++ | **Favourable** | The program significantly supports the possibility of achieving the goal or avoids the risks related to limiting the possibility of achieving the goal |
| + | **Slightly beneficial** | The positive effects expected as a result of the implementation of the Programme clearly outweigh the possible negative effects, however, their achievement requires the fulfilment of additional conditions in |

| | | |
|---|---|---|
| | | the form of, for example, the use of measures strengthening positive impacts or minimizing negative impacts |

**Type:**

- direct interactions that may occur as a result of direct interaction between the measure itself and the environment (receptor), e.g. improvement of the visual qualities of the landscape as a result of the reconstruction/modernization of the objects, or reduction of the visual qualities by the appearance of new anthropogenic objects in the space, clearly distinguished from the landscape,
- indirect impacts that may arise as a result of measures not directly related to measures in aPOWM, e.g. improving the attractiveness for tourism in connection with improving the quality of sea water,
- secondary, are impacts resulting from direct and indirect interactions resulting from subsequent interactions with the environment, e.g. improvement or deterioration of the visual value of the landscape as a result of the manner of development resulting from secondary measures,
- cumulated, is the accumulation of changes in the same landscape/space due to the implementation of at least two types of measures.

**Duration**

- short-term impacts occurring during the construction/implementation period of a given activity,
- medium-term are impacts occurring within a period of up to 6 years (current planning cycle),
- long-term effects may occur for more than 6 years,

**Reversibility:**

- permanent are impacts resulting from the implementation of types of measures, the effects of which are lasting for many years and setting new conditions in the landscape, without the possibility of spontaneous return to the original state,
- temporary, transient, reversible, of short duration, which may recur with high frequency or occur incidentally, such as temporary changes in the landscape as a result of the location of the construction site facilities, the movement of ships during construction, etc.

**Nature:**

- positive impact contributing to the protection and even improvement of landscape values and increasing attractiveness for tourists,
- negative, is the impact causing adverse changes in the landscape, e.g. the emergence of dominants adversely affecting the visual qualities of the space

*Source: Own study*

The proposed action in groups A and B directly pursues the objective of protecting biodiversity. It is predicted that the measures indicated in the activity group B will potentially limit the supply of biogenic compounds and bacteriological contaminants. The regulation of water and sewage management in coastal areas, ports, municipalities adjacent to the boundaries of protected areas, or located in the catchment areas of protected coastal lakes, may contribute to the preservation or strengthening of biodiversity by improving abiotic conditions conducive to the restoration of habitats of species living in sub-basins (marine mammals to a small extent). The introduction and promotion of technologies in waste water treatment plants aimed at greater reduction of biogenes and measures aimed at reducing biogenes flowing from agricultural areas to waters are also assessed positively. measures from group A will allow to improve the living environment of organisms and preserve and reproduce, among others, porpoise and other species.

The measures indicated in groups C, E and F significantly support the achievement of the objective of biodiversity protection. The proposed measures indicated in group C will contribute to the reduction of invasive species and limit the spread of alien species. Due to the possibility of the natural spread of potentially invasive species, the problem already concerns the biodiversity of the entire Polish maritime area. Overall, the impact of this type of action on the biodiversity conservation objective has been assessed as positive.

measures aimed at reducing pollutants (group E), as well as reducing the amount of waste, including micro and nanoparticles of plastics (group F), will improve the quality of life and development of marine species. It is predicted that the measures proposed in the above groups will have a beneficial effect on biodiversity.

The proposed measures indicated in group D will contribute to the protection and preservation of the integrity of the seabed to a certain extent, as improving the quality of water – reducing the content of biogens reduces the development of self-nutritive organisms, including phytoplankton, and this means a secondary impact (on a local or sub-body of water scale) on the bottom habitats and the organisms inhabiting them, including phytobenthos. The proposed measures will contribute secondarily to preserving or enhancing the biodiversity of coastal waters, especially around seaports, by reducing the discharge of petroleum substances and persistent organic pollutants into port waters. They therefore directly concern the areas covered by the WFD (transitional and coastal waters). Overall, the impact of this type of action on the biodiversity conservation objective was assessed as slightly beneficial.

The aPOWM is not expected to have a negative impact on the achievement of the Biodiversity Protection objective. However, the implementation of selected measures, including those of a research and pilot nature (in the field of the reduction of invasive species, the study of wrecks or the implementation of technical protective measures for ornitofauna within protected areas, requires special attention and monitoring in terms of the elimination of secondary threats to biodiversity).

**Summary and conclusions**

The impact of the individual measures designed in the aPOWM on the biodiversity protection objective will be positive for all groups of measures. Support for the objective will be particularly strong in the group of measures directly related to the protection of biodiversity and measures related to the reduction of eutrophication. The duration of the impact will be both permanent and long-term.

## 8.4 Expected impacts and effects for the objective 'To promote the achievement or maintenance of good environmental status of marine waters'

Promoting the achievement or maintenance of good environmental status of water is an important environmental objective. This objective should be achieved as a result of the implementation of the strategy papers and its achievement is closely linked to the measures proposed in the aPOWM document. These measures will have a particular impact on the achievement of this objective and are linked by the following guiding features: D1 Biodiversity, D2 Alien species, D3 Commercially exploited fish and invertebrate species, D4 Trophic chain D5 Eutrophication, D6 Seabed integrity, D8 Pollutants, D10 Waste, D11 Underwater noise.

According to the study "Ecological hazards related to chemical pollution – hydrocarbons", the[168] specificity of the Baltic Sea affects its exceptional sensitivity to the occurring pollution. This is due to the relative shallowness of the basin and the limited exchange of waters with the North Sea. As a result, it takes 25 to 35 years to completely replace salty Baltic waters with well-oxygenated and saline ocean waters. This results in the accumulation of foreign substances for many years and poses a huge ecological threat to this area.

The threats to the achievement or maintenance of good environmental status of marine waters also result to a large extent from water and sewage management infrastructure, potential pollution from industrial waters, cargoes of pollutants discharged into the sea from vessels, as well as wrecks at the bottom of the sea.

Chemical pollution (from industrial measures), sewage, agricultural measures, waste pollution, including micro- and nano-particles of plastics, as well as climate change are among the main causes of the poor environmental status of marine waters. In addition, poor water status and concentration of pollutants have an impact on biodiversity and human health and life (hazards described in chapter 8.2). Thus, the risks to the achievement or maintenance of good environmental status of marine waters as a consequence of marine pollution may be direct or indirect. The concentration of marine pollution affects the quality of bathing sites and the safety of use of beaches, as well as the quality of fish harvested from the Baltic and destined for consumption. Undoubtedly, inadequate water quality also affects the level and preservation of biodiversity.

Measures to ensure the good environmental status of marine waters are those that will have a positive impact on the regulation of waste water management, in particular in direct sea basins. In addition, these will be measures aimed at reducing biogens in sewage treatment plants, as well as biogens flowing to surface water from agriculture. Measures related to D8 Pollutants and D10 Waste would reduce the negative impact of heavy metals, petroleum-derived pollutants, micro- and nanoparticles of plastics and other elements directly or indirectly entering marine waters. In addition, measures aimed at limiting the expansion of alien species (in particular the reduction of the number of invasive gobiidae species by biomanipulation) contribute to the improvement of the environment of transitional waters by affecting the composition of fish communities.

[168] Fabisiak J., Ecological hazards of the Baltic Sea related to chemical pollution – hydrocarbons, Scientific Journals of the Naval Academy, 2008

**Table 59Identified impacts on the achievement of the objective of "Supporting the achievement or maintenance of good environmental status of marine waters"**

| Type of measures foreseen in the aPOWM / impact | Overall assessment of impacts on the achievement of the objective | direct | indirect | secondary | cumulative | short-terminal | medium-terminal | long-terminal | Permanent | momentary | positive | negative |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. measures to conserve and restore biodiversity** | +++ | - | x | x | x | - | - | x | x | - | x | - |
| **B. measures to reduce eutrophication** | +++ | x | x | x | x | - | - | x | x | - | x | |
| **C. Measures to reduce invasive species** | ++ + | x | x | x | x | - | - | x | x | x | x | - |
| **D. measures aimed at preserving and improving the integrity of the seabed** | +++ | - | x | x | - | - | - | x | x | - | x | - |
| **E. measures aimed at reducing pollutants** | +++ | x | x | x | x | - | - | x | x | - | x | - |
| **F. measures aimed at reducing the amount of waste, including micro and nanoparticles of plastics** | +++ | x | x | x | x | - | - | x | x | - | x | - |

(x) – impact occurs

(-) – impact does not exist

**Explanations for the table**

| | | |
|---|---|---|
| +++ | **Strengthening** | **The programme is directly used to achieve the goal** |

**Type:**

- direct interactions that may occur as a result of direct interaction between the measure itself and the environment (receptor), e.g. improvement of the visual qualities of the landscape as a result of the reconstruction/modernization of the objects, or reduction of the visual qualities by the appearance of new anthropogenic objects in the space, clearly distinguished from the landscape,
- indirect impacts that may arise as a result of measures not directly related to measures in aPOWM, e.g. improving the attractiveness for tourism in connection with improving the quality of sea water,

- secondary, are impacts resulting from direct and indirect interactions resulting from subsequent interactions with the environment, e.g. improvement or deterioration of the visual value of the landscape as a result of the manner of development resulting from secondary measures,
- cumulated, is the accumulation of changes in the same landscape/space due to the implementation of at least two types of measures.

**Duration**

- short-term impacts occurring during the construction/implementation period of a given activity,
- medium-term are impacts occurring within a period of up to 6 years (current planning cycle),
- long-term effects may occur for more than 6 years,

**Reversibility:**

- permanent are impacts resulting from the implementation of types of measures, the effects of which are lasting for many years and setting new conditions in the landscape, without the possibility of spontaneous return to the original state,
- temporary, transient, reversible, of short duration, which may recur with high frequency or occur incidentally, such as temporary changes in the landscape as a result of the location of the construction site facilities, the movement of ships during construction, etc.

**Nature:**

- positive impact contributing to the protection and even improvement of landscape values and increasing attractiveness for tourists,
- negative, is the impact causing adverse changes in the landscape, e.g. the emergence of dominants adversely affecting the visual qualities of the space

*Source: Own study*

The proposed measures from group A implement the objective of Supporting the achievement or maintenance of good environmental status of marine waters by preserving and supporting biodiversity, which in turn improves the quality of inland waters, and thus the quality of waters in the transitional and open sea zones.

It is predicted that the measures indicated in the group of measures B and D will potentially reduce the supply of biogenic compounds and bacteriological contaminants, which in turn will contribute to reducing blooms and the inflow of nutrients to waters. This will improve the quality of groundwater, which will have an impact on the development and quality of fish intended for consumption. Group C measures will directly contribute to the reduction of invasive species, thereby supporting the development of native species and the achievement or maintenance of GES. These measures (in particular the reduction of invasive gobiidae species by biomanipulation) will indirectly contribute to the improvement of the environment of transitional waters, through the impact on the composition of fish assemblies and ecological status assessment indicators (SI and in the future PMFI).

The measures identified in Groups E and F provide for a positive impact in terms of targets for the reduction of newly emerging and deposited marine solid waste from different land and sea sources and the presence of pollutants in marine waters, including their input from land-based sources and as a result of emergencies. These measures are closely related to the reduction of the risk of the spread of harmful substances and waste in the environment, including micro- and nanoparticles of plastics, which in turn has a direct impact on the quality of water and its impact on human and animal health and safety. The implementation of the measures will result, among others, in a reduction in the amount of solid waste along the rivers' shoreline, which will contribute to reducing the potential amount of waste transported to the sea. However, it should be emphasized that the effects of some of the measures, in particular those indicated in group F, are potential and depend on the possibility of future implementation of the postulates contained in aPOWM (e.g. in the scope of introducing restrictions and/or bans on the use of micro- and nanoparticles of plastic in products).

These groups of measures are part of the basic assumptions of sustainable development, by striving for environmental order in marine ecosystems, biodiversity and waste management. The effects of these measures will be noticeable in the long term due to the long decomposition time of individual pollutants accumulated in the environment. The negative impact of aPOWM on the achievement of the objective of "Supporting the achievement or maintenance of good environmental status of marine waters" has not been determined.

**Summary and conclusions**

The impact of the individual measures designed in the aPOWM on the objective of "Supporting the achievement or maintenance of good environmental status of marine waters" will be positive, in particular in the group of measures related to the reduction of eutrophication, reduction of invasive species, reduction of pollutants or reduction of the amount of waste, including micro and nanoparticles of plastics, and the preservation and improvement of the integrity of the seabed will directly contribute to the achievement of GES. This is due to the fact that the objective in question coincides with the main objective of the aPOWM study. All aPOWM measures are of a nature that reinforces and serves directly the objective of "Supporting the achievement or maintenance of good environmental status of marine waters", with the positive effect of the implementation of individual measures varying in scale and the achievement of the effects of selected measures will be postponed in time. In most of the analyzed measures, the mode of impact will be long-term.

## 8.5 Projected impacts and effects in relation to the objective 'To support the achievement of the environmental objectives for water bodies on land'

Supporting the achievement of environmental objectives for water bodies on land is an important objective from the point of view of, among others, meeting the requirements of Article 11 of the Water Framework Directive, indicating the need to develop measures for all river basin districts, the implementation of which will ensure the timely achievement of the environmental objectives set. Measures affecting the achievement of this objective fall into the following group of characteristics: D5 Eutrophication, D8 Pollutants, D10 Waste.

The pressures associated, in particular, with the introduction of wastewater loaded with biogenic substances (nitrogen and phosphorus compounds) and pollutants, as well as the supply of biogenic substances from agricultural sources to waters, are particularly important from the point of view of MSFD.

Measures in the field of water and sewage management development will have a positive impact in coastal waters, in the area of land centres not yet regulated by sewage management, in the direct catchments of the Baltic Sea. On the other hand, measures to reduce the inflow of biogens from agriculture will contribute to improve the quality of marine waters in the long-term process – by improving the quality of the water body.

These measures are of particular importance for improving the quality of waters in the area of large ports and cities or fuel bases. Beneficial effects of the implementation of the measures will be noted primarily locally in the area of estuaries of seaside rivers and port waters.

**Table 60 Identified impacts on the achievement of the objective "Supporting the achievement of environmental objectives for water bodies on land"**

| Type of measures foreseen in the aPOWM / impact | Overall assessment of impacts on the achievement of the objective | direct | indirect | secondary | cumulative | short-terminal | medium-terminal | long-terminal | Permanent | momentary | positive | negative |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. measures to conserve and restore biodiversity** | ++ | - | x | x | x | - | - | x | x | - | x | - |
| **B. measures to reduce eutrophication** | +++ | x | x | x | x | - | - | x | x | - | x | |
| **C. Measures to reduce invasive species** | ++ | - | x | - | - | - | - | x | - | - | x | - |
| **D. measures aimed at preserving and improving the integrity of the seabed** | 0 | - | - | - | - | - | - | - | - | - | - | - |
| **E. measures aimed at reducing pollutants** | ++ | x | x | x | x | - | - | x | x | - | x | - |
| **F. measures aimed at reducing the amount of waste, including micro and nanoparticles of plastics** | ++ | x | x | x | x | - | - | x | x | - | x | - |

(x) – impact occurs

(-) – impact does not exist

**Explanations for the table**

| | | |
|---|---|---|
| **+++** | **Strengthening** | **The program is directly used to achieve the goal** |
| ++ | **Favourable** | The program significantly supports the possibility of achieving the goal or avoids the risks related to limiting the possibility of achieving the goal |
| **0** | **Neutral** | no significant influence has been found or positive and negative influences are balanced |

**Type:**

- direct interactions that may occur as a result of direct interaction between the measure itself and the environment (receptor), e.g. improvement of the visual qualities of the landscape as a result of the reconstruction/modernization of the objects, or reduction of the visual qualities by the appearance of new anthropogenic objects in the space, clearly distinguished from the landscape,
- indirect impacts that may arise as a result of measures not directly related to measures in aPOWM, e.g. improving the attractiveness for tourism in connection with improving the quality of sea water,
- secondary, are impacts resulting from direct and indirect interactions resulting from subsequent interactions with the environment, e.g. improvement or deterioration of the visual value of the landscape as a result of the manner of development resulting from secondary measures,
- cumulated, is the accumulation of changes in the same landscape/space due to the implementation of at least two types of measures.

**Duration**

- short-term impacts occurring during the construction/implementation period of a given activity,
- medium-term are impacts occurring within a period of up to 6 years (current planning cycle),
- long-term effects may occur for more than 6 years,

**Reversibility:**

- permanent are impacts resulting from the implementation of types of measures, the effects of which are lasting for many years and setting new conditions in the landscape, without the possibility of spontaneous return to the original state,
- temporary, transient, reversible, of short duration, which may recur with high frequency or occur incidentally, such as temporary changes in the landscape as a result of the location of the construction site facilities, the movement of ships during construction, etc.

**Nature:**

- positive impact contributing to the protection and even improvement of landscape values and increasing attractiveness for tourists,
- negative, is the impact causing adverse changes in the landscape, e.g. the emergence of dominants adversely affecting the visual qualities of the space

*Source: Own study*

The proposed measures in Group A indirectly pursue the objective of 'Supporting the achievement of the environmental objectives for water bodies on land'. Adequate resources of organisms in water reservoirs and rivers allow for the initiation of the self-cleaning process, which in turn may have an impact on the suitability of water for food purposes. The supporting effect is largely due to the link between Group A and Group C. By itself, Group C measures to limit the expansion of alien species will indirectly contribute slightly to the improvement of the state of the environment and the achievement of environmental objectives by SWB, by limiting the spread of alien species from transitional waters to inland waters.

Measures belonging to group B – aimed at reducing the eutrophication phenomenon will translate into a reduction in the amount of biogens in the water body, which in turn may translate into strengthening the achievement of the set environmental goals. Measures involving the water and sewage management zone will be particularly beneficial in coastal waters, in the area of land centres not yet regulated by sewage management, in the direct watersheds of the Baltic Sea. Long-term effects can be achieved by measures related to the reduction of the supply of biogens from agriculture.

Measures in Group E to reduce pollutants and in Group F to reduce waste, including micro- and nanoparticles of plastics, will have a negligible positive impact in the area of large ports and cities. Those measures will contribute to the reduction of the amount of harmful compounds entering and spreading particularly harmful chemicals, which pose an immediate threat to the maintenance of good status of water bodies and thus to the health of people using the surrounding areas for recreational purposes and to the quality of fish for consumption. The effects of these measures will be noticeable in the long term due to the long decomposition time of individual pollutants accumulated in the environment.

In addition, the negative impact of aPOWM on the achievement of environmental objectives for water bodies on land has not been determined.

**Summary and conclusions**

The impact of the individual measures designed in the aPOWM on the objective of "Supporting the achievement of environmental objectives for water bodies on land" will be positive, in particular in the group of measures related to the reduction of the eutrophication phenomenon, the reduction of pollutants or the reduction of the amount of waste, including micro- and nanoparticles of plastics, will directly contribute to the achievement of GES. In most of the analyzed measures, the mode of impact will be long-term.

## 8.6 Projected impacts and impacts for the 'Reduce vulnerability and prepare for climate change' objective

Climate change – both mitigation and adaptation – is associated with long-term trends and changes that are often too gradual to be seen in the normal times of implementation of a plan or programme. However, the effects of many plans and programmes are often sustainable in the long term.

In the context of the 'Reducing vulnerability and preparing for climate change' objective, attention should be paid to the interrelationship between biodiversity protection and climate change objectives. The links between biodiversity and climate change are mutual. The effects of changing climatic conditions are already affecting biodiversity and ecosystem services, and in the future climate change may become one of the most important factors contributing to biodiversity loss. On the other hand, the protection of biodiversity benefits the carbon cycle, increasing the capacity of the environment to absorb and store carbon.

Therefore, due to their characteristics, the implementation of the measures proposed in group B and aimed at protecting biodiversity will have a supporting effect in the context of reducing sensitivity and preparing for climate change. Under the influence of climate change, invasive species are much more viable than native species. Therefore, measures aimed at reducing invasive species (group C) will indirectly and positively affect the achievement of the objectives. However, due to the type and scale of the measures, the proposed measures from groups A and C are projected to have a negligible positive impact.

Group B measures to reduce eutrophication will have the effect of reducing the amount of biogenes that will indirectly reduce the effects of temperature increase. Reducing the introduction of biogenes with wastewater and agricultural pollution in the long term will allow for a slightly beneficial impact on the reduction of sensitivity and preparation for climate change.

The implementation of other measures provided for in the aPOWM will not have a significant impact on achieving the goal.

In addition, there is no significant negative impact of aPOWM in relation to the objective of "Reducing sensitivity and preparing for climate change".

**Summary and conclusions**

The impact of individual measures designed in the aPOWM on the objective of "Reducing sensitivity and preparing for climate change" will generally be positive. However, it will not be significant and results mainly from the link between the objectives of reducing vulnerability and preparing for climate change and the issue of biodiversity protection.

The following table summarizes the impacts on the achievement of this goal.

