KESKKONNAMINISTEERIUM

Estonian Marine Strategy's Programme of Measures 2022-2027

Strategic Environmental Assessment (SEA) Report

(26.08.2022)

Author of the strategic planning document: Estonian Ministry of the Environment

SEA conducted by: Private company Alkranel

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Introduction

Directive 2001/42/EC of the European Parliament and of the Council „On the Assessment of the Effects of Certain Plans and Programmes on the Environment“ and national Environmental Impact Assessment and Environmental Management System Act (henceforth EIA&EMSA) provide for an obligation to conduct environmental impact assessment while preparing strategic planning documents.

Minister of the Environment approved with the Directive No 1-1/21/390 (15.09.2021) preparing „Estonian Marine Strategy's Programme of Measures“, and initiation of strategic environmental impact assessment (SEA) for it (Annex 1). Strategic environmental impact assessment for Estonian Marine Strategy's Programme of Measures 2022-2027 (henceforth *programme of measures*) has been initiated based on § 33 section 1 point 1 and § 35 section 2 of Environmental Impact Assessment and Environmental Management System Act, without justifying the need for it since the programme of measures includes the fields of fisheries, waste management and water management.

Purposes of this SEA are:

1) to identify, describe and assess the significant strategic environmental impact that the implementation of the measures planned in the programme of measures may have and, if necessary, propose measures to mitigate and/or prevent negative environmental impact or enhance the positive impact;
2) to give an assessment of the internal consistency of the measures developed in the programme of measures and its relations to national and international environmental goals;
3) description of the activities necessary to monitor the significant environmental impact accompanying the implementation of the measures specified in the programme of measures, if the possibility of significant environmental impact is identified during the strategic environmental impact assessment;
4) to involve various interest groups in the preparation of the SEA and receiving feedback from them, which in turn should be taken into account in the preparation of the SEA programme and report.

The scope of SEA includes strategic environmental impact assessment of implementing the new measures set out in the programme of measures. Since SEA is prepared for a strategic planning document, the impacts will be assessed at a more general strategic level during the SEA. SEA will be conducted according to Environmental Impact Assessment and Environmental Management System Act.

The basis for the preparation of the SEA report is the SEA programme declared as compliant (Annex 2).

The organizer and approver of Marine Strategy's programme of measures is Estonian Ministry of the Environment. The programme of measures is being prepared by a private company Estonian Environmental Research Centre (*Eesti Keskkonnauuringute Keskus*). SEA is conducted by a private company Alkranel:

- Alar Noorvee, private company Alkranel, SEA leading expert;
- Tanel Esperk, private company Alkranel, environmental expert;
- Elar Põldvere, private company Alkranel, environmental specialist;

- Paula Nikolajeva, private company Alkranel, environmental consultant;
- Terje Liblik**,** private company Alkranel, environmental consultant.

List of institutions and persons expected to be affected by and interested in preparing the strategic planning document is provided in SEA programme (Annex 2).

1. Object of the SEA – programme of measures and its list of new measures

The object of the strategic environmental impact assessment is Estonian Marine Strategy's programme of measures 2022-2027. The Marine Strategy applies to the entire Estonian maritime area and its objectives are as follows (Regulation No 46 of the Minister of Environment, 25.09.2020):

- to protect and preserve the marine environment, prevent deterioration of its status or, where possible, restore marine ecosystems in areas where they have been damaged;
- to prevent and reduce discharges into the marine environment in order to gradually reduce its pollution and ensure that discharges neither significantly impact nor threaten marine biodiversity, marine ecosystems, human health or legitimate uses of the sea.

Preparing the programme of measures and its strategic environmental impact assessment was initiated by the Directive No 1-1/21/390 (15.09.2021) of the Minister of Environment (Annex 1).

The purpose of the programme of measures is to update Estonian Marine Strategy's programme of measures approved by the Government of the Republic in 2017, in order to ensure the fulfilment of the established environmental targets (table 1.1) and thereby achieve or maintain the good environmental status (henceforth GES) of the Estonian maritime area.

Table 1.1. Revised targets of the Marine Strategy. Approved by the Directive No 1--2/19/295 (10.04.2019) of the Minister of Environment.