**Table 61 Summary of impacts of types of measures on the implementation of the environmental objective "Reducing sensitivity and preparing for climate change"**

| Type of measures foreseen in the aPOWM / impact | Overall assessment of impacts on the achievement of the objective | direct | indirect | secondary | cumulative | short-terminal | medium-terminal | long-terminal | Permanent | momentary | positive | negative |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. measures to conserve and restore biodiversity** | **++** | - | x | x | - | - | - | x | x | - | x | - |
| **B. measures to reduce eutrophication** | **+** | - | x | x | - | - | - | x | x | - | x | |
| **C. Measures to reduce invasive species** | **++** | - | x | x | - | - | - | x | x | - | x | - |
| **D. measures aimed at preserving and improving the integrity of the seabed** | **0** | - | - | - | - | - | - | - | - | - | - | - |
| **E. measures aimed at reducing pollutants** | **0** | - | - | - | - | - | - | - | - | - | - | - |
| **F. measures aimed at reducing the amount of waste, including micro and nanoparticles of plastics** | 0 | - | - | - | - | - | - | - | - | - | - | - |

(x) – impact occurs

(-) – impact does not exist

**Explanations for the table**

| | | |
|---|---|---|
| **++** | **Favourable** | **The program significantly supports the possibility of achieving the goal or avoids the risks related to limiting the possibility of achieving the goal** |
| **+** | **Slightly beneficial** | The positive effects expected as a result of the implementation of the Programme clearly outweigh the possible negative effects, however, their achievement requires the fulfilment of additional conditions in the form of, for example, the use of measures strengthening positive impacts or minimizing negative impacts |
| **0** | **Neutral** | no significant influence has been found or positive and negative influences are balanced |

**Type:**

- direct interactions that may occur as a result of direct interaction between the measure itself and the environment (receptor), e.g. improvement of the visual qualities of the landscape as a result of the reconstruction/modernization of the objects, or reduction of the visual qualities by the appearance of new anthropogenic objects in the space, clearly distinguished from the landscape,
- indirect impacts that may arise as a result of measures not directly related to measures in aPOWM, e.g. improving the attractiveness for tourism in connection with improving the quality of sea water,
- secondary, are impacts resulting from direct and indirect interactions resulting from subsequent interactions with the environment, e.g. improvement or deterioration of the visual value of the landscape as a result of the manner of development resulting from secondary measures,
- cumulated, is the accumulation of changes in the same landscape/space due to the implementation of at least two types of measures.

**Duration**

- short-term impacts occurring during the construction/implementation period of a given activity,
- medium-term are impacts occurring within a period of up to 6 years (current planning cycle),
- long-term effects may occur for more than 6 years,

**Reversibility:**

- permanent are impacts resulting from the implementation of types of measures, the effects of which are lasting for many years and setting new conditions in the landscape, without the possibility of spontaneous return to the original state,
- temporary, transient, reversible, of short duration, which may recur with high frequency or occur incidentally, such as temporary changes in the landscape as a result of the location of the construction site facilities, the movement of ships during construction, etc.

**Nature:**

- positive impact contributing to the protection and even improvement of landscape values and increasing attractiveness for tourists,
- negative, is the impact causing adverse changes in the landscape, e.g. the emergence of dominants adversely affecting the visual qualities of the space

*Source: Own study*

## 8.7 Expected impacts and effects in relation to the objective 'Protection of the earth surface, including soil'

In the Forecast, the definition of land surface also includes sediments under water.

The implementation of the measures provided for in the aPOWM involves neutral, slightly beneficial impacts. They will serve the purpose of "Protection of earth surface, including soils".

The supporting impact is predicted in the case of the implementation of the aPOWM postulates contained in the measures of groups B, D, F.

The implementation of measures from group B, have a beneficial effect on the surface of the ground, soil and the seabed. measures to reduce eutrophication are aimed at preventing soil contamination in the coastal zone and seabed sediments, and contribute to protecting soils from excessive use of organic fertilisers.

The main objective of the implementation of Group D measures is to reduce the anthropogenic transformation of the seabed through the postulated establishment of rules on the maximum scale and extent of coastal and seabed transformation and the establishment of guidelines for the management of bottom sediments. However, these are non-technical measures, the positive impact of which will depend on the final method and scope of implementation of the measures in the form of applicable regulations or guidelines.

The measures from group F are aimed at, among others, direct cleaning of the land surface on land (river and sea shores, beaches) and reduction of the amount of waste entering the environment in the coastal region. Related measures, in particular supporting the cleanliness of the banks of rivers, seas, beaches, will have a beneficial impact on the surface of the ground in the short term. However, this will be a negligible effect in the context of the whole issue of protection of the earth's surface and soil.

Measures neutral to the earth's surface include tasks proposed in groups A, C, D and E.

Significant impacts undermining the achievement of the objective of "Protection of the Earth's surface, including soil" are not predicted.

The following table presents the results of the analyzes in the context of the possibility of achieving the analyzed goal, in relation to the types of measures provided for in the aPOWM.

**Table 62 Summary of impacts of types of measures on the implementation of the environmental protection objective "Protection of earth surface including soils on land"**

| Type of measures foreseen in the aPOWM / impact | Overall assessment of impacts on the achievement of the objective | direct | indirect | secondary | cumulative | short- terminal | medium-terminal | long-terminal | Permanent | momentary | positive | negative |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. measures to conserve and restore biodiversity** | **0** | - | - | - | - | - | - | - | - | - | - | - |
| **B. measures to reduce eutrophication** | **++** | x | x | - | x | x | - | x | x | x | x | x |
| **C. Measures to reduce invasive species** | **0** | - | - | - | - | - | - | - | - | - | - | - |
| **D. measures aimed at preserving and improving the integrity of the seabed** | **++** | + | + | - | - | + | - | + | + | - | + | - |
| **E. measures aimed at reducing pollutants** | **0** | - | - | - | - | - | - | - | - | - | - | - |
| **F. measures aimed at reducing the amount of waste, including micro and nanoparticles of plastics** | **++** | x | - | - | - | x | - | - | - | x | x | - |

(x) – impact occurs

(-) – impact does not exist

**Explanations for the table**

| | | |
|---|---|---|
| ++ | **Favourable** | **The program significantly supports the possibility of achieving the goal or avoids the risks related to limiting the possibility of achieving the goal** |
| **0** | **Neutral** | no significant influence has been found or positive and negative influences are balanced |

**Type:**

- direct interactions that may occur as a result of direct interaction between the measure itself and the environment (receptor), e.g. improvement of the visual qualities of the landscape as a result of the reconstruction/modernization of the objects, or reduction of the visual qualities by the appearance of new anthropogenic objects in the space, clearly distinguished from the landscape,
- indirect impacts that may arise as a result of measures not directly related to measures in aPOWM, e.g. improving the attractiveness for tourism in connection with improving the quality of sea water,
- secondary, are impacts resulting from direct and indirect interactions resulting from subsequent interactions with the environment, e.g. improvement or deterioration of the visual value of the landscape as a result of the manner of development resulting from secondary measures,
- cumulated, is the accumulation of changes in the same landscape/space due to the implementation of at least two types of measures.

**Duration**

- short-term impacts occurring during the construction/implementation period of a given activity,
- medium-term are impacts occurring within a period of up to 6 years (current planning cycle),
- long-term effects may occur for more than 6 years,

**Reversibility:**

- permanent are impacts resulting from the implementation of types of measures, the effects of which are lasting for many years and setting new conditions in the landscape, without the possibility of spontaneous return to the original state,
- temporary, transient, reversible, of short duration, which may recur with high frequency or occur incidentally, such as temporary changes in the landscape as a result of the location of the construction site facilities, the movement of ships during construction, etc.

**Nature:**

- positive impact contributing to the protection and even improvement of landscape values and increasing attractiveness for tourists,
- negative, is the impact causing adverse changes in the landscape, e.g. the emergence of dominants adversely affecting the visual qualities of the space

*Source: Own study*

## 8.8 Expected impacts and effects for the objective 'Protection and, where possible, enhancement of landscape values'

In accordance with Article 5 (23) of the Nature Conservation Act of 16 April 2004, landscape values were defined as "*natural, cultural, historical, aesthetic and visual values of the area and the associated terrain, formations and components of nature and civilisation elements, shaped by the forces of nature or human activity*". In the case of aPOWM, however, the division of the landscape into: the waterfront landscape and the underwater landscape should be adopted. Elements related to cultural heritage, including underwater archaeological monuments, are presented for the purpose of "Protection of cultural heritage, including underwater archaeological monuments".

The greatest impacts will be on the measures in Group D to regulate the maximum magnitude of coastal and seabed transformation interference and to prepare comprehensive guidelines for the management of bottom sediments. These will be impacts supporting the achievement of the objectives in the field of landscape value protection, as the aPOWM measures are aimed at reducing the scale of transformations and strengthening the aspect of protection of the marine environment in the excavation management processes. However, it should be emphasized that these are non-technical measures, the positive impact of which will depend on the final method and scope of implementation of the measures in the form of applicable regulations or guidelines.

The impacts from the other groups of measures shall be indirect in relation to the objective 'Protection and, where possible, improvement of landscape values', in particular through a general impact on the conservation of biodiversity.

The following table presents the results of the analyzes in the context of the possibility of achieving the analyzed goal, in relation to the types of measures provided for in the aPOWM.

**Table 63** **Identified impacts on the achievement of the goal "Protection and, where possible, improvement of landscape values"**

| **Type of measures foreseen in the aPOWM / impact** | **Overall assessment of impacts on the achievement of the objective** | **direct** | **indirect** | **secondary** | **cumulative** | **short-terminal** | **medium-terminal** | **long-terminal** | **Permanent** | **momentary** | **positive** | **negative** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. measures to conserve and restore biodiversity** | ++ | x | - | x | - | - | - | x | x | - | x | - |
| **B. measures to reduce eutrophication** | ++ | | x | x | - | - | - | x | x | - | x | |
| **C. Measures to reduce invasive species** | **0** | - | - | - | - | - | - | - | - | - | - | - |
| **D. measures aimed at preserving and improving the integrity of the seabed** | +++ | x | x | x | x | - | - | x | x | - | x | - |
| **E. measures aimed at reducing pollutants** | ++ | - | x | x | x | - | - | x | x | - | x | - |
| **F. measures aimed at reducing the amount of waste, including micro and nanoparticles of plastics** | ++ | - | x | x | x | - | - | x | x | - | x | - |

(x) – impact occurs

(-) – impact does not exist

**Explanations for the table**

| | | |
|---|---|---|
| +++ | **Strengthening** | **The program is directly used to achieve the goal** |
| ++ | Favourable | The program significantly supports the possibility of achieving the goal or avoids the risks related to limiting the possibility of achieving the goal |
| **0** | Neutral | no significant influence has been found or positive and negative influences are balanced |

**Type:**

- direct interactions that may occur as a result of direct interaction between the measure itself and the environment (receptor), e.g. improvement of the visual qualities of the landscape as a result of the reconstruction/modernization of the objects, or reduction of the visual qualities by the appearance of new anthropogenic objects in the space, clearly distinguished from the landscape,
- indirect impacts that may arise as a result of measures not directly related to measures in aPOWM, e.g. improving the attractiveness for tourism in connection with improving the quality of sea water,
- secondary, are impacts resulting from direct and indirect interactions resulting from subsequent interactions with the environment, e.g. improvement or deterioration of the visual value of the landscape as a result of the manner of development resulting from secondary measures,
- cumulated, is the accumulation of changes in the same landscape/space due to the implementation of at least two types of measures.

**Duration**

- short-term impacts occurring during the construction/implementation period of a given activity,
- medium-term are impacts occurring within a period of up to 6 years (current planning cycle),
- long-term effects may occur for more than 6 years,

**Reversibility:**

- permanent are impacts resulting from the implementation of types of measures, the effects of which are lasting for many years and setting new conditions in the landscape, without the possibility of spontaneous return to the original state,
- temporary, transient, reversible, of short duration, which may recur with high frequency or occur incidentally, such as temporary changes in the landscape as a result of the location of the construction site facilities, the movement of ships during construction, etc.

**Nature:**

- positive impact contributing to the protection and even improvement of landscape values and increasing attractiveness for tourists,
- negative, is the impact causing adverse changes in the landscape, e.g. the emergence of dominants adversely affecting the visual qualities of the space

*Source: Own study*

Most of the measures provided for in aPOWM will have an indirect impact on the implementation of the objective "Protection and, where possible, improvement of landscape values" in the context of visual landscape values. Measures related to the preservation and restoration of biodiversity, reduction of eutrophication, reduction of pollutants and measures related to the reduction of waste will directly or indirectly contribute to a slight improvement of landscape values by improving and shaping marine natural habitats.

With regard to measures aimed at reducing invasive species, due to their pilot nature in the current aPOWM, it was considered that the supporting impact on the improvement of landscape values will be negligible.

Measures more directly related to the underwater landscape and the landscape of the coastal seas are those related to the preservation and improvement of the integrity of the seabed, the aim of which is to limit the scope of anthropogenic transformations. These measures affect, among others, the protection of the structure and functions of benthic ecosystems or the elimination of negative impact on them. Most of the planned measures in this area are of a non-technical nature, they are related to the postulated legal limitations, including determining the maximum scale and scope of permanent transformations of coasts and seabed and increasing the knowledge base on the environmental impacts of trawling. In the longer term, these measures will have a positive impact on landscape values.

**Summary and conclusions**

The impact of individual measures designed in aPOWM on the goal "Protection and, where possible, improvement of landscape values" will be of a lasting and positive nature. However, the effect supporting the achievement of the goal is not without significance, except for the potential effect of measures postulating the establishment of legal regulations, the result of which is to limit the transformation of anthropogenic banks and seabed.

## 8.9 Expected impacts and consequences for the objective 'Protection of cultural heritage, including underwater archaeological sites'

At the current stage of forecasting, it is expected that most of the measures provided for in the aPOWM will not have a significant impact on the protection of this objective.

By definition, cultural heritage is an important factor in every human life and activity. It constitutes the material and spiritual achievements of previous generations, as well as the achievements of our times. It means a value – tangible or intangible – conveyed by ancestors and defining our culture. It contains all the environmental effects resulting from the interaction between people and the environment over the course of history.[169] For the purposes of this assessment, reference is made to cultural heritage of material value.

In the case of a heritage located on land in the coastal zone, an impact may be recorded only when any of the measures carried out under aPOWM would be carried out in the immediate vicinity of the structure or would require its liquidation. No such measures were identified in the draft of the aPOWM document.

In the case of underwater heritage, it is expected that all measures in groups B, E and F, related to the reduction of biological and chemical pollution introduced into marine waters, may have a slightly beneficial impact on the conservation status of the underwater heritage, as they will, among others, reduce the corrosion of metal elements.

Wrecks lying on the bottom of the sea are an element of cultural heritage. According to data held by the Naval Hydrological Bureau, more than 415 wrecks, about 100 of which are in the Gulf of Gdansk, lie in Polish maritime areas.[170]Some of the sunken vessels were fuelled with fuel stored in tanks (oil). At least a few dozen of them certainly had large amounts of fuel, some of which is potentially found in their wrecks.[171] The largest ones include: Wilhelm Gustloff, Steuben, Stuttgart, Goya and Franken. The group of measures E includes a research activity consisting in examining/monitoring the risks related to the residual wreckage on the bottom of the Baltic Sea. Monitoring will generally be based on non-invasive methods, i.e. it will not penetrate, raise or move objects containing potentially harmful chemical substances or other substances or hazardous materials (e.g. unexploded ordnance and unexploded ordnance). It should be emphasized that the subject of the action are not measures consisting in the disposal of chemical weapons, removing fuels from wrecks or taking objects from the bottom. Therefore, no direct negative impact on the state of preservation of the wrecks is expected.

The following table shows the results of the analyzes in the context of the possibility of achieving the analyzed goal, in relation to the groups of measures provided for in the aPOWM.

**Summary and conclusions**

The impact of individual measures designed in the aPOWM on the objective "Protection of cultural heritage, including underwater archaeological monuments" will be of a lasting and positive nature. However, the effect supporting the achievement of the objective will not be significant.

[169] https://www.nid.pl/pl/Informacje_ogolne/Ochrona_dziedzictwa_kulturowego/
[170] Counteracting the risks resulting from the deposition of hazardous materials on the Baltic Sea bottom, NIK, Delegation in Gdańsk
[171] Counteracting the risks resulting from the deposition of hazardous materials on the Baltic Sea bottom, NIK, Delegation in Gdańsk

**Table 64 Characteristics of the identified impacts on the achievement of the objective "Protection, cultural heritage"**

| Type of measures foreseen in the aPOWM / impact | Overall assessment of impacts on the achievement of the objective | direct | indirect | secondary | cumulative | short-terminal | medium-terminal | long-terminal | Permanent | momentary | positive | negative |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. measures to conserve and restore biodiversity** | 0 | - | - | - | - | - | - | - | - | - | - | - |
| **B. measures to reduce eutrophication** | ++ | - | x | x | x | - | - | x | x | - | x | - |
| **C. Measures to reduce invasive species** | 0 | - | - | - | - | - | - | - | - | - | - | - |
| **D. measures aimed at preserving and improving the integrity of the seabed** | ++ | x | - | x | x | - | - | x | x | - | x | - |
| **E. measures aimed at reducing pollutants** | + | x | x | x | x | - | - | x | x | - | x | x |
| **F. measures aimed at reducing the amount of waste, including micro and nanoparticles of plastics** | 0 | - | - | - | - | - | - | - | - | - | - | - |

(x) – impact occurs

(-) – impact does not exist

**Explanations of the table**

| | | |
|---|---|---|
| +++ | **Strengthening** | **The program is directly used to achieve the goal** |
| ++ | **Favourable** | The program significantly supports the possibility of achieving the goal or avoids the risks related to limiting the possibility of achieving the goal |
| + | **Slightly beneficial** | The positive effects expected as a result of the implementation of the Programme clearly outweigh the possible negative effects, however, their achievement requires the fulfilment of additional conditions in the form of, for example, the use of measures strengthening positive impacts or minimizing negative impacts |
| 0 | **Neutral** | No significant impact was found or positive and negative effects balance each other out |

**Type:**

- direct interactions that may occur as a result of direct interaction between the measure itself and the environment (receptor), e.g. improvement of the visual qualities of the landscape as a result of the reconstruction/modernization of the objects, or reduction of the visual qualities by the appearance of new anthropogenic objects in the space, clearly distinguished from the landscape,
- indirect impacts that may arise as a result of measures not directly related to measures in aPOWM, e.g. improving the attractiveness for tourism in connection with improving the quality of sea water,
- secondary, are impacts resulting from direct and indirect interactions resulting from subsequent interactions with the environment, e.g. improvement or deterioration of the visual value of the landscape as a result of the manner of development resulting from secondary measures,
- cumulated, is the accumulation of changes in the same landscape/space due to the implementation of at least two types of measures.

**Duration**

- short-term impacts occurring during the construction/implementation period of a given activity,
- medium-term are impacts occurring within a period of up to 6 years (current planning cycle),
- long-term effects may occur for more than 6 years,

**Reversibility:**

- permanent are impacts resulting from the implementation of types of measures, the effects of which are lasting for many years and setting new conditions in the landscape, without the possibility of spontaneous return to the original state,
- temporary, transient, reversible, of short duration, which may recur with high frequency or occur incidentally, such as temporary changes in the landscape as a result of the location of the construction site facilities, the movement of ships during construction, etc.

**Nature:**

- positive impact contributing to the protection and even improvement of landscape values and increasing attractiveness for tourists,
- negative, is the impact causing adverse changes in the landscape, e.g. the emergence of dominants adversely affecting the visual qualities of the space

*Source: Own study*

## 8.10 Expected impacts and consequences for the 'Economic objectives and protection of high value tangible goods' objective

Economic development related to maritime measures is multidirectional and diverse. It concerns the fisheries sector, transport, tourism and the exploitation of raw materials. The achievement of the economic objectives will often run counter to the achievement of the environmental (protection) objectives. The achievement of this goal is directly related to the numerous measures proposed in the aPOWM.

The economy (including mainly maritime) and the protection of material goods are related to the features of pressure such as: D3 Commercially exploited fish and invertebrate species, D5 Eutrophication, D8 Pollutants and pollution effects, D9 Harmful substances in fish and seafood. These measures are related to maintaining the stocks of commercially exploited fish and crustaceans at or below the maximum sustainable yield level and maintaining the inflow of annual landings of nitrogen and phosphorus introduced into the Baltic Sea at the MAI values established under the regional arrangements (HELCOM), which will allow the reduction of the concentration of biogenic substances in the sea to a level not exceeding the limit values. Some measures concern the reduction or maintenance at the current level of inputs of pollutants from marine and terrestrial sources, including measures to minimise releases of pollutants due to sudden and terrestrial events, introduced into the marine environment or the presence of harmful substances in fish and seafood. measures (of a technical and non-technical nature) related to this objective are included in the following groups: A, B, C, D, E, F.

The following table shows the results of the analyzes in the context of the possibility of achieving the analyzed goal, in relation to the groups of measures provided for in the aPOWM.

**Table 65 Characteristics of the identified impacts on the achievement of the objective "Economic objectives and protection of material goods of high value"**

| Type of measures foreseen in the aPOWM / impact | Overall assessment of impacts on the achievement of the objective | direct | indirect | secondary | cumulative | short-terminal | medium-terminal | long-terminal | Permanent | momentary | positive | negative |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A. measures to conserve and restore biodiversity** | **- -*** | x | x | x | x | - | x | x | x | x | x | x |
| **B. measures to reduce eutrophication** | **-*** | x | x | x | x | - | - | x | x | - | x | x |
| **C. Measures to reduce invasive species** | **++** | - | x | - | - | - | - | x | x | - | x | - |
| **D. measures aimed at preserving and improving the integrity of the seabed** | **0** | - | - | - | - | - | - | - | - | - | - | - |
| **E. measures aimed at reducing pollutants** | **++** | - | x | - | x | - | - | x | x | - | x | - |
| **F. measures aimed at reducing the amount of waste, including micro and nanoparticles of plastics** | **++** | - | x | - | x | - | - | x | x | - | x | - |

(x) – impact occurs

(-) – impact does not exist

* in the long term, once the overall state of the Baltic Sea is improved, a significant and positive impact on economic objectives can be predicted (note: for the investments in the analysed strategic plans and programmes directly linked to the implementation of environmental legislation and standards in the measures of ports, transport, agriculture/fisheries, etc., the aPOWM measures will be ancillary).

**Explanations for the table**

| | | |
|---|---|---|
| **++** | **Favourable** | **The program significantly supports the possibility of achieving the goal or avoids the risks related to limiting the possibility of achieving the goal** |

| | | |
|---|---|---|
| **+** | Slightly beneficial | The positive effects expected as a result of the implementation of the Programme clearly outweigh the possible negative effects, however, their achievement requires the fulfilment of additional conditions in the form of, for example, the use of measures strengthening positive impacts or minimizing negative impacts |
| **0** | Neutral | No significant impact was found or positive and negative effects balance each other out |
| **-** | Slightly negative | When the negative effects of the Programme's implementation outweigh or exceed its positive impact within the scope of achieving the objective. It is possible to limit the negative impact using standard minimising measures |
| **--** | Negative | When the implementation of the Programme entails unavoidable environmental costs prevailing in this respect, it limits the possibility of achieving the objective. It is possible to limit the impact, but in addition to the standard measures for a given type of project, individual mitigation measures should be indicated |

**Type:**

- direct interactions that may occur as a result of direct interaction between the measure itself and the environment (receptor), e.g. improvement of the visual qualities of the landscape as a result of the reconstruction/modernization of the objects, or reduction of the visual qualities by the appearance of new anthropogenic objects in the space, clearly distinguished from the landscape,
- indirect impacts that may arise as a result of measures not directly related to measures in aPOWM, e.g. improving the attractiveness for tourism in connection with improving the quality of sea water,
- secondary, are impacts resulting from direct and indirect interactions resulting from subsequent interactions with the environment, e.g. improvement or deterioration of the visual value of the landscape as a result of the manner of development resulting from secondary measures,
- cumulated, is the accumulation of changes in the same landscape/space due to the implementation of at least two types of measures.

**Duration**

- short-term impacts occurring during the construction/implementation period of a given activity,

- medium-term are impacts occurring within a period of up to 6 years (current planning cycle),
- long-term effects may occur for more than 6 years,

**Reversibility:**

- permanent are impacts resulting from the implementation of types of measures, the effects of which are lasting for many years and setting new conditions in the landscape, without the possibility of spontaneous return to the original state,
- temporary, transient, reversible, of short duration, which may recur with high frequency or occur incidentally, such as temporary changes in the landscape as a result of the location of the construction site facilities, the movement of ships during construction, etc.

**Nature:**

- positive impact contributing to the protection and even improvement of landscape values and increasing attractiveness for tourists,
- negative, is the impact causing adverse changes in the landscape, e.g. the emergence of dominants adversely affecting the visual qualities of the space

*Source: Own study*

It can be predicted that some of the measures listed in the aPOWM (from groups A and B) may limit the development of selected branches of the maritime economy in the medium or long term (mainly measures related to the reduction of catches), but in the long term they should translate into an improvement in the overall state of fish and shellfish stocks (i.e. improving the economic conditions and care for material goods). It is anticipated that, after a period of limited fishing, the impact of this action on the fisheries economy will be significant and positive, contributing to the achievement of high quality fishery products. These goals will also be indirectly served by measures from groups C, by limiting the expansion of invasive species. The analyzed measures will also indirectly contribute to the development of tourism and the development of fishing ports, fish processing companies, which in the longer term will translate into the development of the labour market, new jobs, improvement of the quality of life and prosperity of the inhabitants of the region.

Issues relating to the development and needs of maritime transport have been assessed in other strategy papers. In terms of the planned measures, it can be concluded that maritime transport, thanks to the planned measures, will achieve an improvement in the standards of operations carried out at sea and on land. Port investments directly related to environmental regulations and standards in port measures and water transport, such as those related to the reception of sanitary sewage from passenger ships, to the infrastructure for handling dangerous goods, and to the reduction of runoff from rainwater and snowmelt, will contribute to the achievement of water protection objectives. These measures will also affect the value of port infrastructure. The planning measures under aPOWM in relation for this type of investment will be ancillary. Similarly, aPOWM's measures are supportive of investments directly related to environmental regulations and standards contained in strategic documents concerning the development of other areas of the economy, in particular agriculture or fisheries.

It is not possible to predict the potential impact of measures (group D) postulating the introduction of legal regulations in the scope of determining upper limits of the transformed bottom in individual waters and upper limits of the transformed sea shores. Therefore, at this stage, it is not expected that the measures will have an impact on the exploited/planned for exploitation natural resources.

**Summary and conclusions**

The impact of individual measures designed in the aPOWM on the objective "Economic objectives and protection of material goods of high value " will be of a mixed nature, where the initial impact will be negative, but in the long term positive. On the other hand, the period of occurrence of the impact will be both permanent and long-term and medium-term. In addition, in relation to the investments of the analysed strategic documents directly related to the implementation of environmental regulations and standards in the measures of ports, transport, agriculture/fisheries, etc., the aPOWM measures will be ancillary.

## 8.11 Interactions and accumulation of impacts

The accumulation of environmental impacts includes such phenomena as:

- summation of impacts within a specific environmental component,
- synergy, i.e. an effective impact greater than the sum of partial interactions ("more-than-additive"),
- "less-than-additive" impacts, i.e. situations in which the effects of component impacts are at least partially eliminated (compensated).

As part of the analysis of cumulative impacts, cumulation was considered in two dimensions:

**Internal cumulation** - whether the implementation of technical measures (and non-technical measures that result in the implementation of measures of a technical nature) proposed in the aPOWM draft may cause the phenomena indicated in points 1-3 above, in this aspect, the pressures that may result from the implementation of measures provided for in other strategic documents have not been considered,

**External cumulation** - whether the implementation of technical measures (and non-technical measures that result in the implementation of measures of a technical nature) proposed in the aPOWM draft, together with the emergence of pressures resulting from the implementation of measures provided for in other strategic documents, may cause the phenomena indicated in the points above.

The following sections present the conclusions of this analysis.

### 8.11.1 Cumulation of impacts related to aPOWM measures

Taking into account the nature of the measures provided for in the aPOWM draft, both of a technical and non-technical nature, as well as the potential scope of their implementation and the effects of their implementation, it is not expected that the phenomena of accumulation of impacts in a negative environment may occur. In particular, there will be no significant negative impact on Natura 2000 sites and other area forms of nature protection, or as a result of the implementation of individual measures provided for in the aPOWM draft.

Potentially, the greatest potential for the occurrence of negative impacts can be indicated for measures from group B in the scope of increasing the requirements for nitrogen and phosphorus removal in wastewater, which in the long term may require the implementation of technical measures in sewage treatment plants. However, due to the location of measures within the existing facilities, relatively small and possible to minimize the impact of a dispersed nature, no significant potential for internal accumulation of the aPOWM measures indicated above is predicted.

The environmental impacts of the (packages) of measures included in Measure Groups A - F show the greatest potential for cumulation in relation to the D1 feature – Biodiversity. All the packages of proposed measures reinforce the effects of Group A measures and reinforce each other in the direction of achieving the objective indicated for this feature. The protection of biodiversity is served in particular by the planned measures reducing the inflow of phosphorus and nitrogen (measures from group B), which may ultimately improve the functioning of protected areas, including Natura 2000 thanks to the improvement of the quality of inland waters in the Polish Baltic basin. Their purpose is to limit the flow of biogens from agriculture and sewage treatment plants to receivers. However, given the time needed for their implementation (first the establishment of legal standards and funding mechanisms, and then the implementation of technical measures), it is to be expected that the positive effects may be visible in the long term.

As part of the measures included in group C, measures aimed at reducing selected invasive species of fish and invertebrates were proposed. As part of the current aPOWM, it is proposed to implement pilot measures that will allow to assess both the effectiveness of the proposed solutions and develop methods that take into account the minimization of the impact on native species.

### 8.11.2 Cumulation of impacts with external measures to aPOWM

As part of the analysis of the possibility of external cumulation, the pressures that may occur in the environment as a result of the implementation of measures provided for in other strategic documents were analyzed. For this purpose, more than 70 strategy documents of different levels were analysed. The results of the analysis indicate that potential pressures may result from the implementation of the directions of action resulting from the documents described in chapter 2.3 and Annex 1.

All documents which provided a framework for the subsequent implementation of projects which could materially affect the environment were subject to a strategic assessment[172], which assessed the potential impacts that may result from the implementation of these documents. For the purposes of this Forecast, the projections of the environmental impacts of these Strategy documents have been analysed and selected those issues that may be relevant in the context of potential negative impacts / pressures on the marine environment, coastal waters and transitional waters. The results of this examination are presented in Annex 5 to the Forecast.

Taking into account the above-mentioned pressures and types of measures and thus the measures provided for in the aPOWM draft, the time of implementation of the Program and the above-mentioned measures, as well as potential impacts during their construction and operation, one should not expect the occurrence of significantly negative cumulative impacts. This is due to the nature of the measures proposed in the aPOWM aimed at improving the state of the environment. However, the impacts of the analyzed strategic documents should be indicated, weakening the effects of the implementation of the measures proposed in the aPOWM and thus hindering the achievement or maintenance of GES. For the identified potential negative impacts of the implementation of the above-mentioned measures, i.e. those specified in the analyzed strategic documents and analyzed individual projects, adequate minimizing measures were indicated or will be indicated, both in the strategic documents on the basis of which they will be implemented or are being implemented, as well as at the stage of individual assessment for these measures. However, this does not mean that their implementation will not affect the achievement or maintenance of GES, especially in the sub-bodies in which they will be implemented.

The main potential impacts currently identified are presented below.

After analysing a number of strategic documents referred to in Chapter 2.3 and Annex 1 of the Forecast, the most important potential **positive cumulations** with regard to indicators (features) and KTMs were identified[173].

**D1 - Biological diversity**

As indicated in the description of the accumulation of internal impacts of aPOWM, the environmental effects of the measures included in groups A - F show the greatest potential for accumulation in

[172] taking into account the procedure for waiving the need for a strategic environmental impact assessment
[173] KTM - Key Types of Measures designated for reporting under the WFD and MSFD (see chapter 2.1.).

relation to the feature D.1 – Biodiversity. All packages of proposed measures are mutually reinforcing in the direction of achieving the objective indicated for this feature. The protection of biodiversity is primarily served by the planned measures to reduce the inflow of phosphorus and nitrogen (provided for in the strategic documents resulting from the implementation of the obligations of the Nitrates Directive and the Urban Waste Water Treatment Directive), that is, to prevent eutrophication (KTM 1, 2) and pollution with hazardous substances (KTM 15, 16, 31), as well as KTM 27 grouping measures to reduce temporary disturbances of the seabed and KTM 30 including measures to reduce disturbances of hydrological processes or pollution of the sea as a result of accidents (KTM 32). Thus, the measures undertaken under the different KTMs are mutually reinforcing, but will not be sufficient to achieve the GES in such a short timeframe of the current maritime strategy planning period and aPOWM.

Measures undermining the achievement or maintenance of the GES are, in particular, those related to changes on the sea shore resulting from the need to adapt to climate change, as provided for in the SPA, the Marine Coastal Protection Programme and the CFP (for shore reinforcement), as well as in the Transport Development Strategy and the implementation programmes of the Strategy for maritime and semi-inland waterway transport. Large investments that undermine the integrity of the seabed and depleting onshore habitats may also pose a threat to biodiversity (expected investments are listed below in the description of cumulation for features: D6 and D7). The risks associated with the development of shipping, including the transport of gas and oil, also concern the risk of alien species being transferred with the ballast waters of sea-going vessels and on the hulls of sea-going vessels, as well as the risk of spills and incidents polluting marine waters. The available information on the environmental impact identified during environmental impact assessments of individual projects indicates that such impacts are identified and minimizing and monitoring measures are determined.

Due to the state of their preparation, it should be expected that the implementation of at least some of them will be started or completed within the time horizon of the analyzed aPOWM.

**D4 - food chain**

As regards indicator / characteristic D4, the overlapping effects of the measures covered by the different KTMs should be indicated, resulting in a reduction of the exposure of the different stages of the trophic chain to toxic substances or otherwise disrupting metabolism. Clearly, this indicator is neither independent nor fully distinct from D1 (biodiversity providing a food base, conditions for the development and stability of populations at different stages of the trophic chain) on the one hand and D9 (harmful substances in the marine environment), D1 (marine litter) and D8 (pollutants and pollution effects) which may selectively or generally weaken individual links in the trophic chain on the other hand. Thus, the measures undertaken under these features will positively affect the D4 feature, which, however, will not be sufficient to achieve GES in the short term (until 2027).

Measures that weaken the achievement or maintenance of GES are, in particular, those that contribute to an increase in the concentration of biogenes in marine waters (see description below in the section on D5 – eutrophication) or those that increase the potential for pollution at sea – e.g. the development of maritime transport.

**D5 - eutrophication,**

This is one of the most serious problems faced by aPOWM. For eutrophication, measures in the field of agriculture and sewage management are critical - in the entire Baltic basin, and especially in the Polish part of the Baltic - the Vistula and Odra basins. The measures proposed in the aPOWM draft from group B are directly dedicated to the phenomenon of eutrophication. They clearly support measures to reduce the inflow of phosphorus and nitrogen into inland waters provided for in the strategic documents resulting from the implementation of the obligations of the Nitrates Directive and the Urban Wastewater Treatment Directive), that is, to prevent eutrophication (KTM 1, 2). It is also appropriate to indicate the accumulation of positive impacts of other land-based measures concerning inland waters in terms of increasing the renaturalisation of watercourses and restoring the capacity of waters for self-cleaning. These measures will have a positive effect in the long term, within a time frame far beyond the aPOWM time horizon (due to pollution accumulated in river, lake and marine sediments).

Measures that weaken the achievement of the GES are, in particular, measures to increase the intensity of agricultural production (despite the implementation of measures in the field of sustainable agriculture) or measures to reduce the degree of river renewal included in the Transport Development Strategy - SRT (inland development) or FRMP and PPSS.

**D6 – seabed integrity, D7 - hydrographic conditions and D11 - underwater noise and other energy sources**

The effectiveness of measures undertaken for the implementation of GES for these 3 features may be strongly weakened by planned investments included in several programmes, in particular those related to the Transport Development Strategy, the Fuel and Energy Sector Development Strategy " (PEP2040) or the Polish Nuclear Power Programme. This weakening concerns the measures of KTM 27 grouping measures to reduce disturbances of the seabed and KTM 6 relating to measures to improve the hydromorphological conditions of coastal waters, as well as KTM 31 concerning the reduction of energy and noise emissions to the marine environment. The planned measures, in particular large investments, may lead to negative developments, in particular with regard to the D6 as well as the D7 indicator. This will be related to the implementation of:

- nuclear power plant (applies mainly to coastal waters/littoral zone – the Eastern Gotland Basin sub-body with Polish coastal waters of the Eastern Gotland Basin),
- the Danish pipeline, the so-called Baltic Pipe (applies to the littoral zone, but also to the pelagic zone - the Bornholm Basin sub-body, along with the Polish coastal waters of the Bornholm Basin),
- excavation through the Vistula Spit (applies to the waters of the Gdańsk Basin and the Polish coastal waters of the Gdańsk Basin),
- construction of offshore wind farms (sub-bodies: The Bornholm Basin and the Eastern Gotland Basin),
- measures on the shore provided for by the Programme for the Protection of the Marine Coast, FRMP, SPA and SRT (mainly applies to Polish coastal waters of sub-basins within pom).

Taking into account the state of preparation of these investments, it was concluded that in the current planning period of the maritime strategy, the excavation through the Vistula Spit will be completed, the construction of several offshore wind farms will start and the measures provided for in the SPA, SRT or the FRMP draft will be implemented. The associated negative impacts will affect all 3 above-mentioned indicators – they are discussed in chapter 6 (pressures). It will mainly be noise emission (at the construction and operation stage, e.g. wind farms, measures on the shore), changes in the shape of the bottom (e.g. as a result of the implementation of underwater power cables from wind farms), hydrography (e.g. measures on the shore, such as reinforcements, silting). In addition, they will also affect biodiversity and other related indicators.

it should be emphasized again that in the strategic documents, which result in the implementation of these projects, measures are provided to minimize potential negative impacts and compensate for significantly negative impacts. In addition, at the stage of individual assessment for individual projects, the minimisation measures initially defined in the plans and programmes are subject to verification and appropriate selection for the type, scale and location of the project under specific environmental conditions. In accordance with the applicable law, at this stage, the cumulative impacts with existing, implemented and planned projects are taken into account. Individual assessment for these projects should also address their impact on the achievement of the GES, for example through a related assessment with the transitional and coastal water body.

## 8.12 Alternative solutions

Due to the specific nature of the measures indicated for implementation in the aPOWM strategic document supporting the achievement of GES, and at the same time the lack of identified significant negative impacts on individual environmental objectives and thus environmental components, alternative solutions to individual groups of measures and the measures themselves were not analyzed.

# 9 Summary of analyses

The measures proposed in the aPOWM draft are aimed at maintaining or achieving the GES of the marine environment. They refer to the indicators (features) of quality regarding the determination of good environmental status indicated in Annex 1 MSFD (characteristics: D1-D11).

In accordance with Article 159 (1) (1) and (3) of the water Law, the marine waters protection programme determines:

- basic measures necessary to achieve or maintain good environmental status of marine waters, including legal, administrative, economic, educational and control measures,
- ad hoc measures.

The analyzed aPOWM draft mostly includes measures consisting in:

- proposals for changes in legal acts,
- establishing restrictions,
- carrying out research and monitoring of the state and resources of the marine environment,
- development of tools for control and management,
- implementation of the guidelines,
- development of analyses, documents, reviews, plans,
- developing and promoting good practices,
- education.

All these measures are aimed at maintaining or achieving good environmental status of the marine environment (GES), including by improving the status of the water body on land. These measures mostly do not directly concern interference with the environment, but only as a result, in the future, technical measures may be more expensive, the scope of which and possible impacts on the environment are difficult to predict at this stage. However, as far as possible, the impacts of future technical measures were also predicted, which may probably be the result of the implementation of postulates (e.g. proposed legal changes or recommendations) contained in the aPOWM measures.

As part of the Forecast, the expected significant impacts of aPOWM in terms of achieving environmental objectives at the level of specific groups of measures, which were specified on the basis of the leading feature of GES:

**A. measures aimed at preserving and restoring biodiversity,**

**B. measures aimed at reducing the eutrophication phenomenon,**

**C. Measures aimed at reducing invasive species,**

**D. measures aimed at preserving and improving the integrity of the seabed,**

**E. measures aimed at reducing pollutants,**

**F. measures aimed at reducing the amount of waste, including micro- and nanoparticles of plastics.**

The evaluated measures are indicated in Annex 4 to the draft aPOWM document – the action sheets developed for each of them are included there.

It was then examined to what extent the implementation of these groups of measures could contribute to the achievement of the following strategic environmental objectives, which were selected on the basis of the environmental objectives indicated in other documents at international, Community and national level:

- Assuring human health and safety,
- 'Protection of biodiversity',
- 'Supporting the achievement or maintenance of good environmental status in marine waters',
- 'Supporting the achievement of the environmental objectives for water bodies on land',
- "Reducing vulnerability and preparing for climate change",
- "Protection of the surface of the earth, including soil", "Protection and, where possible, improvement of landscape values",
- "Protection of cultural heritage, including underwater archaeological monuments",
- Economic objectives and protection of high value tangible goods

As a result of the analyses, it was found that the implementation of the above-mentioned groups of measures will have a positive impact on the environment and will support the strategic objectives of environmental protection. Only with regard to the objective 'Economic objectives and protection of high value tangible goods', it was concluded that, in the medium and long term, the measures of Groups A and B may have a detrimental effect on the achievement of the objective of limiting the development of selected branches of the maritime economy. However, in the long term, achieving a significant improvement in the state of marine waters should also have a positive and significant impact on the achievement of economic objectives.