No	CODE (IF THERE IS ONE) AND TARGET
1. Cross-sectoral targets of the Marine Strategy	
1.1	BALEE-T38. 75% of the indicators of primary pressure factors indicate good status and 25% indicate an improvement trend.
1.2	BALEE-T39. Marine Strategy's dataset is available as spatial data.
1.3	BALEE-T40. Spatial planning of the maritime area, which takes into account the ecological approach, has been developed and approved.
1.4	BALEED-T41. Methodology(s) for assessing climate change and anthropogenic burden and their combined impact on marine ecosystems developed in regional cooperation.
1.5	BALEED-T42. The sustainable use of the marine environment is supported by innovative technologies and research.
1.6	BALEE-T43. The entire sea area is covered by data for the MSRD primary assessment criteria and HELCOM core indicators.
2. The impact of the most important anthropogenic pressure factors on the marine environment, and marine uses and human activities in the marine environment or their impact on the marine environment, and targets related to them.	
2.1	No new alien species are added through primary invasion, including ballast water from ships

No	CODE (IF THERE IS ONE) AND TARGET
2.2	Of the stocks of economically important fish species in Estonia, the proportion of fish stocks having good status is 50% (2021).
2.3	Reducing anthropogenic nutrient load from Estonia in accordance with what was agreed on in HELCOM (BSAP, CART).
2.4	Gradual reduction of anthropogenic burdens of hazardous substances (HELCOM core indicators) important for the Estonian maritime area.
2.5	BALEE-T31. Estonia's marine pollution control capability is at the agreed level in the Baltic Sea region.
2.6	Impact of marine litter (macro- and micro-litter), 30% reduction in the amount of marine litter (including abandoned fishing gear) compared to the base level (2017) (within the 6-year assessment period).
2.7	BALEE-T33. Reducing the environmental impact of direct discharges of rainwater flowing into the sea (point pollution sources).
2.8	BALEE-T30. Shoreline's environmental pressure index indicates an improvement trend, the situation does not deteriorate in water bodies having very good status.
2.9	The areal pressure index indicates an improvement trend, the situation does not deteriorate in assessment units having very good status.
2.10	Regarding industrial fish stocks, fishing is carried out within biologically safe limits and in a sustainable manner.
2.11	BALEE-T34. Developing environmentally friendly marine aquaculture and infrastructure for it.
2.12	BALEE-T32. Reducing environmental disturbance resulting from loading and unloading operations in ports.
2.13	BALEE-T35. Ships visiting Estonian ports meet environmental requirements arising from international conventions .
2.14	BALEE-T36. Developing environmentally sustainable tourism.
2.15	BALEE-T37. Increasing the capacity of marine research, promoting maritime education.

Based on the results of the maritime area assessment, the good environmental status of the maritime area is defined as a set of environmental status criteria and parameters, based on 11 qualitative descriptors (table 1.2). (RT I, 29.09.2020, 11)

Table 1.2. Qualitative descriptors for determining good environmental status (GES) (RT I, 29.09.2020, 11).

Code	GES descriptor	Indicator
D1	Biodiversity	Biodiversity is preserved, the quality and availability of habitats and the distribution and abundance of species are consistent with the prevailing physiographic, geographical and climatic conditions.
D2	Alien species	Alien species introduced as a result of human activities remain at a level that does not have a negative impact on the ecosystem.
D3	Commercial fish and other species	Populations of all commercial fish, crustaceans and mussels are within safe biological limits, the age and size distribution of the population indicates good status of the stocks.
D4	Food web	All known elements of the marine food web are at normal levels of abundance and diversity, which ensures the long-term abundance of species and the preservation of their full reproductive capacity.
D5	Eutrophication	The negative impacts of anthropogenic eutrophication, such as loss of biodiversity, ecosystem degradation,

Code	GES descriptor	Indicator
		dangerous algal blooms and oxygen deficiency of benthic water layers have been minimized.
D6	Seabed integrity	The integrity of the seabed is at a level that ensures the functioning and structure of the ecosystem, especially that the seabed ecosystem is not damaged.
D7	Hydrographic conditions	Permanent change in hydrographic conditions will not have negative impact on marine ecosystems.
D8	Pollutant content	Pollutant concentrations are at levels not giving rise to pollution effects.
D9	Pollutants in seafood	Pollutant concentrations in fish and other seafood intended for human consumption do not exceed levels established by legislation or other relevant standards.
D10	Marine litter	The characteristics and quantities of marine litter do not harm the coastal or marine environment.
D11	Energy	The discharge of energy into the environment, including underwater noise, is at a level that does not harm the marine environment.