Significant negative impacts are not expected to arise as a result of the implementation of individual groups of measures, which also means that they will not arise as a result of the implementation of individual measures planned for a given group. As a result of their implementation, no significant negative accumulated impacts (internal cumulation) are expected, as well as negative impacts of a cross-border nature.

The results of the performed analyses are shown in the following table.

**Table 66** **Summary of the characteristics of the identified impacts of the types of technical measures provided for in the aPOWM on the implementation of strategic environmental objectives**

| Type of measures foreseen in the aPOWM / impact | Assuring human health and safety | Protection of biodiversity | Supporting the achievement or maintenance of good environmental status of marine waters | Supporting the achievement of the environmental objectives for water bodies on land | Reducing vulnerability and preparing for climate change | Protection of Earth surface | Protecting and, if possible, improving landscape values | Protection of cultural heritage, including underwater archaeological monuments | Economic objectives and protection of material goods of high value |
|---|---|---|---|---|---|---|---|---|---|
| **A. measures to conserve and restore biodiversity** | 0 | +++ | +++ | + | ++ | 0 | ++ | 0 | --* |
| **B. measures to reduce eutrophication** | ++ | +++ | +++ | +++ | + | ++ | ++ | ++ | -* |
| **C. Measures to reduce invasive species** | 0 | ++ | +++ | ++ | ++ | 0 | 0 | 0 | ++ |
| **D. measures aimed at preserving and improving the integrity of the seabed** | 0 | + | +++ | 0 | 0 | ++ | +++ | ++ | 0 |
| **E. measures aimed at reducing pollutants** | ++ | ++ | +++ | ++ | 0 | 0 | ++ | + | ++ |
| **F. measures aimed at reducing the amount of waste, including micro and nanoparticles of plastics** | ++ | ++ | +++ | ++ | 0 | ++ | ++ | 0 | ++ |

**in the long term, once the overall status of the Baltic Sea is improved, a significant and positive impact on economic objectives can be predicted (note: in relation to the investments of the analyzed strategic plans and programmes directly related to the implementation of environmental regulations and standards in the measures of ports, transport, agriculture/fisheries, etc., the aPOWM measures will be of an ancillary nature)*

*Source: Own study*

**KEY**

| | | |
|---|---|---|
| **When the Program serves directly to achieve the goal** | **Strengthening** | **+++** |
| **When the Program significantly supports the possibility of achieving the goal or avoids the risks associated with limiting the possibility of achieving the goal** | Favourable | ++ |
| **When the positive effects expected as a result of the implementation of the Programme clearly outweigh the possible negative effects, however, their achievement requires the fulfilment of additional conditions in the form of, for example, the use of measures to strengthen the positive effects or to minimize the negative effects** | Slightly beneficial | + |
| **When no significant effect or positive and negative effects are found, they shall be balanced** | Neutral | 0 |
| **When the negative effects of the Programme's implementation outweigh or exceed its positive impact within the scope of achieving the objective. It is possible to limit the negative impact using standard minimising measures** | Slightly negative | - |
| **When the implementation of the Programme entails unavoidable environmental costs prevailing in this respect, it limits the possibility of achieving the objective. It is possible to limit the impact, but in addition to the standard measures for a given type of project, individual mitigation measures should be indicated** | Negative | - - |
| **When the implementation of the Program entails unavoidable conflicts in the context of the possibility of achieving the goal. The need to apply compensation, i.e. the restoration of damaged environmental resources. Indicate feasible compensation solutions and the conditions for its implementation or the need to apply a derogation** | Conflict | - - - |

*Source: Own study*

On the other hand, it can be expected that the state of the marine waters environment will be affected by the implementation of measures resulting from the already adopted programs and plans providing a framework for the subsequent implementation of projects with a potential negative impact on the marine waters environment.

Due to the specificity of the marine environment, it was considered that the most important pressures that may arise as a result of the implementation of the strategy papers relate to measures such as:

- execution of the excavation through the Vistula Spit (investment resulting from the project "Multiannual program Construction of a waterway connecting the Vistula Lagoon with the Gulf of Gdańsk" – investment at the construction stage),
- construction of the first nuclear power plant in Poland (the investment resulting from the "Polish Nuclear Power Programme" – in accordance with the schedule in the adopted Programme – obtaining a permit for the construction and commencement of the construction of the EJ1 nuclear power plant is planned for 2026),
- construction of wind farms within the Polish maritime area (the development of this type of investment results, among others, from the provisions of the "Energy Policy of Poland until

2050", for a number of offshore wind farms, decisions on environmental conditions were obtained or proceedings leading to their issuance are being conducted).

In addition, from the analyzed strategic documents, it was indicated that there may be pressures resulting from other measures such as:

- dredging of fairways,
- construction of shoreline reinforcements and other investments within the sea shore resulting from the Flood Risk Management Plans, the Strategic Adaptation Plan for sensitive sectors and the Sea Shore Protection Programme,
- development of infrastructure in the form of gas pipelines, including Baltic Pipe and the second NordStream line – cross-border impacts,
- modernization and development of port infrastructure and access to ports from the land and sea (in accordance with the Programme for the Development of Polish Sea Ports until 2030),
- construction of a water level below Włocławek,
- extraction of oil and gas from deposits located in the Polish economic zone,
- the development of tourism.

At this stage, it is not clear whether and when investments will be carried out within the lines of action foreseen in the strategy documents. Nevertheless, it should be assumed that implementation or commencement of implementation will take place within the time horizon of the current aPOWM. The current construction and subsequent operation of the excavation through the Vistula Spit and the operation of the nuclear power plant after its construction constitute the most serious source of pressure in the marine environment. The above-mentioned projects will generate pressures, which may in particular affect the following features: D1, D5, D6, D7 and D11. According to the environmental documentation concerning the construction of the Vistula Spit, the dredging works carried out during the construction of the fairway and at the stage of its operation will result in an increase in the content of slurries in the water, an increase in the turbidity of the water, the release of organic matter deposited at the bottom of the reservoir, including biogenic compounds (mainly nitrogen and phosphorus) and other pollutants (heavy metals, petroleum substances). The execution of the shipping channel will result in a permanent cut of the freshwater through the salt water wedge, which will flow from the Vistula Lagoon and the Gulf of Gdańsk. The width of the wedge will depend on the water level of the lagoon and the bay.

On the other hand, the operation of a nuclear power plant on the coast, due to the very likely use of open cooling systems, may be associated with a significant impact on the thermal properties and chemistry of the Baltic waters. However, the commencement of construction works related to the construction of the EJ1 nuclear power plant will not take place until 2026, and the commissioning will take place after the implementation period of the current aPOWM[174].

Given the permits issued for offshore wind farms, it can be expected that the construction of this type of investment will take place before 2027. In this case, the pressures that may arise at the stage of building artificial islands concern mainly:

- impact on the hydromorphology of the seabed, violation of bottom sediments, water fogging,
- increased traffic of ships and machines generating, among others, air emissions and noise,
- impact on habitats and protected species, including habitat destruction and underwater noise.

[174] According to the schedule constituting Annex 1 to the Polish Nuclear Power Programme (M.P. of 2020, item 946)

The pressures that may be generated at the stage of wind farm operation are mainly:

- visual changes in the landscape,
- impact on the avifauna, bats and migration routes,
- electromagnetic fields (power lines).

The construction of offshore gas transmission systems contributes to:

- whereas the agitation of sediments may contribute to the release of pollutants and nutrients deposited on the seabed;
- generating threats to biodiversity at the implementation stage (conducting works within marine protected areas - in the case of the BALTIC PIPE also land-based on the Polish coast; threats to marine mammals - noise generated by works interfering with the seabed or potential noise emissions caused by the detonation of conventional ammunition found in the bottom).

The modernisation and development of port infrastructure and access to ports from the land and sea creates a potential risk of negative impacts associated with the development or construction of new port parts in protected areas – this applies to long-term plans for the port in Świnoujście, Gdańsk, Gdynia. Investments in the development of ports related to the construction/expansion of waterways may cause adverse changes in the morphology of the bottom and shores and cause deterioration of physicochemical water indicators (note: the Development Programme of Polish seaports until 2030 also includes investment plans that positively affect the state of waters or the preservation of biodiversity and are thus consistent with the objectives of the implementation of aPOWM: an investment that directly refers to the provisions and standards of environmental protection in the measures of ports and water transport. These include investments related to the reception of sanitary sewage from passenger ships, infrastructure for handling dangerous goods, and reducing the flow of pollutants with rain and thaw water[175]).

The above-mentioned projects will generate pressures, which may in particular affect the following features: D1, D5, D6 and D11, for which the achievement of good water status may be delayed or its maintenance may be endangered (depending on the scale and location of these projects).

All these projects require an individual environmental and/or Natura 2000 impact assessment. As part of it, the impact specified at the stage of strategic assessment for the documents from which the implementation of the above-mentioned projects results will be verified or has already been selected, and appropriate minimizing or compensating measures have already been selected.

<u>The indicated pressures related to the implementation of measures resulting from the already adopted programmes and plans providing a framework for the subsequent implementation of projects with a potential negative impact on the environment of marine waters may weaken the selected effects of the implementation of the measures proposed in the aPOWM. However, the accumulation of impacts in the sense of increasing negative impacts on the environment as a result of the implementation of aPOWM measures is not predicted</u>.

[175] Forecast of the environmental impact of the project of the Programme for the Development of Polish Seaports until 2030

# 10 Proposed solutions aimed at preventing, reducing or compensating for negative environmental impacts that may result from the implementation of aPOWM, in particular on the objectives and objects of protection and integrity of Natura 2000 sites and the coherence of the Natura 2000 network

The analyses of the impact of the measures planned in the aPOWM on the strategic objectives of environmental protection show that they will have a positive impact on the achievement of these objectives, in some cases it will be an effect strengthening the achievement of the objective. This also applies to the economic objectives related to the direct implementation of the investments of the analyzed strategic documents directly related to the implementation of environmental regulations and standards in the measures of ports, transport, agriculture or fisheries.

The occurrence of negative impacts, proposed as part of the aPOWM measures, can be considered only in relation to the accidental release of toxic and hazardous substances during research works within the wrecks. Therefore, the assumptions of the system for monitoring the hazards associated with the deposition in the maritime areas of the Republic of Poland of combat toxic agents and products of their disintegration, conventional weapons and residual fuel and petroleum substances in wrecks (an element of the task of the Interdepartmental Team for Hazards resulting from hazardous materials remaining in the maritime areas of the Republic of Poland, covered by the modified BALPL-M034 action) should take into account the need to minimize the risk of emergencies, consisting in the release of toxic substances during research works and minimizing the impact in the event of emergencies, by:

- the use of primarily non-invasive methods (i.e. monitoring should generally not puncture, lift or move objects potentially containing toxic chemicals or other hazardous substances);
- developing procedures for securing tests by vessels specialised in taking and/or disposing of chemical weapons on site;
- equipping test facilities with adequate equipment to minimise the effects of the release of toxic substances (e.g. cut-off barriers from the environment of the installation from which the release occurred).

Due to the nature of the other measures specified in the aPOWM, the lack of identification of significant negative impacts on the environment, including on the objectives and objects of protection and the integrity of Natura 2000 sites and the coherence of the Natura 2000 network, it is not necessary to propose minimizing or compensating measures. With regard to measures to reduce the population of invasive species, Chapter 12 indicates a proposal to monitor the potential impact of measures on native fish species.

# 11 Possibility of transboundary impacts

The measures proposed in the aPOWM may potentially be of a cross-border nature, because the marine areas covered by the programme are part of the common Baltic Sea basin, the same as other marine areas in the Baltic Sea, including those under the jurisdiction of other countries directly bordering the Polish areas. Draft plans and programmes (and any modifications thereof) which have the potential to have significant effects on the environment, including on humans and valuable species and habitats, shall be subject to, inter alia, a risk assessment for the occurrence of significant transboundary effects on the environment as part of the strategic environmental impact assessment procedure. Conducting such an assessment is a requirement provided for in the Act of 3 October 2008 on access to information on the environment and its protection, public participation in environment protection and environmental impact assessments (consolidated text Journal of Laws of 2021, item 247, as amended), which results from the provisions of international law - the UNECE Convention on Environmental Impact Assessment in a Transboundary Context, drawn up in Espoo on 25 February 1991 (hereinafter referred to as the Espoo Convention) and Directive 2001/42/EC on the assessment of the impact of certain plans and programmes on the environment (hereinafter referred to as the sea Directive). In accordance with Article 104. 1. of the above Act, the proceedings concerning the cross-border impact on the environment are carried out <u>in the event of finding the possibility of a significant cross-border impact on the environment</u>, originating from the territory of the Republic of Poland as a result of the implementation of projects, including policy, strategy, plan and programme in the field of industry, energy, transport, telecommunications, water management, waste management, forestry, agriculture, fisheries, tourism and land use, developed or adopted by the administrative bodies, setting the framework for the subsequent implementation of projects which may materially affect the environment.

**Taking into account the nature of the aPOWM strategic document and the nature of the measures provided for therein, no cross-border impacts are expected.**

The analyzed aPOWM draft mostly includes measures consisting in:

- proposals for changes in legal acts,
- establishing restrictions,
- carrying out research and monitoring of the state and resources of the marine environment,
- development of tools for control and management,
- implementation of the guidelines,
- development of analyses, documents, reviews, plans,
- developing and promoting good practices,
- education.

All these measures are aimed at maintaining or achieving good environmental status of the marine environment (GES), including by improving the status of the water body on land. These measures mostly do not directly concern interference with the environment, but only as a result, in the future, technical measures may be more expensive, the scope of which and possible impacts on the environment are difficult to predict at this stage. Only some of the measures are strictly technical. In the Forecast, as far as possible, the impacts of future technical measures were also predicted, which may probably be the result of the implementation of postulates (e.g. proposed legal changes or recommendations) contained in the aPOWM measures. The table in Chapter 8.1. describes the possible impacts for aPOWM measures broken down into groups of measures specified for the strategic impact assessment.

The greatest impact on the state of the Baltic Sea, including in relation to the entire Baltic Sea basin, will be the measures related to the legal changes and other non-technical measures postulated in the aPOWM, the effect of which should be to limit the inflow of biogenic substances from agricultural and municipal sources (discharges from municipal sewage treatment plants). Technical measures that may result from the implementation of aPOWM measures (e.g. modernization / optimization of wastewater treatment processes) or the implementation of postulated technical-organizational and institutional solutions in agriculture will not be associated with generating significant negative environmental impacts. In addition, they will concern only the land area of the Republic of Poland.

With regard to the aPOWM measures planned for implementation within POM, the most important of them concern the introduction of restrictions in various types of anthropogenic measures and anthropogenic transformations within POM. These include: the extension of areas with a ban on dredging; the limitation of measures resulting in a high level of impulse noise to months irrelevant for porpoises; the limitation of underwater noise in Natura 2000 sites where marine mammals are subject to protection; the legal determination of the maximum scale and range of permanent transformations of shores and seabed; the limitation of the stream of spoil moved within waters, including those directed to damping sites (the latter as a potential effect of the study activity entitled "Use of dredging waste and rational management of spoil", which concerns, among others, the preparation of comprehensive guidelines for the management of bottom sediments). Reducing the scale of potential future anthropogenic transformations and impacts will have a definite positive impact on the state of the marine environment. The measures proposed in aPOWM can be understood as recommendations for solutions preventing impacts. The measures proposed in the aPOWM can be understood as recommendations for solutions preventing negative impacts.

Measures of a technical nature carried out in marine waters, which may be associated with potential negative impacts, are:

- research measures in the scope of determining the scale of environmental hazards resulting from the deposition of wrecks on the seabed (KPOWM operation continued),
- study of the impact of bottom dredging on benthic communities.

However, it is not expected that the generated impacts, if any, will be significant and may concern areas outside the jurisdiction of Poland. In particular, the subject of the action, described in the aPOWM, concerning the examination of the hazards associated with the residual wreckage at the bottom of the Baltic Sea (the scope of the action includes the tasks of the Interministerial Team for Hazards arising from hazardous materials in the maritime areas of the Republic of Poland and the implementation of the recommendations developed by the Team) are not measures involving the disposal of chemical weapons, the removal of fuels from wrecks or the taking of objects from the bottom, which may result in the significant release of hazardous substances into the environment. Monitoring using non-invasive methods (tests consisting in identifying objects posing a threat and assessing their condition using sonars, echo probes, robots equipped with cameras, and chemical analyses of water samples, sediments and organisms in the vicinity of such objects) and research units, will be equipped with appropriate equipment to minimize the effects of the release of toxic substances, will minimize the risk of emergency situations, consisting in the release of toxic substances during research works. With regard to surveys of the impact of trawling on benthic communities, it should be concluded that the most invasive way of implementing the action will be to fish with commercially used bottom gear. The impacts will therefore be analogous to commercial fishing.

The aPOWM will also implement measures related to the reduction of invasive invertebrate species: Cinese mitten crab in the area of the Szczecin Lagoon and Orconectes limosus in the Vistula Lagoon. In the current planning period of the Marine Strategy, research and pilot works have been programmed to identify effectiveness and improve the effectiveness of methods of population reduction. The indicated measures will not have a significant negative impact on other protected organisms, in particular in both these cross-border areas there are no invertebrates (in particular native species of crayfish or other protected crustaceans), which may fall into the trap for the indicated alien species. For small fish that can be trapped, large-scale applications with high catch selectivity (small by-catch of fish) and a structure allowing the release of fish back into the environment during regular inspections have been assumed. In addition, within the framework of aPOWM, measures were planned in the scope of reducing the population of invasive gobiidae species in transitional waters by biomanipulation with the use of predatory fish - a programme of restocking with predatory species (zander, pike, eel) on the basis of the experience and results of the project "Restitution of key elements of the Puck Bay internal ecosystem (ZOSTERA)", which, including restocking with pike and zander to reduce the population of sticklebacks and gobies. The main expected effect will be a reduction in the population of the goby and a reduction in the expansion of other invasive species of the goby family in transitional waters and an improvement in the structure of transitional water ichthyofauna complexes by increasing the share of predatory species. The cross-border dimension will also have the positive effect indicated. The proposed, in this Forecast, linking the monitoring of the effectiveness of the applied measures to reduce alien species with the monitoring of the state of the population of native species will effectively eliminate the possibility of significant negative impacts associated with the reduction of alien species, also in a cross-border dimension.

Other technical measures (new and continued), mainly related to the reduction of pollution of the Baltic Sea by chemical substances and waste and the protection of species of protected birds and marine mammals, have a clear and direct positive impact on the state of marine waters and biodiversity. These measures include: "fishing for litter" – cleaning the sea, marking fishing nets – preventing the formation of spectral networks, supporting measures to clean up the sea and rivers, supporting the system of combating pollution at sea, limiting by-catches of porpoises, measures in the field of active ornithofauna protection and limiting the disturbance of seals on the Polish coast.

It is assumed that all impacts resulting from the implementation of new measures and the continuation of measures included in the aPOWM from the previous planning period will be positive, and possible negative impacts on some elements of the environment will be negligible or not significant and limited directly to the place of their implementation in the Republic of Poland. In addition, existing mechanisms ensure both notification and consultation with other Baltic Sea States for which HELCOM provides regional coordination of the Marine Strategy Action Programmes.

In the light of the provisions of the SEA Directive, when plans and programmes are part of the hierarchy, Member States, in order to avoid duplication of assessment, take into account the fact that the assessment is carried out, at different levels of the hierarchy (Article 4, paragraph 3), it is assumed that in the case of commencing the implementation of specific projects for which it would be possible to have significant environmental impacts on the neighbouring country, at the stage of conducting the impact assessment procedure for the planned measures, it will also be necessary to conduct the procedure on transboundary environmental impacts[176], and in the case of projects already subject to the assessment procedure, it seems justified to adopt the results and conclusions from these assessments, among others, in the scope of assessing the risk of transboundary impact.

The aPOWM document assesses the cumulative impact resulting from the implementation of measures adopted in other strategic documents, including in the sectors of energy, water and sewage, water, agriculture and fisheries. These documents were subject to the cross-border impact assessment procedure if there was a possibility of a cross-border impact.

An additional factor minimizing the risk of significant cross-border impact of projects implemented under aPOWM is the obligation specified in Article 2, item 1 of the general provisions of the Espoo Convention: “The Parties shall take, individually or jointly, all appropriate and effective measures to prevent, reduce and control significant harmful transboundary environmental impacts resulting from the planned measures.”

In addition, it should be remembered that Poland is bound by a number of international agreements, conventions and protocols aimed at protecting not only the local environment, but also the one that is a common supranational good. Such a multilateral agreement is, among others, the Helsinki Convention. Its primary objective is the comprehensive protection of the marine environment of the Baltic Sea area[177]. The rules of possible cooperation in the event of pollution in the Baltic Sea or the Vistula Lagoon are also regulated by bilateral agreements binding Poland with the Russian Federation.

[176] Article 2 (3) of the Convention: The Party of origin shall ensure that, in accordance with the provisions of this Convention, an environmental impact assessment is carried out before a decision is taken to approve or undertake a planned activity listed in Annex I which is likely to cause significant transboundary harm.
Article 2 (7) of the Convention: The environmental impact assessment, as required by this Convention, shall be undertaken, as a minimum, at the design stage of the planned activity. The Parties shall endeavour to apply, to the appropriate extent, the principles of environmental impact assessments to policies, plans and programmes.

[177] The most important obligations of the Convention concern the reduction of the supply of biogenic and hazardous substances, the protection of biodiversity and the reduction of the environmental impact of offshore measures.

# 12 Proposals regarding the expected methods of analysis of environmental impacts of the implementation of the provisions of the designed document and the frequency of its implementation

Monitoring the quality of the marine environment is one of the elements provided for by the MSFD and the Water Law. In accordance with the provisions of the Water Law of 20 July 2017 (consolidated text Journal of Laws of 2021, item 624, as amended, item 784.) in order to protect the environment of marine waters, a marine strategy is developed and implemented on the principles specified in the provisions of the Act (Article 144, paragraph 1). One of the elements of the Marine Strategy is the development and implementation of a marine monitoring programme. In accordance with Article 11 of the Marine Strategy Framework Directive 2008/56/EC (MSFD), Member States shall develop a monitoring programme for the waters under their jurisdiction. The implementation of the marine environment studies carried out in accordance with the planned monitoring programme must enable both the assessment of the state of the marine environment and the assessment of the achievement of the environmental objectives, and must enable the assessment of the effectiveness of the measures taken to maintain or improve the state of the marine environment (in accordance with point 3 of Annex V to the 'Monitoring Programme' to the MSFD). Therefore, in accordance with Article 351 (2) of the Water Law, when developing the marine water monitoring program and updating it, one must consider the need to, among others: '*provide information to allow an ongoing assessment of the status of the marine environment and to determine the measures remaining to be taken and the progress made towards achieving good environmental status of marine waters, in accordance with the initial assessment of the status of the marine waters and with a set of characteristics typical of good environmental status of marine waters*'; '*provide information to allow an assessment of the effectiveness of the measures set out in the Marine Waters Protection Programme*'; '*ensure identification of the cause of changes in the environmental status of marine waters and take possible corrective measures to restore the good environmental status of marine waters, if deviations from the good environmental status of marine waters are found'; 'include studies to ensure that corrective measures will yield expected changes in the environmental status of marine waters and will not have undesirable side effects'.*

The marine water monitoring programme was developed by GIOŚ and submitted to the European Commission. The developed draft programme is an update of the programme prepared in 2014, adopted by the Council of Ministers in the circulation mode on 3 June 2015 and takes into account the update of the initial assessment of the state of the marine environment (Resolution of the Council of Ministers No. 8 of 18 January 2019 – Journal Of Laws of 2019, item 230), characteristics typical of good environmental status (Resolution of the Council of Ministers No. 8 of 18 January 2019 – Journal Laws 2019, item 230) and the update of environmental objectives (Resolution of the Council of Ministers No. 170 of 15 November 2018 – M.P. of 2019, item 173).

Therefore, the above-mentioned updated monitoring programme - after adoption by the Council of Ministers, will be a tool for analysing the environmental effects of the implementation of the provisions of the designed aPOWM document.

This Forecast analyses whether it is necessary to propose additional monitoring of the environmental impacts of the implementation of the Programme covering other environmental aspects not covered by the 'Marine Waters Monitoring Programme'. It is proposed that, in the framework of monitoring the environmental impact of the implementation of the aPOWM measures, in addition to the measures included in the "Marine Waters Monitoring Programme", additional measures should be considered:

- Supplementing the monitoring proposed under action N 14 "Reduction of the population of invasive goby fish in transitional waters by biomanipulation with the use of predatory fish" (in particular, including the registration of fishing and recreational fisheries for introduced predatory fish species and annual monitoring of the occurrence of goby and other invasive goby fish) with monitoring of the impact on native protected fish species, which may constitute food for predatory fish species, which will be used for restocking (zander, pike, eel). Monitoring should cover the stage before the implementation of the action and the period of implementation and concern such species as: amur bitterling, loach, weatherfish. Monitoring of these fish species should be carried out in accordance with the methodology developed under the "Pilot implementation of monitoring of marine species and habitats in 2015-2018" programme.
- Including in the methodology of pilot studies within the N12 "Development of methods for reducing invasive species of crayfish" and N13 "Reduction of the population of the Chinese mitten crab in the area of the Szczecin Lagoon", monitoring the impact of the action on protected fish species, in particular amur bitterling and loach, in the case of identification during the implementation of the action of significant by-catches of representatives of these species in traps on alien species. The monitoring should cover the area in the immediate vicinity of the traps for the capture of alien species.

# 13 Summary in non-specialist language

**What is the Forecast and what is it for?**

The update of the Marine Waters Protection Programme (hereinafter aPOWM) is an updating document of the KPOWM[178] and completes a multi-stage process based on the requirements of the MSFD in the next cycle of planning and implementation of marine strategies. Pursuant to Article 159 (1) of the Water Law (consolidated text: Journal of Laws of 2021, item 624, as amended, item 784.) defines the basic measures – necessary to achieve or maintain a good environmental status of marine waters and ad hoc measures, aimed at further pursuit of environmental objectives for marine waters, in order to prevent further deterioration of the environmental status of marine waters for the reasons indicated in paragraph 2 points 2–4 , as well as to mitigate the negative impact on the waters of the Baltic Sea region or the marine waters of other Member States of the European Union, if such an impact occurs.

Prior to the adoption of this document, in accordance with the applicable law, it is necessary to carry out a so-called strategic environmental impact assessment (hereinafter referred to as "SEA") procedure. One of the elements necessary to carry out SEA is a document verifying the impact on the environment of the implementation of measures resulting from aPOWM, i.e. a forecast of the impact on the environment (hereinafter referred to as the Forecast).

As part of the work on the aPOWM environmental impact forecast, methodological consistency with the forecast developed for the updated document, i.e. KPOWM, was maintained. Therefore, in order to carry out a strategic environmental impact assessment of the Programme project, a goal-led method was adopted, as in the case of the KPOWM environmental impact forecast. Only the evaluation module was expanded by listing separately the groups of measures determined according to the leading feature of GES.

During the development of the Forecast, the effects in the environment as a result of the implementation of the measures indicated in aPOWM were analyzed. The expected potential impacts on environmental objectives were also analysed, including: "Assuring human health and safety", "Protection of biodiversity", "Supporting the achievement or maintenance of good environmental status of marine waters", "Supporting the achievement of environmental objectives for water bodies on land", "Reducing sensitivity and preparing for climate change", "Protection of land surface, including soil", "Protection and, where possible, improvement of landscape values", "Protection of cultural heritage, including underwater archaeological monuments", "Economic objectives and protection of material goods of high value".

The Forecast refers to the broader environment covering not only the marine environment to which aPOWM refers, but also the terrestrial environment, where the effects of the proposed measures may occur.

This summary presents the most important information resulting from the environmental impact verification, which is described in more detail and in a technical manner in the Forecast.

[178] In the previous Marine Strategy Planning Period, the Marine Waters Protection Programme was developed under the name National Marine Waters Protection Programme (KPOWM)

**What is the legal basis for strategic assessment and forecasting?**

The requirement to conduct a strategic environmental impact assessment of the draft document results from Article 46 (2) of the Act of 3 October 2008 on access to information on the environment and its protection, public participation in environmental protection and environmental impact assessments (consolidated text: Journal of Laws of 2021, item 247 as amended), hereinafter referred to as the EIA Act. Pursuant to Article 46 (2) of the EIA Act, the strategic environmental assessment is to be carried out on the basis of a draft *'policy, strategy, plan and programme in the fields of industry, energy, transport, telecommunications, water management, waste management, forestry, agriculture, fisheries, tourism and land use, developed or adopted by the administrative authorities, which sets the framework for the subsequent implementation of projects which may materially affect the environment'.*

The EIA Act implements Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment (Official Journal of EU L 197, 21.7.2001, p. 30; hereinafter referred to as the SEA Directive) by, inter alia, the provision of Article 46 (2) of the Act. The required scope of the Forecast has also been specified by the approving authorities, i.e.: General Director for Environmental Protection, Chief Sanitary Inspector and Directors of the Maritime Office in Szczecin and Gdynia.

The general scheme of the proceedings on the environmental impact assessment for the implementation of aPOWM is presented in the figure below.

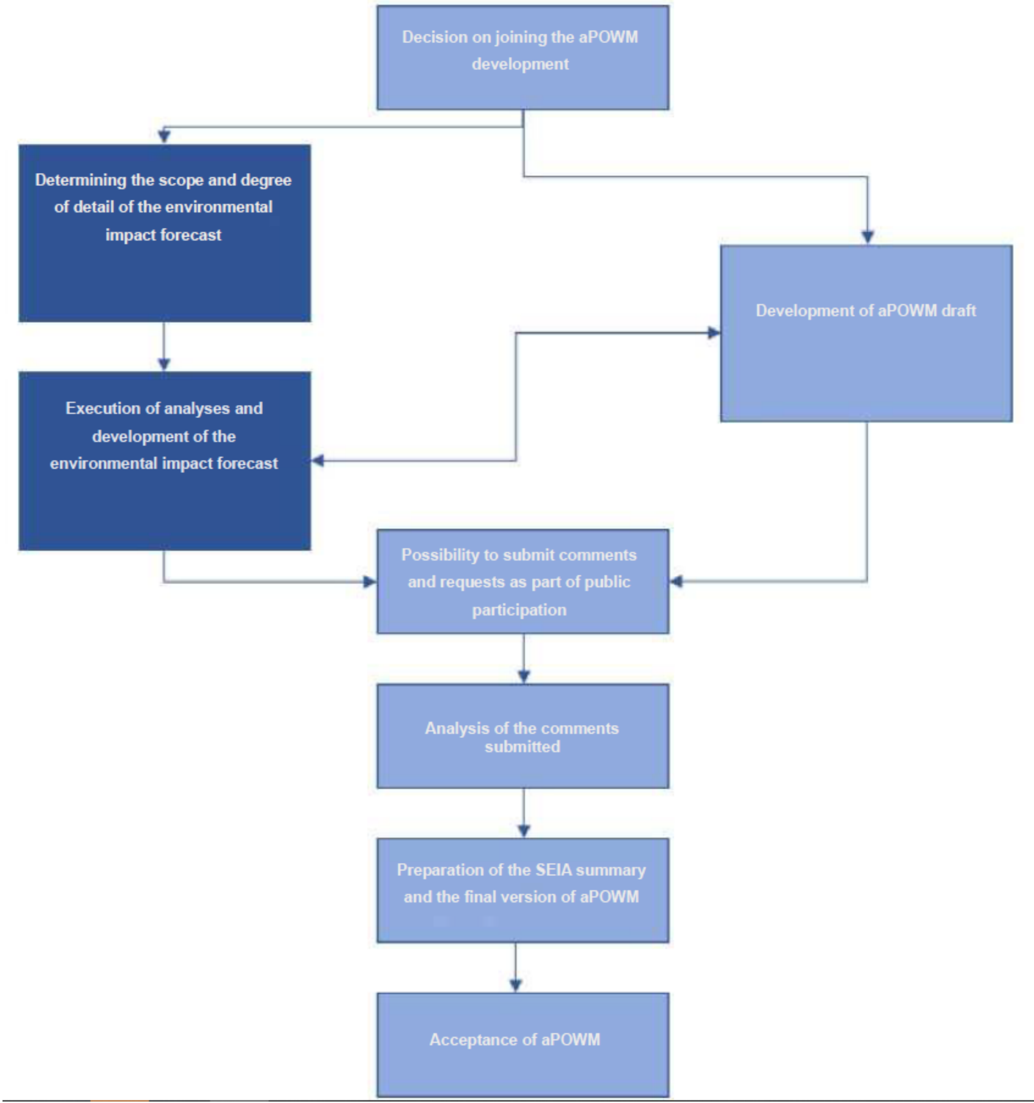



**Fig. 73 Overview of the environmental impact assessment procedure for the implementation of aPOWM (Strategy Paper)**

*Source: Own study*

### What are the most important objectives for POWM?

The aPOWM draft aims to achieve environmental objectives for marine waters, which have been defined and submitted to the European Commission on the basis of MSFD requirements.

Pursuant to Article 156 (3) of the Act of 20 July 2017 – Water Law (i.e. Journal of Laws of 2021, item 624, as amended) No. 784), when developing a set of environmental objectives for marine waters, the following shall be taken into account in particular:

- the characteristics and properties of marine waters,
- pressures and impacts on marine waters,
- the characteristics and environmental impacts of the transboundary waters of the Baltic Sea region and the need to ensure that the environmental objectives for marine waters are consistent with those of other Member States of the European Union in the Baltic Sea region and of countries outside the borders of the European Union bordering the Baltic Sea region,

- the need to define the environmental objectives in such a way as to enable the monitoring of marine waters and the ongoing assessment of the status of the marine environment and the operational objectives related to the measures undertaken to achieve the environmental objectives,
- the characteristics of the target or maintained environmental status of the marine waters and the need to determine that status, taking into account the characteristics and properties of the marine waters,
- the coherence of the environmental objectives for marine waters,
- a description of the parameters used to monitor progress and to guide the measures taken to achieve the environmental objectives for marine waters,
- the need to take account of social, economic and spatial issues.

The MSFD defines 11 descriptive indicators (features, in accordance with the Water Law) for the determination of good environmental status, for which an assessment should be carried out in relation to the defined criteria of good environmental status.

Table 67 **Descriptive indicators (characteristics) for the determination of good environmental status of marine waters**

| Indicators/features | | Description of the indicator/feature |
|---|---|---|
| **Indicators in accordance with MSFD** | **Features in accordance with the Water Law** | |
| **Annex 1 p. 1** | Article 153 (1) (1a) | D 1 Biological diversity |
| **Annex 1 p. 2** | Article 153 (1) (1b) | D2 Non-native species |
| **Annex 1 p. 3** | Article 153 (1) (1c) | D3 Commercially exploited fish and invertebrate species |
| **Annex 1 p. 4** | Article 153 (1) (1d) | D 4 Food chains |
| **Annex 1 p. 5** | Article 153 (1) (1e) | D5 Eutrophication, |
| **Annex 1 p. 6** | Article 153 (1) (1f) | D 6 Seabed integrity |
| **Annex 1 p. 7** | Article 153 (1) (g) | D7 Hydrographic conditions |
| **Annex 1 p. 8** | Article 153 (1) (1h) | D8 Pollutants and pollutant effects |
| **Annex 1 p. 9** | Article 153 (1) (1i) | D9 Harmful substances in fish and seafood |
| **Annex 1 p. 10** | Article 153 (1) (1j) | D10 Marine litter |
| **Annex 1 p. 11** | Article 153 (1) (1k) | D11 Underwater noise and other energy sources |

*Source: Own study based on MSFD.*

Commission Decision (EU) 2017/848 is an implementing act to the MSFD. Decision 2017/848 established the breakdown of the indicators that must be included in the assessment of the status of the marine environment into two groups: the group covering the **features of pressure:** D2, D3, D5, D6, D7, D8, D9, D10 and D11; and groups **of status features**: D1, D4 and D6 for ecosystem elements: mammals, fish, birds, pelagic habitats, benthic habitats.

The aPOWM document mostly covers non-technical measures, such as proposals for changes in legal acts, setting restrictions or education. These measures mostly do not directly concern interference with the environment, but only as a result, in the future, technical measures may be more expensive, the scope of which and possible impacts on the environment are difficult to predict at this stage. However, as far as possible, the impacts of future technical measures were also predicted, which may probably be the result of the implementation of postulates (e.g. proposed legal changes or recommendations) contained in the aPOWM measures.

The measures referred to above result from a number of strategy papers. More than 70 documents adopted at Community, national and regional level have been reviewed to identify them. Within the scope of the national documents**,** the documents that result in measures directly or indirectly supporting the implementation of the objectives directly or indirectly affecting the aPOWM were analyzed (which does not mean that they do not include measures that may adversely affect the achievement of the objectives), in particular:

- Water (River Basin) Management Plans for the Baltic catchment (documents resulting from the preparation of the current PGW (IIuRBMP) update were also used – the documents were not adopted by the Council of Ministers),
- V update of the National National Programme for Municipal Waste Treatment (KPOSK) 2017 / draft VI update of KOPOSK,
- Strategic Adaptation Plan for sectors and areas sensitive to climate change by the year 2020 with a view to 2030,
- Strategy for Responsible Development to 2020 (with a perspective to 2030),
- Sustainable Development Strategy for Rural Areas, Agriculture and Fisheries 2030 (SDRAAF 2030),
- State Environmental Policy 2030 - development strategy in the field of environment and water management (PEP 2030),
- Sustainable Transport Development Strategy to 2030,
- A programme of measures to reduce and prevent the pollution of waters by nitrates from agricultural sources,
- National Waste Management Plan 2022,
- The Drought Effects Counteracting Plan (PPSS).

**What area is covered by aPOWM?**

The area of Polish maritime areas including: internal marine waters, territorial sea and the exclusive economic zone. The extent and division of Polish maritime areas is presented in the figure below.

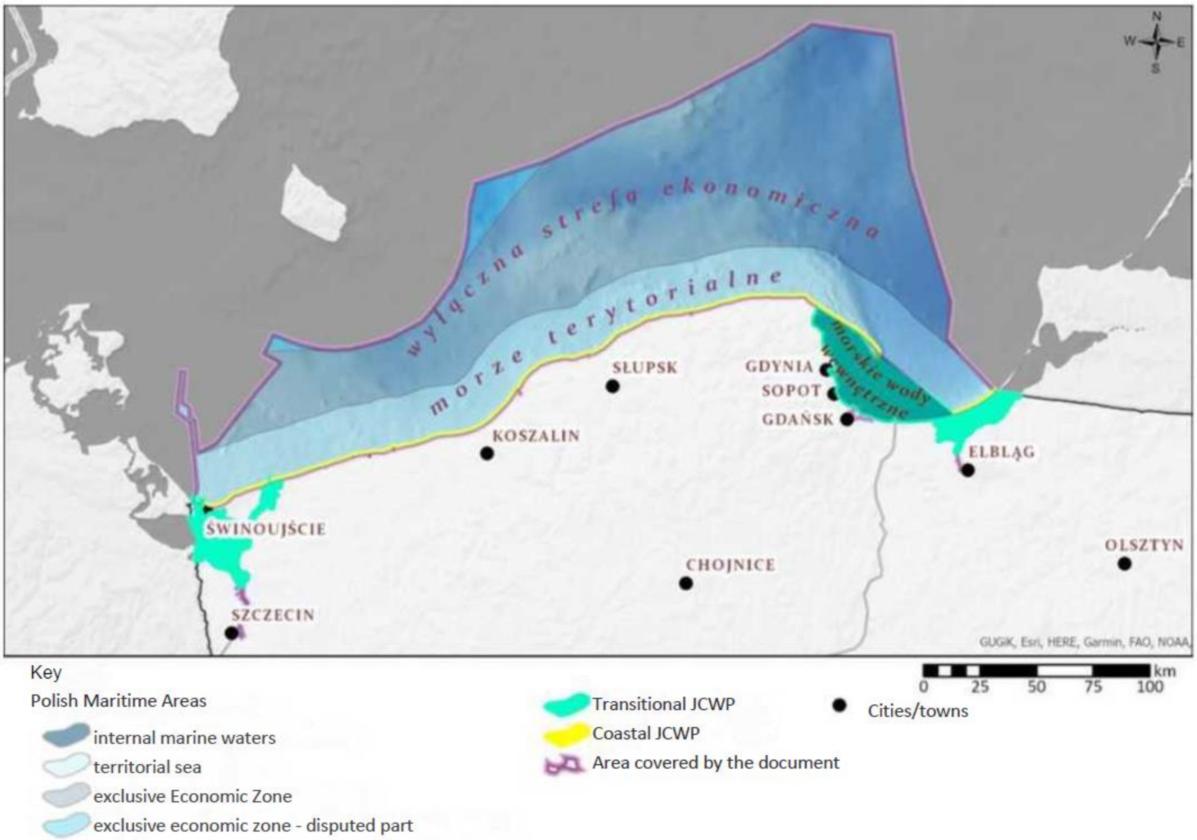



**Fig. 74 Extent and division of Polish maritime areas**

*Source: Own study based on data Update of the preliminary assessment of the status of the marine waters environment*

When determining the spatial scope of the analyzes, the cumulative impact (internal accumulation) of measures with a link to accumulation in time and space was also taken into account – as far as it was possible to determine it in the framework of the strategic document, which is aPOWM and thus in the Forecast for it. It should be noted that, where possible, measures were associated with specific sub-water bodies. Their location is presented in the figure below.

**Table 68 List of sub-water bodies analyzed as part of the Forecast**

| HELCOM_ID | Polish title | English title |
|---|---|---|
| **22** | polskie wody przybrzeżne wschodniego Basenu Gotlandzkiego | Eastern Gotland Basin Polish Coastal waters |
| **SEA-009** | wschodni Basen Gotlandzki | Eastern Gotland Basin |
| **24** | polskie wody przybrzeżne Basenu Gdańskiego, | Gdansk Basin Polish Coastal waters |
| **SEA-008** | Basen Gdański | Gdansk Basin |
| **26** | polskie wody przybrzeżne Basenu Bornholmskiego | Bornholm Basin Polish Coastal waters |
| **SEA-007** | Basen Bornholmski | Bornholm Basin |

*Source: Own study based on HELCOM Monitoring and Assessment Strategy (HELCOM MAS)*

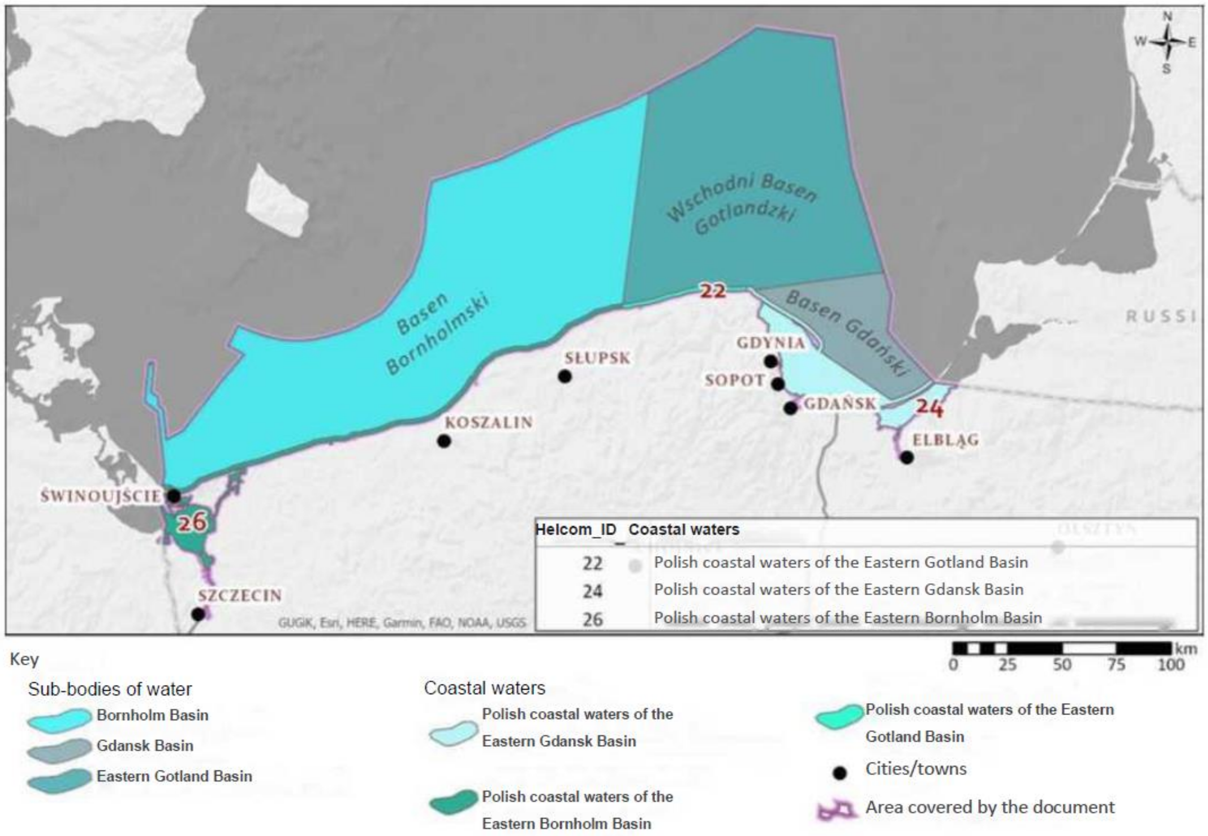



**Fig. 75 Map of analyzed sub-water bodies – aPOWM spatial extent of analyzes**

*Source: Own study based on HELCOM*

**What is the current status of the marine environment and what are the most important problems?**

The environmental status of Polish marine areas in accordance with the MSFD was determined on the basis of the assessment of the basic indicators assigned to the descriptive indicators of the state in the Update of the preliminary assessment of the environmental status of marine waters. The final result is expressed in two classes corresponding to the achievement of GES (denoted as' GES ') or non-achievement of GES (denoted as: “subGES” or “non-GES”).

The following figures present a summary of assessments for individual sub-bodies separately for ecosystem elements and pressure features.

| Trophic groups | Ecosystem elements | Indicator | Bornholm Basin | Eastern Gotland Basin | Gdansk Basin |
|---|---|---|---|---|---|
| Trophic group A | Fito plankton (primary producers) | Dia/Dino | GES | GES | GES |
| | Macrozoobenthos | B | subGES | subGES | subGES |
| | Demersal fish | LFI | subGES | subGES | subGES |
| Trophic group B | Fitoplankton (primary producers) | Dia/Dino | GES | GES | GES |
| | Macrozoobenthos | B | subGES | subGES | subGES |
| | Birds feeding on benthos | Group of breeding birds | subGES | subGES | - |
| | | Group of wintering birds | GES | GES | |
| Trophic group C | Fitoplankton (primary producers) | Dia/Dino | GES | GES | GES |
| | Zooplankton (secondary producers) | MSTS | - | ■ | GES |
| | Fish feeding on plankton | - | - | ■ | - |
| | Grey seals | Abundance and trend | subGES | | |
| | | Occurrence | | | |
| | | Reproduction status | | | |

**Fig. 76 Environmental status assessment for D4 – Trophic chains:**

*Source: Initial update of the assessment of the status of marine waters environment.*

| Body of water | Ecosystem elements | | | | | |
|---|---|---|---|---|---|---|
| | Feature D1 | | | | | Feature D 6 |
| | Mammals | Wintering Birds | Breeding birds | Fish | Pelagic habitats | Benthic habitats |
| POM | | | | | | |
| Polish waters of the Bornholm Basin | | | | | | |
| Polish waters of the eastern Gotland Basin | | | | | | |
| Polish waters of the Gdansk Basin | | | | | | |
| Polish coastal waters of the Bornholm Basin | | | | | | |
| Polish coastal waters of the eastern Gotland Basin | | | | | | |
| Polish coastal waters of the Gdansk Basin | | | | | | |

**Fig. 77 Environmental status assessment for the status features: D1 and D6 – integrated biodiversity assessment:**

*Source: Initial update of the assessment of the status of marine waters environment.*

**Fig. 78 Assessment of the status of the environment for the features of pressure: D2, D3, D5, D6 (part), D7, D8, D9, D10, D11**

| Body of water | Pressure characteristics | | | | | | | | | | Average of grades for individual features |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D2 | D3 | | D5 | D6 | D7 | D8 | D9 | D10 | D11 | |
| | | sprat | herring | | | | | | | | |
| POM | | | | | | | | | | | |
| Polish waters of the Bornholm Basin | | | | | | | | | | | 0.55 |
| Polish waters of the eastern Gotland Basin | | | | | | | | | | | 0.55 |
| Polish waters of the Gdansk Basin | | | | | | | | | | | 0.55 |
| Polish coastal waters of the Bornholm Basin | | | | | | | | | | | 0.00 |
| Polish coastal waters of the eastern Gotland Basin | | | | | | | | | | | 0.40 |
| Polish coastal waters of the Gdansk Basin | | | | | | | | | | | 0.00 |
| **Summary according to the features of pressure** | | | | | | | | | | | 0.55 |

*Source: Initial update of the assessment of the status of marine waters environment.*

The Forecast analyzes the status of the environment in a wider scope than the above, including also other environmental components. The most important information relating to the state of the environment is presented below.

- The Baltic Sea is a shallow, northern European internal sea, which is also an epicontinental shelf sea (the average depth is 52 m, while the maximum is 459 m). The Danish straits connecting the Baltic Sea with the North Sea are: Skagerrak, Kattegat (outer straits) and Sund, Great Belt and Little Belt (inner straits).

- The most pronounced form in the morphology of the southern shores of the Baltic Sea are the cliffs. Their average height ranges from 10 to 30 m, while the active cliffs reach an average height of approx. 18 m.
- The sea water zone is a world of animated nature, where individual elements have an impact on each other. The food web in the Baltic Sea consists of a small number of species and trophic levels. The most famous habitats of Polish marine waters are the Bay of Puck or the Słupsk Bar, which include areas of special bird protection, including: ducks, seagulls, turtles, perch and loons.
- Habitats protected in Polish marine Natura 2000 sites include: Sandy underwater beds permanently covered by water of low depth (habitat No 1110 according to the Habitats Directive), Estuary (No 1130), Coastal Lagoons (No 1150), Large shallow bays (No 1160) and Reefs (No 1170) and Annual vegetation of drift lines (No 1210).
- "Marine Natura 2000 areas" are those that are at least partially located in marine waters, within the meaning of the Marine Areas Act of the Republic of Poland and maritime administration. Currently, 18 marine Natura 2000 sites have been established. It consists of 8 bird areas (PLB), 9 habitat areas (PLH) and one area of Ławica Słupska (PLC), which is within the same boundaries a bird and habitat area.[179] Forms of nature conservation in the area analyzed as part of SEA are presented in the figure below.

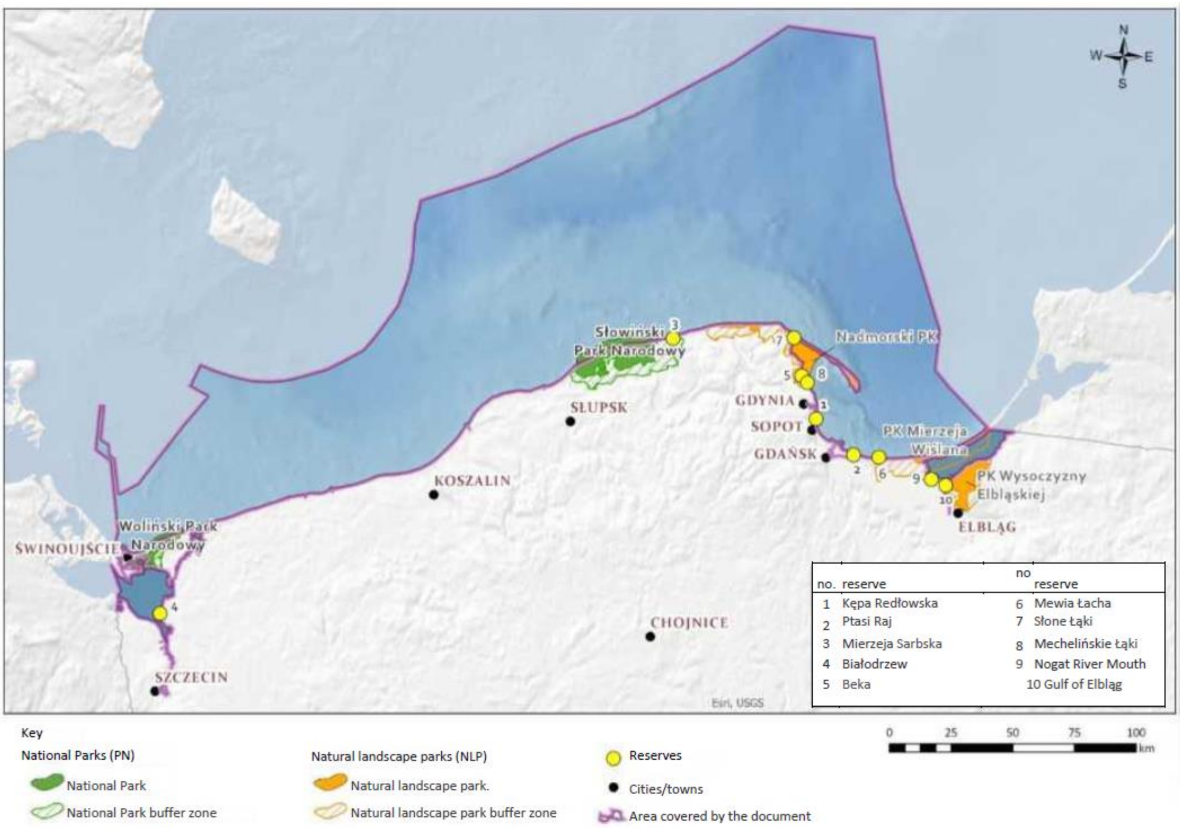



**Fig. 79 Forms of nature conservation (national parks, landscape parks and reserves) in the POM area**

*Source: Own study based on GDOŚ data*

[179] "Marine Natura 2000 sites", GDOŚ.

- The Baltic Sea, compared to other areas, is characterised by a low degree of biodiversity. The marine ecosystem of the Baltic Sea is vulnerable to external pressures caused, among other things, by the fact that the ecosystem and its ecological interactions are based on a relatively small number of species. Both the southern and central parts of the Baltic Sea are characterised by a poor state of biodiversity.
- There are only a few species that build the basis of the trophic chain. The functioning of the ecosystem and ecological interactions based on a relatively small number of species make it vulnerable to external pressures.
- Polish marine waters are subject to strong pressure, which is eutrophication caused by human activity (including pollution from municipal sources and agriculture). This process causes a decrease in biodiversity and hypoxia of the bottom parts of the reservoir.
- Climate change from an ecological and economic point of view can cause risks from rising or falling mean sea levels. The 2011-2030 scenarios, developed on the basis of changes in the regional pressure field simulated by the ECHAM5 model and taking into account global changes in the average sea level, predict that the average sea level in these years will increase by about 4-5 cm in relation to the values from the reference period 1971-1990.
- Within the analysed area, there are a number of forms of nature protection under the Nature Conservation Act, within which the landscape is an element subject to legal protection. These are in particular:
    - national parks (Woliński PN, Słowiński PN),
    - natural and landscape complexes (Helski Cypel, Usedom Peat bogs, Dębina),
    - landscape parks (Seaside PK, PK of the Elbląg Upland, PK of the Vistula Spit),
    - protected landscape areas (OChK Nogat River, OChK Bauda River, OChK Koszalin Coastal Belt, OChK Old prussian Coastal Belt, OChK Coastal Belt East of Ustka, OChK Coastal Belt West of Ustka, OChK Coastal Belt West of Ustka (West Pomeranian province), OChK River Szkarpawa and Tuga, OChK Sobieszewska Island, OChK Coastal Belt, OChK Elbląg Upland – East).
- One of the most unique places on the coast in terms of the value of the landscape is the Słowiński National Park, primarily due to the dune belt of the spit with moving dunes. The park is covered by the UNESCO's "Man and the Biosphere" programme and is thus included in the global network of biosphere reserves and forms the so-called Ramsar wetlands.
- So far, the geological survey of the area of Polish maritime areas in terms of extraction of mineral resources has shown the existence of oil, natural gas, construction aggregate and amber. Four areas were distinguished, where there are significant resources of gravel and coarse-grained sands.
- Underwater cultural heritage sites are sunken settlements/landscapes and shipwrecks. According to data held by the Naval Hydrological Bureau, more than 415 wrecks, about 100 of which are in the Gulf of Gdansk, lie in Polish maritime areas.
- Maritime measures related, inter alia, to economic measures, including shipping and related services, fisheries, measures of certain public services, including shipping and ship safety, research and scientific measures, recreational measures, etc., have a significant impact on the functioning of the marine water ecosystem, causing pressures on the marine environment. The greatest pressures are observed in the area of the Gulf of Gdansk, in the vicinity of large urban centers and in the estuary sections of large rivers carrying pollution.
- The Baltic Sea Pressure Index distribution for the Baltic Sea area is shown on the map below.

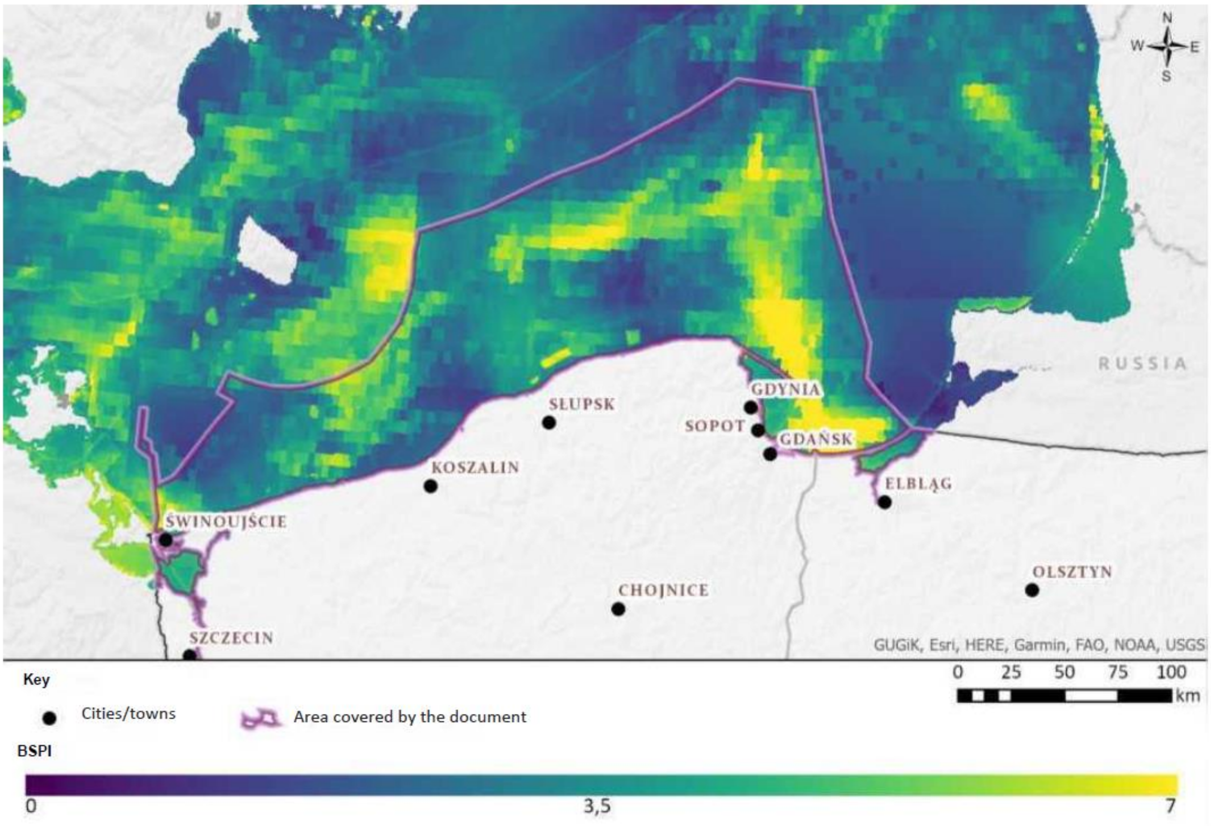



**Fig. 80 BSPI map for Polish maritime areas**

*Source: HELCOM [http://maps.helcom.fi/website/mapservice/index.html](http://maps.helcom.fi/website/mapservice/index.html)*

The use of Polish maritime space is mainly limited to freight and passenger navigation, defence, water sports and fishing.

The analysed area is adjacent to three provinces: Warmian-Masurian, Pomeranian and Western Pomeranian. In Pomeranian and western Pomeranian provinces, international and national transport routes in the north-south and east-west systems intersect. The dominant centres of the maritime economy sector are Gdańsk and Gdynia and Szczecin, Świnoujście, and ports in these centres have over 97% share in national turnover (97.6% in 2019). In 2018, in the national register of entities of national economy REGON, there were 7,164 entities registered, whose main activity was the production and repair of ships and boats, i.e. by 27.3% more than in 2014.

The second largest group of entities operating in the field of maritime economy are entities engaged in the wholesale and retail sale of fish, crustaceans and molluscs. In 2018, 2,868 entities conducting such measures were registered, i.e. an increase by 17.4% compared to 2014. At the end of 2018, 1 297 marine fisheries operators were registered, i.e. 14.1% more than in 2014.

According to the GUS, most of the vessels (boats) registered in 2010-2018 were in the ports of Władysławowo and Ustka, then in Kołobrzeg and Jastarnia, while the least in the ports of Gdańsk and Świnoujście.

When analysing the experiences of highly developed countries, one should expect an increase in economic activity related to maritime areas.

Due to the specificity of the marine environment, it was considered that the most important pressures that may arise as a result of the implementation of the strategy papers relate to measures such as:

- execution of the excavation through the Vistula Spit (investment resulting from the project "Multiannual program Construction of a waterway connecting the Vistula Lagoon with the Gulf of Gdańsk" – investment at the construction stage),
- construction of the first nuclear power plant in Poland (the investment resulting from the "Polish Nuclear Power Programme" – in accordance with the schedule in the adopted Programme – obtaining a permit for the construction and commencement of the construction of the EJ1 nuclear power plant is planned for 2026),
- construction of wind farms within the Polish maritime area (the development of this type of investment results, among others, from the provisions of the "Energy Policy of Poland until 2050", for a number of offshore wind farms, decisions on environmental conditions were obtained or proceedings leading to their issuance are being conducted).

In addition, from the analyzed strategic documents, it was indicated that there may be pressures resulting from other measures such as:

- dredging of fairways,
- construction of shoreline reinforcements and other investments within the sea shore resulting from the Flood Risk Management Plans, the Strategic Adaptation Plan for sensitive sectors and the Sea Shore Protection Programme,
- development of infrastructure in the form of gas pipelines, including Baltic Pipe and the second NordStream line – cross-border impacts,
- modernization and development of port infrastructure and access to ports from the land and sea (in accordance with the Programme for the Development of Polish Sea Ports until 2030),
- construction of a barrage below Włocławek,
- extraction of oil and gas from deposits located in the Polish economic zone,
- the development of tourism.

**How was the impact of aPOWM on the environment assessed?**

This aPOWM document proposes approx. 60 measures, of which approx. 40 are new measures. Other measures are continued measures, defined in the previous planning period (measures with KPOWM), which were verified and modified as part of aPOWM. Most of the measures proposed in the aPOWM (new and continued) are non-technical measures, e.g. organisational measures, changes in legal documents, etc. Non-technical measures do not involve direct interference with the environment, but may provide a framework for the implementation of projects which may materially affect the environment in the future. All these measures are aimed at maintaining or achieving good environmental status of the marine environment (GES), including by improving the status of the water body on land. These measures mostly do not directly concern interference with the environment, but only as a result, in the future, technical measures may be more expensive, the scope of which and possible impacts on the environment are difficult to predict at this stage. However, as far as possible, the impacts of future technical measures were also predicted, which may probably be the result of the implementation of postulates (e.g. proposed legal changes or recommendations) contained in the aPOWM measures.

As part of the Forecast, the expected significant impacts of aPOWM in terms of achieving environmental objectives at the level of specific groups of measures, which were specified on the basis of the leading feature of GES:

A. measures aimed at preserving and restoring biodiversity,
B. measures aimed at reducing the eutrophication phenomenon,

C. measures aimed at reducing invasive species,
D. measures aimed at preserving and improving the integrity of the seabed,
E. measures aimed at reducing pollutants,
F. measures aimed at reducing the amount of waste, including micro- and nanoparticles of plastics.

As part of the analyses, the impact of the planned measures in the aPOWM draft on the possibility of achieving strategic environmental protection objectives was assessed. These objectives are indicated in other overarching documents, including Community and national documents and in international agreements. Nine strategic environmental objectives have been identified that may be related to the aPOWM measures and the marine environment. They include the following objectives:

1. Assuring human health and safety
2. Protection of biodiversity
3. Supporting the achievement or maintenance of good environmental status of marine waters (GES)
4. Supporting the achievement of the environmental objectives for water bodies on land
5. Reducing vulnerability and preparing for climate change
6. Protection of earth surface, including soils on land
7. Protection and, if possible, improvement of landscape values
8. Protection of cultural heritage, including underwater archaeological monuments
9. Economic objectives and protection of material goods of high value

Such defined environmental objectives cover all elements of the environment, which should be subject to a strategic impact assessment in accordance with the law, i.e.: people, biodiversity, animals, plants, water, air, earth's surface, landscape, climate, natural resources, monuments and material goods.

During the analysis in the strategic evaluation we encountered some gaps in knowledge that could have an impact on the forecasting outcome. The most important deficiencies and uncertainties are:

- The proposed measures aim at maintaining or achieving good environmental status of the marine environment (GES), including by improving the status of the water body on land. These measures mostly do not directly concern interference with the environment, but only as a result, in the future, technical measures may be more expensive, the scope of which and possible impacts on the environment are difficult to predict at this stage.
- The forecasting of potential impacts that may occur in the environment is fraught with uncertainty due to climate change, which in turn can have a significant impact on the marine environment. The KLIMADA project presents various scenarios of climate change in the 21st century. Unfortunately, they are burdened with many uncertainties resulting from the gaps in knowledge and a relatively short period of observation of climate change. Climate change and its effects do not significantly affect the results of the analyses, but it should be borne in mind that the frequency and strength of extreme phenomena, which may determine the achievement of GES, is increasing.

**What is the outcome of the strategic assessment?**

The measures proposed in the aPOWM draft are aimed at maintaining or achieving the GES of the marine environment. They refer to the indicators (features) of quality regarding the determination of good environmental status indicated in Annex 1 MSFD (characteristics: D1-D11).

**Table 69 Summary of the characteristics of the identified impacts of the types of technical measures provided for in the aPOWM on the implementation of strategic environmental objectives**

| Type of measures foreseen in the aPOWM / impact | Assuring human health and safety | Protection of biodiversity | Supporting the achievement or maintenance of good environmental status of marine waters | Supporting the achievement of the environmental objectives for water bodies on land | Reducing vulnerability and preparing for climate change | Protection of Earth surface | Protecting and, if possible, improving landscape values | Protection of cultural heritage, including underwater archaeological monuments | Economic objectives and protection of material goods of high value |
|---|---|---|---|---|---|---|---|---|---|
| **A. measures to conserve and restore biodiversity** | 0 | +++ | +++ | + | ++ | 0 | ++ | 0 | --* |
| **B. measures to reduce eutrophication** | ++ | +++ | +++ | +++ | + | ++ | ++ | ++ | -* |
| **C. Measures to reduce invasive species** | 0 | ++ | +++ | ++ | ++ | 0 | 0 | 0 | ++ |
| **D. measures aimed at preserving and improving the integrity of the seabed** | 0 | + | +++ | 0 | 0 | ++ | +++ | ++ | 0 |
| **E. measures aimed at reducing pollutants** | ++ | ++ | +++ | ++ | 0 | 0 | ++ | + | ++ |
| **F. measures aimed at reducing the amount of waste, including micro and nanoparticles of plastics** | ++ | ++ | +++ | ++ | 0 | ++ | ++ | 0 | ++ |

**in the long term, once the overall status of the Baltic Sea is improved, a significant and positive impact on economic objectives can be predicted (note: in relation to the investments of the analyzed strategic plans and programmes directly related to the implementation of environmental regulations and standards in the measures of ports, transport, agriculture/fisheries, etc., the aPOWM measures will be of an ancillary nature)*

**KEY**

| | | |
|---|---|---|
| **When the Program serves directly to achieve the goal** | **Strengthening** | **+++** |
| **When the Program significantly supports the possibility of achieving the goal or avoids the risks associated with limiting the possibility of achieving the goal** | Favourable | ++ |
| **When the positive effects expected as a result of the implementation of the Programme clearly outweigh the possible negative effects, however, their achievement requires the fulfilment of additional conditions in the form of, for example, the use of measures to strengthen the positive effects or to minimize the negative effects** | Slightly beneficial | + |
| **When no significant effect or positive and negative effects are found, they shall be balanced** | Neutral | 0 |
| **When the negative effects of the Programme's implementation outweigh or exceed its positive impact within the scope of achieving the objective. It is possible to limit the negative impact using standard minimising measures** | Slightly negative | - |
| **When the implementation of the Programme entails unavoidable environmental costs prevailing in this respect, it limits the possibility of achieving the objective. It is possible to limit the impact, but in addition to the standard measures for a given type of project, individual mitigation measures should be indicated** | Negative | - - |
| **When the implementation of the Program entails unavoidable conflicts in the context of the possibility of achieving the goal. The need to apply compensation, i.e. the restoration of damaged environmental resources. Indicate feasible compensation solutions and the conditions for its implementation or the need to apply a derogation** | Conflict | - - - |

*Source: Own study*

The new measures identified in the aPOWM draft are aimed at strengthening existing measures aimed at improving or maintaining the existing good environmental status, including marine waters.

However, in many cases, aPOWM measures will be weakened by measures resulting from already adopted programmes and plans that provide a framework for the subsequent implementation of projects with a potential negative impact on the environment of marine waters. This applies in particular to the characteristics of: D1, D4, D5, D6, D11 for which the achievement of good water status may be delayed or its maintenance may be endangered in some sub-bodies. The planned measures, in particular large investments (e.g. the excavation of the Vistula Spit or the future operation of the offshore nuclear power plant), may also cause negative changes in the D7 index.

Due to the specificity of the marine environment, it was considered that the most important pressures that may arise as a result of the implementation of the strategy papers relate to measures such as:

- execution of the excavation through the Vistula Spit (investment resulting from the project "Multiannual program Construction of a waterway connecting the Vistula Lagoon with the Gulf of Gdańsk" – investment at the construction stage),
- construction of the first nuclear power plant in Poland (the investment resulting from the "Polish Nuclear Power Programme" – in accordance with the schedule in the adopted

Programme – obtaining a permit for the construction and commencement of the construction of the EJ1 nuclear power plant is planned for 2026),
- construction of wind farms within the Polish maritime area (the development of this type of investment results, among others, from the provisions of the "Energy Policy of Poland until 2050", for a number of offshore wind farms, decisions on environmental conditions were obtained or proceedings leading to their issuance are being conducted).

In addition, from the analyzed strategic documents, it was indicated that there may be pressures resulting from other measures such as:

- dredging of fairways,
- construction of revetments and other investments within the sea shore resulting from the Flood Risk Management Plans, the Strategic Adaptation Plan for sensitive sectors and the Sea Shore Protection Programme,
- development of infrastructure in the form of gas pipelines, including Baltic Pipe and the second NordStream line – cross-border impacts,
- modernization and development of port infrastructure and access to ports from the land and sea (in accordance with the Programme for the Development of Polish Sea Ports until 2030),
- construction of a barrage below Włocławek,
- extraction of oil and gas from deposits located in the Polish economic zone,
- the development of tourism.

At this stage, it is not clear whether and when investments will be carried out within the lines of action foreseen in the strategy papers. Nevertheless, it should be assumed that implementation or commencement of implementation will take place within the time horizon of the current aPOWM. The current construction and subsequent operation of the excavation through the Vistula Spit and the operation of the nuclear power plant after its construction may constitute the most serious source of pressure in the marine environment. The above-mentioned projects will generate pressures, which may in particular affect the following features: D1, D5, D6, D7 and D11. According to the environmental documentation concerning the construction of the Vistula Spit, the dredging works carried out during the construction of the fairway and at the stage of its operation will result in an increase in the content of slurries in the water, an increase in the turbidity of the water, the release of organic matter deposited at the bottom of the reservoir, including biogenic compounds (mainly nitrogen and phosphorus) and other pollutants (heavy metals, petroleum substances). The execution of the shipping channel will result in a permanent cut of the freshwater through the salt water wedge, which will flow from the Vistula Lagoon and the Gulf of Gdańsk. The width of the wedge will depend on the water level of the lagoon and the bay.

All these projects require an individual environmental and/or Natura 2000 impact assessment. As part of it, the impact specified at the stage of strategic assessment for the documents from which the implementation of the above-mentioned projects results will be verified or has already been selected, and appropriate minimizing or compensating measures have already been selected.

The indicated pressures related to the implementation of measures resulting from the already adopted programmes and plans providing a framework for the subsequent implementation of projects with a potential negative impact on the environment of marine waters may weaken the selected effects of the implementation of the measures proposed in the aPOWM. However, the accumulation of impacts in the sense of increasing negative impacts on the environment as a result of the implementation of aPOWM measures is not predicted.

According to the analyses carried out for the needs of aPOWM, despite the application of additional measures to be implemented in the aPOWM draft, in the current cycle until 2027, it will not be possible to achieve GES for most features. In particular, due to the distant (2036) deadline for full implementation of the measures and the long response time of the ecosystem to the reduction of loads (the time of exchange of waters in the Baltic Sea is 25 years), no significant improvement in eutrophication rates is expected by 2027. The achievements of GES in the perspective of 2050 can be expected mainly in transitional waters, where water exchange times are shorter, waters are regularly mixed to the bottom, and the influences of loads from other countries are small. In open waters, it is to be expected that even with the reduction of cargo to NIC[180] by other countries, the GES will be achieved after 2050 due to a very slow improvement in oxygen conditions.

**What changes would occur in the environment if aPOWM wasn't adopted?**

The Forecast specifies the environmental impacts that could occur if aPOWM was not adopted and implemented. In the absence of implementation of the measures resulting from the aPOWM, it can be assumed that in relation to these indicators, where the currently good condition (GES) has been achieved, it may deteriorate as a result of increasing pressure. In the case of indicators where currently no good condition has been achieved (subGES), in the absence of aPOWM implementation, this condition will at least continue or even deepen.

In particular, given the trends in biogenic loads discharged by Poland, it is to be expected that the potential of the measures already fully implemented has been fully exploited and, therefore, their maintenance alone will not be sufficient to sustain the downward trends in biogenic emissions to the Baltic Sea. The lack of aPOWM implementation precludes the achievement of GES even in the long term and will contribute to the further deterioration of habitats in transitional and coastal waters, as well as to the extension of anaerobic zones in open marine waters.

In addition, the lack of implementation of aPOWM measures will result (among others) in:

- An unbridled increase in the level of pressure from alien species in the coming decades, including in relation to alien species present in Polish inland waters and potentially invasive in brackish waters, which are only on the threshold of invasion of Polish transitional and coastal waters (these include, among others, fish of the goby family).
- reduction of the population of marine mammals in the Baltic Sea in the next decades (in particular porpoise, which is on the list of endangered HELCOM species, as a critically endangered and endangered species, due to its very small population size).
- Leaving unchanged the current monitoring system for marine habitats in POM will perpetuate the gap in knowledge about the state of coastal waters and fish habitats in these waters.
- The problem of by-catch of protected or prohibited fish species will continue and, with the use of standard fishing gear and techniques, this will not change the scale or reduce the adverse impact on these species.
- Continued fishing in transitional waters, targeting valuable species, including predatory species, in the absence of systematic restocking, will contribute to the consolidation of the adverse status of ichthyofauna, particularly in relation to the persisting pressure of eutrophication.

[180] HELCOM Baltic Sea Action Plan (BSAP) national nutrient input ceilings (NICs)

- In the absence of corrective measures, the risk of leaks of hazardous substances from wrecks and sunk chemical weapons will increase as a result of corrosion and unsealing of tanks and containers.
- In the absence of aPOWM measures in the field of active protection of bird species, the increase in anthropogenic pressures may be associated with the progressive disappearance of marine bird habitats, and thus affect the range and species composition. The increase in pressure is related to the development of offshore wind energy and the Baltic mining industry, the development of coastal tourism and increased human penetration of coastal areas.

**Can there be negative impacts outside the country?**

The measures proposed in the aPOWM may potentially be of a cross-border nature, because the marine areas covered by the programme are part of the common Baltic Sea basin, the same as other marine areas in the Baltic Sea, including those under the jurisdiction of other countries directly bordering the Polish areas. **However, taking into account the nature of the aPOWM strategic document and the nature of the measures provided for therein, it is not expected that cross-border impacts will occur.**

The aPOWM document assesses the cumulative impact resulting from the implementation of measures adopted in other strategic documents, including in the sectors of energy, water and sewage, water, agriculture and fisheries. These documents were subject to the cross-border impact assessment procedure if there was a possibility of a cross-border impact.

An additional factor minimizing the risk of significant cross-border impact of projects implemented under aPOWM is the obligation specified in Article 2, item 1 of the general provisions of the Espoo Convention: “The Parties shall take, individually or jointly, all appropriate and effective measures to prevent, reduce and control significant harmful transboundary environmental impacts resulting from the planned measures.”

**Does the implementation of aPOWM measures require the design of additional measures in the field of preventing, limiting or compensating for environmental negative impacts on the environment that may be the result of the implementation of aPOWM, in particular on the objectives and objects of protection and integrity of Natura 2000 sites and the coherence of the Natura 2000 network?**

Due to the nature of the other measures specified in the aPOWM, the lack of identification of significant negative impacts on the environment, including on the objectives and objects of protection and the integrity of Natura 2000 sites and the coherence of the Natura 2000 network, it is not necessary to propose minimizing or compensating measures. The occurrence of negative impacts, proposed as part of the aPOWM measures, can be considered only in relation to the accidental release of toxic and hazardous substances during research works within the wrecks. Therefore, the assumptions of the system for monitoring the hazards associated with the deposition in the maritime areas of the Republic of Poland of combat toxic agents and products of their disintegration, conventional weapons and residual fuel and petroleum substances in wrecks (an element of the task of the Interministerial Team for the Hazards resulting from dangerous materials remaining in the maritime areas of the Republic of Poland, covered by the modified measure BALPL-M034) should take into account the need to minimize the risk of emergencies involving the release of toxic substances during research works and minimize the impact in the event of emergencies.

In addition, with regard to measures to reduce the population of invasive species, this Forecast indicates a proposal to monitor the potential impact of measures on native fish species:

- Supplementing the monitoring proposed under action N 14 "Reduction of the population of invasive goby fish in transitional waters by biomanipulation with the use of predatory fish" (in particular, including the registration of fishing and recreational fisheries for introduced predatory fish species and annual monitoring of the occurrence of the goby and other invasive goby family fish) with monitoring of the impact on native protected fish species, which may constitute food for predatory fish species, which will be used for restocking (zander, pike, eel). Monitoring should cover the stage before the implementation of the action and the period of implementation and concern such species as: amur bitterling, loach, weatherfish. Monitoring of these fish species should be carried out in accordance with the methodology developed under the "Pilot implementation of monitoring of marine species and habitats in 2015-2018" programme.
- Including in the methodology of pilot studies within the N12 "Development of methods for reducing invasive species of crayfish" and N13 "Reduction of the population of the Chinese mitten crab in the area of the Szczecin Lagoon", monitoring the impact of the action on protected fish species, in particular amur bitterling and loach, in the case of identification during the implementation of the action of significant by-catches of representatives of these species in traps on alien species. The monitoring should cover the area in the immediate vicinity of the traps for the capture of alien species.

## 13.1 List of legal acts

1. Commission Decision (EU) 2017/848 of 17 May 2017 laying down the criteria and methodological standards relating to the good environmental status of marine waters and laying down specifications and uniform methods for monitoring and evaluation, and repealing Decision 2010/477/EU (OJ (Official Journal of EU L 125/43 of 18.5.2017),
2. Commission Decision of 1 September 2010 on methodological criteria and standards for good environmental status of marine waters (Journal (Official Journal of EU L 232/14 of 2.9.2010),
3. Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (Official Journal of EU L 327/1 of 22.12.2000),
4. Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the impact of certain plans and programmes on the environment (Journal (Official Journal of EU L 197/30 of 21.7.2001),
5. Directive 2003/35/EC of the European Parliament and of the Council of 26 May 2003 providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment and amending, as regards public participation and access to justice, Council Directives 85/337/EEC and 96/61/EC (OJ (Official Journal of EU L 156/17 of 25.6.2003),
6. Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for Community action in the field of marine environmental policy (Marine Strategy Framework Directive), (OJ (Official Journal of EU L 164/19 of 25.6.2008),
7. Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC (Journal (Official Journal of EU L 140/16 of 5.6.2009),
8. Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 establishing a framework for maritime spatial planning (Journal (Official Journal of EU L 257/135 of 28.8.2014),
9. Directive of the European Parliament and of the Council EU) 2018/2001 of 11 December 2018 on the promotion of the use of energy from renewable sources (Journal (Official Journal of EU L 328/82 of 21.12.2018.),
10. Council Directive of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources 91/676/EEC (Journal (Official Journal of EU L 375/1 of 31.12.1991),
11. Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC (Journal (Official Journal of EU L 64/37 of 4.3.2006),
12. European Convention for the Protection of the Archaeological Heritage (Revised), drawn up in La Valetta on 16 January 1992. (Journal of Laws of 1996, No. 120, item 564),
13. The UNESCO Convention on the Protection of the Underwater Cultural Heritage of 2 November 2001,
14. Convention on the Protection of the Marine Environment of the Baltic Sea Area, drawn up in Helsinki on 9 April 1992 (Journal of Laws of 2000, No. 28, item 346).
15. Convention for the Protection of the World Cultural and Natural Heritage, adopted at Paris on 16 November 1972 by the General Conference of the United Nations Educational, Scientific and Cultural Organization at its seventeenth session. (Journal of Laws 76.32.190),

16. Aarhus Convention - Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Journal of Laws 2003, No. 78, item 706).,
17. Convention of 13 November 1979 on Long-range Transboundary Air Pollution (Journal of Laws 1985 No. 60, item 311),
18. Announcement of the Marshal of the Sejm of the Republic of Poland of 25 October 2018 on the announcement of the consolidated text of the Maritime Code (Journal of Laws 2018, item 2175),
19. Regulation of the Pomeranian Voivode of 5 December 2006 on the establishment of the "Helskie Dunes" reserve (Journal of Laws of 2005, No. 113 item 954 and no. 130 item 1087),
20. Regulation of the Minister of Infrastructure of 25 February 2021 on the adoption of an update of the set of environmental objectives for marine waters (Journal of Laws 2021, item 569),
21. Regulation of the Minister of Environment of 17 February 2017 on the adoption of a set of environmental objectives for marine waters (Journal of Laws 2017, item 593),
22. Regulation of the Minister of Health of 17 January 2019 on supervision over water quality in a bathing water and a place occasionally used for bathing (Journal of Laws 2019, item 255),
23. Regulation No. 11/98 of the Governor of Gdańsk of September 3, 1998 amending Regulation No. 5/94 of November 8, 1994 on the designation of protected landscape areas, defining the boundaries of landscape parks and creating buffer strips around them and introducing prohibitions and restrictions applicable therein for the area of the "Sobieszewska Island" (Official Gazette of 1998. No. 59, item 294).
24. Regulation No. 14/2002 of the West Pomeranian Voivode of 9 July 2002 (Laws 2002 No. 52, item 1127),
25. Regulation No. 325 of the Warmia and Mazury Province Governor of 13 December 2001 on recognition as a nature reserve "Ujście Nogatu" (Journal Official Gazette z 2001 r. No. 142, item 2040,
26. Regulation No. 5/94 of 8 November 1994 on the delimitation of landscape protection areas, the delimitation of landscape parks and the delimitation of buffer strips around them and the introduction of prohibitions and restrictions in force therein for the "Seaside" area (Journal of Laws 1998 No. 59, item 294),
27. Regulation No. 7/2003 of the West Pomeranian Voivode of 10 May 2003 (Official Journal of of Zachodniopomorskie West of 2003. No. 39, item 611),
28. Regulation of the Council of Ministers of 11 December 2017 on the adoption of the National Programme for the Protection of Marine Waters (Journal of Laws of 2017, item 2469).
29. Regulation of the Council of Ministers of 12 February 2020 on the adoption of the "Programme of measures aimed at reducing the pollution of waters with nitrates from agricultural sources and preventing further pollution" (Journal of Laws of 2020, item 243),
30. Regulation of the Council of Ministers of 14 April 2021 on the adoption of the spatial development plan for internal marine waters, territorial sea and the exclusive economic zone in the scale of 1:200 000 (Journal of Laws 2021, item 935),
31. Regulation of the Council of Ministers of 23 September 1966 on the establishment of the Słowiński National Park (Journal of Laws of 1966 No. 42, item 254),
32. Regulation of the Council of Ministers of 3 March 1960 on the establishment of the Wolin National Park (Journal of Laws 1960 No. 14, item 79).,
33. Treaty of Lisbon amending the Treaty on European Union and the Treaty establishing the European Community, drawn up in Lisbon on 13 December 2007 (Journal of Laws of 2009, No. 203, item 1569)

34. Resolution No. 100 of the Council of Ministers of 17 September 2019 on the adoption of the program entitled "Programme for the development of Polish seaports until 2030",
35. Resolution No. 8 of the Council of Ministers of 18 January 2019 on the consent to the submission to the European Commission of the preliminary assessment of the state of the marine waters environment together with the draft update of the set of properties typical of the good state of the marine waters environment (M.P. of 2019, item 230).
36. Resolution No. VI/51/85 WRN in Elbląg of 26 April 1985 on the establishment of landscape parks and protected landscape area in the Elbląg province, (Journal (Official Journal of of Elbląskie from 1985. No. 10, item 60),
37. Resolution No. X/42/81 of the Provincial National Council in Słupsk of 8 December 1981 on the establishment of the "Słupia Valley" Landscape Park and protected landscape areas "Coastal Belt to the East of Ustka" (Journal of Laws 1981 No. 9, item 23),
38. Resolution No. X/46/75 of the Provincial National Council in Koszalin of 17 November 1975 on the protected landscape zones "Koszalin Seaside Belt" (Journal (Official Journal of WRN 1975 No. 9 item 49),
39. Resolution No. X/46/75 of the Provincial National Council in Koszalin of 17 November 1975 on the protected landscape zones for the "Koszalin Seaside Belt" area (Journal (Official Journal of WRN in Koszalin No. 9, item 49),
40. Resolution of the Hel Town Council No XXVI/155/08 of 29 October 2008 (Journal (Official Journal of of Pom. z 2008 r. No. 136, item 3453,
41. Resolution of the Council of Ministers No. 170 of 15 November 2018 on consenting to the submission to the European Commission of a draft update of the set of environmental objectives for marine waters. (M.P. of 2019, item 173).
42. Resolution No IX/49/78 of the Provincial National Council in Gdańsk of 5 January 1978 (Journal WRN in Gdańsk 1978 r. No. 1, item 3),
43. Act of 16 April 2004 on nature protection (consolidated text Journal of Laws of 2020, item 1378),
44. Act of 18 September 2001 Maritime Code (consolidated text Journal of Laws of 2018, item 2175).
45. Act of 20 December 1996 on seaports and harbours (consolidated text Journal of Laws of 2021, item 491)
46. The Law of 21 March 1991 on Maritime Areas of the Republic of Poland and Maritime Administration (consolidated text Journal of Laws of 2021, item 234),
47. Act of 23 July 2003 on protection and care of monuments (consolidated text Journal of Laws of 2021, item 710),
48. The Environmental Protection Law Act of 27/04/2001 (i.e. Journal of Laws of 2021, items 802, 868).
49. Act of 27 March 2003 on landscape planning and development (consolidated text Journal of Laws of 2021, item 741, as amended, item 922),
50. The Act of 28 March 2003 on the establishment of a multiannual programme "Programme for the Protection of the Marine Coast" (Journal of Laws of 2016, item 678),
51. Act of 3 October 2008 on access to information on the environment and its protection, public participation in environment protection and environmental impact assessments (consolidated text Journal of Journal of Laws of 2021, item 247, as amended)
52. Act of 4 January 2013 amending the Water Law and certain other Acts (Journal of Laws item 165),

53. The Act of 9 June 2011 Geological and Mining Law (consolidated text Journal of Laws of 2021, item 914)
54. Water Law Act of 20 July 2017 (consolidated text Journal of U. of 2021, item 624, as amended, item 784).,
55. Ordinance of the Minister of Forestry and Wood Industry of 5 November 1959 on the establishment of the reserve "Ptasi Raj" (Monitor Polski of 1959. No. 97, item 525).,
56. Ordinance of the Minister of Environment, Natural Resources and Forestry of 9 October 1991 on recognition as nature reserves "Mewia Łacha" (Monitor Polski of 1991., No. 38, item 273),
57. Ordinance of the Minister of Forestry and Wood Industry of 10 November 1976 on the establishment of the "Mierzeja Sarbska" landscape reserve (Monitor Polski No. 42, item 206),
58. Ordinance of the Minister of Forestry and Wood Industry of 11 April 1985 on recognizing "Białodrzew Kopicki" (Monitor Polski of 1985. No. 7, item 60),
59. Ordinance of the Minister of Environment, Natural Resources and Forestry of 9 October 1991 on recognition as nature reserves of the "Gulf of Elbląg" (M.P. of 1991. No. 38, item 273),
60. Ordinance of the Regional Director for Environmental Protection in Gdańsk of 26 April 2018 on the "Beka" nature reserve (Journal of Laws of 2018, item 2025),
61. Ordinance of the Pomorskie Voivode No. 162/99 of 16 November 1999 (Journal (Official Journal of of Pom. z 1999 No 121 item 1072)
62. Ordinance of the Voivode of the Pomeranian province of 23 November 2000 on the establishment of the "Mechelińskie Łąki" nature reserve (Journal of Laws No. 109, item 714).
63. Ordinance of the Voivode of Pomeranian province of 29 July 1938 on the protection of nature creations in the area of Kępa Redłowska in Gdynia (Journal of Laws 1938 No. 23, item 271),
64. Ordinance of the Voivode of Pomeranian province of 30 November 1999 on the establishment of the "Słone Łąki" reserve (Journal of Pomeranian province no. 131, item 1129).

## 13.2 Literature


1. Update of the Marine Waters Monitoring Programme (Report to the European Commission), GIOŚ, Warsaw 2020
2. Update of the preliminary assessment of the status of marine water environment, Warsaw 2018
3. Atlas of the Habitats of the Seabed of Polish Marine Areas, Gdynia 2009
4. B. Wiśniewski, T. Wolski Catalogue of flood and storm lows on the Polish Baltic coast, 2008
5. Baltic Sea Environment Proceedings No. 122 Ecosystem Health of the Baltic Sea 2003-2007 HELCOM Initial Holistic Assessment
6. Baltic Sea Environment Proceedings No. 124A Towards an ecologically coherent network of well-managed Marine Protected Areas
7. Baltic Sea Management – Nature Conservation and Sustainable Development of the Ecosystem through Spatial Planning
8. CBDG Central Geological Database
9. Ewelina Mruk, Tomasz A. Łabuz, Environmental protection of coastal dunes on the Polish coast – areas, forms and effects, Lublin, 2020
10. Fabisiak J., Ecological hazards of the Baltic Sea related to chemical pollution – hydrocarbons, Scientific Journals of the Naval Academy, 2008
11. Maritime Economy 2014, Statistical Office in Szczecin
12. Maritime economy in Poland in 2019, GUS
13. Gójska A. ed. 2012, Grey Seal Protection Programme – draft, WWF Poland Foundation
14. Guidance for assessments under Article 8 of the Marine Strategy Framework Directive on Integration of assessment results, February 2017 (DG Environment, Document ref: R.2733)
15. Håkanson L., 1991, Physical and Geographical Characteristics of the Baltic Sea Basin, Ed. Baltic Sea Environment, 1-37
16. Schedule constituting Annex 1 to the Polish Nuclear Energy Programme (M.P. of 2020, item 946)
17. HELCOM 2009 Biodiversity in the Baltic Sea – An integrated thematic assessment on biodiversity and nature conservation in the Baltic Sea: Executive Summary. Balt. Sea Environ. Proc. No. 116A.,
18. HELCOM 2017d Implementation of the Baltic Sea Action Plan, Activity Report 2017 — BESP 154
19. HELCOM, 2010. Ecosystem Health of the Baltic Sea 2003–2007: Helcom Initial Holistic Assessment. Balt. Sea Environ. Proc. No. 122]
20. J.A. Jania, Z. Zwoliński Extreme meteorological, hydrological and geomorphological events in Poland, 2011
21. Cliffs on the Baltic coast, Habitat and species protection guides, Marine and coastal habitats, coastal and inland salt marshes and dunes, Volume I, GDOŚ, 2016
22. Communication 02/2021 of the interdisciplinary advisory team on the climate crisis at the President of the Polish Academy of Sciences on climate change and sea level rise, 2021.
23. Konik M., Kowalewski M., Bradtke K., Darecki M. 2018. The operational method of filling information gaps in satellite imagery using numerical models
24. Kowalewski M., Kowalewska-Kalkowska H., 2017, Sensitivity of the Baltic Sea level prediction to spatial model resolution, Journal of Marine Systems, 173, 101–113,
25. National Strategy for Regional Development 2030, Warsaw 2019
26. National Marine Waters Protection Programme, Warsaw 2016

27. The map developed by prof. H. Lorenc, IMGW on the basis of measurement data from the years 1971-2000., source: Ministry of Environment, "Pilot implementation programme for the renewable energy development strategy in the scope of increasing the production of electricity from renewable sources, with particular emphasis on wind energy for the years 2003-2005.
28. Marszewska L., Dumnicka E., Normant-Saremba M., 2017. New data on benthic Naididae (Annelida, Clitellata) in Polish brackish waters. Oceanology 59 (1) 81-84
29. Materials from the second update of the Water Management Plans as of 2021
30. Miętus M., 1994, Vector of geostrophic wind in the Baltic Sea region as an index of local circulation and its relationship to hydro-meteorological characteristics along the Polish coast, In: R. Heion (ed.), Proceedings of the European Workshop on Climate Variations, Majvik, Finland, 15-18 May 1994. SILMU, 8-23
31. Miętus M., Filipiak J., Owczarek M., 2004, Climate of the Southern Baltic Coast. The current state and perspectives of changes, in: J. Cyberski (ed.), The Environment of the Polish Southern Baltic Zone – present condition and anticipated changes in the eve of European integration. GTN, 11-44
32. Miętus M., von Storch H., 1997, Reconstruction of the wave climate in the Proper Baltic Basin, April 1947-March 1988, GKSS, External Report, 97/E/28, 30
33. Mölter et al., 2016, Review on the Projections of Future Storminess over the North Atlantic European Region, Atmosphere, 7(60),
34. Monitoring of Marine Species and Habitats in 2016-2018, Biblioteka Monitoringu Środowiska, Warsaw 2018
35. Maritime Fisheries Institute PIB, Maritime Fisheries Economy in the years 2015-2016, Gdynia 2017
36. Marine Natura 2000 sites, GDOŚ
37. Environmental Impact Assessment of the project involving exploration for and exploration for oil and natural gas deposits within the limits of the "Gołdap" concession, Warsaw April 2012.
38. Assessment of the status of the environment of the Polish maritime areas of the Baltic Sea on the basis of monitoring data from 2019 against the background of the decade 2009-2018". GIOŚ, Warsaw, 2020,
39. Assessment of the status of the environment of the Polish maritime areas of the Baltic Sea on the basis of monitoring data from 2018 against the background of the 2008-2017 decade ",GIOŚ, Warsaw, 2019
40. Assessment of the impact of current and future climate change on the Polish coast and the Baltic Sea ecosystem, 2014
41. Ojaveer, H., S. Olenin, A. Narscius, A.-B. Florin, E. Ezhova, S. Gollasch, K.R. Jensen, M. Lehtiniemi, D. Minchin, M. Normant-Saremba & S. Strake, 2016, Dynamics of biological invasions and pathways over time: a case study of a temperate coastal sea. Biological Invasions 19:799-813.
42. Plan for the spatial development of internal marine waters, the territorial sea and the exclusive economic zone, 2021
43. State Environmental Policy 2030, Warsaw 2019
44. Guide on mainstreaming climate change and biodiversity in the Strategic Environmental Assessment
45. Forecast of the environmental impact of the draft plan for the spatial development of internal marine waters, the territorial sea and the exclusive economic zone on a scale of 1: 200 000, 2021

46. Forecast of the impact on the environment of the draft plan for the spatial development of internal marine waters, the territorial sea and the exclusive economic zone (Gdańsk, 2018)
47. Forecast of the impact on the environment of the draft plan for the spatial development of internal marine waters, the territorial sea and the exclusive economic zone 2019.
48. Forecast of the environmental impact of the project of the Programme for the Development of Polish Seaports until 2030
49. Forecast of the environmental impact of the Pomeranian province Development Strategy 2030 draft, Gdańsk 2020
50. Counteracting the risks resulting from the deposition of hazardous materials on the Baltic Sea bottom, NIK, Delegation in Gdańsk
51. The future of offshore wind energy in Poland. PWEA report. Polish Wind Energy Association, May 2019.
52. Report on the state of the Warmian-Masurian province in 2019, Olsztyn 2020
53. Report on the review and update of the preliminary flood risk assessment, 2018
54. The role of geological processes in shaping the Baltic environment.
55. Rutkowski, P., Wajsowicz, T., Maciejewska-Rutkowska, I., Nowiński, M. (2016). Forest soils of the Gardieńsko-Łebska Spit (Słowiński National Park) against the background of selected areas of Polish inland dunes in the context of natural forest regeneration
56. Schwarzer K., Bohling B., Heinrich C. (2014): Submarine hard bottom substrates in the western Baltic Sea – human impact versus natural development. Journal of Coastal Research SI 70: 145–150;
57. Ways of protecting the sea shores and their impact on the natural environment of the Polish Baltic coast, 2013 WWF
58. Sanitary Condition of the Country, GIS 2019
59. Study of Conditions for Spatial Development of Polish Maritime Areas
60. Study of Conditions for Spatial Development of Polish Maritime Areas with spatial analyses", Maritime Institute in Gdańsk, Independent Laboratory of Spatial Policy, Gdańsk, February 2015.
61. Subotowicz W. 1984. Cliffsides. [in:] B. Augustowski (ed.), Pobrzeże Pomorskie. Ossolineum,Gdańsk, pp. 121–149.
62. Sztobryn M., Stigge H. J.(ed.): Stormfalls along the southern Baltic (western and central parts). Institute of Meteorology and Water Management, Warsaw
63. Tomasz Łabuz "Ways to protect the sea shores and their impact on the natural environment of the Polish Baltic coast. Report", WWF, 2013
64. Uścinowicz S., Geochemistry of surface sediments of the Baltic Sea, National Geological Survey, 2011
65. Wibig J., Jakusik E. (ed.)"Climatic and oceanographic conditions in Poland and the Southern Baltic expected changes and guidelines for the development of adaptation strategies in the national economy", Institute of Meteorology and Water Management, National Research Institute, Warsaw 2012
66. Wróblewski A., 1993, Analysis and forecast of long-term sea along the Polish Baltic Sea coast. P. I.Annual sea level Maxima, Oceanology, 33, 65-85
67. Preliminary assessment of the status of marine waters environment of the Polish Baltic Sea zone. Report to the European Commission, Material based on the work entitled: "Development of a preliminary environmental assessment of the Polish economic zone of the Baltic Sea in accordance with the provisions of the Maritime Strategy Framework Directive", team led by Włodzimierz Krzymiński, GIOŚ

68. Updated methodology for Initial Flood Risk Assessment, June 2018
69. Zalewska T., Jakusik E., Meteorological and hydrological conditions and characteristics of physical, chemical and biological elements of the southern Baltic Sea in 2018, Institute of Meteorology and Water Management, National Research Institute, Warsaw 2020
70. A set of properties typical for the good status of the Marine Waters Environment, Report to the European Commission, GIS, Warsaw 2014,


### Websites:


1. https://eur-lex.europa.eu/legal-content/PL/TXT/HTML/?uri=LEGISSUM:l28089&from=EN
2. https://natura2000.gdos.gov.pl/tom-1
3. https://natura2000.gdos.gov.pl/files/artykuly/52912/1110_Piaszczyste_lawice_podmorskie.pdf
4. http://morskiesiedliska.gios.gov.pl/pl/o-programie/19-siedliska-powierzchnie-monitoringowe/48-piaszczyste-lawice-podmorskie-1110
5. https://natura2000.gdos.gov.pl/files/artykuly/52912/1170_Skaliste_i_kamieniste_dno_morskie_rafy.pdf
6. Komunikat_02_2021_w_sprawie_wzrostu_poziomu_morza_2001_01_26_FINAL.pdf (pan.pl)
7. https://www.ipcc.ch/srocc/chapter/summary-for-policymakers/
8. https://powietrze.gios.gov.pl/pjp/content/regional_background_pollution_emep
9. https://webdab01.umweltbundesamt.at/cgi-bin/wedb2_off_choose_pollutants_trend.pl?cgiproxy_skip=1
10. http://www.iopan.pl/baltyk2015/materialy/StreszczeniaWykladowKonferencyjnych/15_RolaProcesowGeologicznych.pdf
11. https://naszbaltyk.pl/cechy-morfometryczne/
12. http://balance-eu.org/
13. http://www.2wrecks.nmm.pl/czym-jest-morski-krajobraz-kulturowy
14. CBDG (pgi.gov.pl)
15. Wrecks studied by NMM - Archaeology - National Maritime Museum in Gdańsk
16. http://metadata.helcom.fi/geonetwork/srv/eng/catalog.search#/metadata/98cc1b96-3469-46e1-8247-7ff924a9ef27
17. http://maps.helcom.fi/website/Biodiversity/index.html
18. https://www.nid.pl/pl/Informacje_ogolne/Ochrona_dziedzictwa_kulturowego/
19. https://MSFD.gios.gov.pl/images/projekt-aktualizacji-PMWM.pdf
20. http://maps.helcom.fi/website/mapservice/index.html
21. https://helcom.fi/baltic-sea-action-plan/follow-up-of-helcom-agreements/
22. https://helcom.fi/baltic-sea-action-plan/bsap-update-2021
23. https://circabc.europa.eu/sd/a/60728950-8791-45a2-9891-e7defdf785c7/GD12%20-%20Guidance%20on%20Art%2013-14-18%20Reporting_post-consultation.pdf
24. https://sdr.gdos.gov.pl/Documents/bio-clia_SEA_2015.pdf
25. http://www.helcom.fi/Lists/Publications/BSEP122.pdf
26. http://mapy.isok.gov.pl/
27. http://dx.doi.org/10.1016/j.jmarsys.2017.05.001
28. https://seaplanspace.ug.edu.pl/wp-content/uploads/2019/11/SEAPLANSPACE-morkie-obszary-chronione.pdfMorskie obszary Natura 2000, GDOŚ

# 14 Authors of the Environmental Impact Forecast

| Surname and first name | Function |
|---|---|
| Krzysztof Waldemar | |
| Kwiatkowski Piotr | |
| Perz Adam | |
| Pędziwiatr Katarzyna | |
| Sadowska Urszula | |
| Topolińska Magdalena | |
| Tyblewska Michalina | |
| Wilanowska Alicja | Team Manager |