The interim report on the implementation of the Estonian Marine Strategy’s programme of measures was prepared in 2019, according to which two measures of the new measures established by the Estonian Marine Strategy’s programme of measures approved in 2017 had been implemented by October 2019: Measure No. 8 – Implementation of the electronic system for reporting fishing data and Measure No. 14 – Reporting the problem of marine litter. By the planned deadline, according to the interim report, measure No. 4 will be implemented – ratification of the International Ballast Water Management Convention and participation in the regional information system. There are delays in the implementation of the rest of the 13 measures, the main reasons for which are the lack of data or knowledge and the lack or updating of national implementation instruments.

According to Article 17 of the EU Marine Strategy Framework Directive, Member States ensure that the elements of their marine strategies are updated every six years. The updated programme of measures must be implemented in 2022.

The proposed measures are divided into four types according to their degree of implementation:

- 1.a – Measures necessary to achieve and maintain GES, which have already been adopted and implemented under other laws and policies;
- 1.b – Measures necessary to achieve and maintain GES, which have been adopted under other policies, but have not yet been implemented or fully implemented;
- 2.a – additional measures to achieve GES, based on existing other EU legislation and international agreements, but the requirements need to be made stricter, specified, etc;
- 2.b – completely new measures to achieve GES that are not based on existing EU legislation or international agreements.

In terms of content, the measures are also divided into four types:

- technical;
- legislative;
- economic (subsidies, fees etc);
- policy measures (voluntary agreements, communication strategies, awareness raising, campaigns, trainings, etc).

The initial list of measures discussed and described by experts is presented in table 3.1. Codes of the measures are provisional and will be assigned to particular measures after final approval of the list. **Compared to the SEA programme, the list of measures has changed somewhat during the preparation of the programme of measures. The changes are due to the circumstances revealed during the work process of the programme of measures, including consultations with the respective relevant institutions**.

Table 1.3. Preliminary list of measures of Estonian Marine Strategy's programme of measures and environmental targets corresponding to each measure (based on table 1.1).

Code (provisional)	Name of the measure	GES descriptor	Environmental target
BALEE-M017	Improving the effectiveness of the existing network of marine protected areas	D1, D4, D6	1.3; 2.14
BALEE-M020	Improving the condition of fish spawning areas and migration routes, stimulating populations and updating protection measures	D1, D3, D4	2.2; 2.10
BALEE-M021	Implementing technologies to reduce and prevent bycatch in order to protect species in the Baltic Sea	D1, D3	1.5; 2.2; 2.10
BALEE-M026	Reducing fishing efforts to GES level and development and implementation of the corresponding concept	D3	2.2; 2.10
BALEE-M032	Developing compensatory measures for disturbing or destroying the integrity of the seabed	D6	1.4; 2.9; 2.11
BALEE-M035	Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects	D6, D1, D2, D3, D4, D5, D7	1.4; 1.5, 2.3; 2.4; 2.6, 2.11
BALEE-M036	Construction of the openings of the road dam of Väike Väin (Väike Strait) to improve the water exchange and to open the strait as a fish migration route	D7, D1, D3	2.2; 2.9; 2.14
BALEE-M039	Enhancing the management of environmentally hazardous pharmaceutical waste and raising awareness on more environmentally friendly disposal of pharmaceuticals	D8, D9	2.4
BALEE-M040	Increasing pollution control capacity through the design and construction of a new pollution control (oil and other hazardous chemicals) buoy and research vessel	D8 jt	1.5; 2.4; 2.5
BALEE-M046	Litter collection campaigns	D10, D6	2.6
BALEE-M047	Environmentally friendly organization of waste management on coasts and beaches with flood risk	D10	2.6; 2.14
BALEE-M051	Treatment of precipitation water and wastewater to reduce the amounts of microplastics	D10, D8	1.4; 2.6; 2.7
BALEE-M053	Reducing the formation of tire debris	D10	2.6

Code (provisional)	Name of the measure	GES descriptor	Environmental target
BALEE-M055	Implementation of the HELCOM marine noise plan and necessary regulations in Estonia	D11, D1	1.4; 1.5; 2.11; 2.12; 2.14
BALEE-M056	Management of marine datasets, improvement of data exchange and availability of environmental data, including development of relevant services	D1-D11	1.2; 1.6;
BALEE-M057	Updating the regulations	D1-D11	1.1-2.15
BALEE-M058	Participation in international cooperation in the field of marine environmental protection	D1-D11	1.1-2.15
BALEE-M059	Informing and involving interest groups in marine environment protection activities	D1-D11	1.1-2.15
BALEE-M076	Changing hydromorphological conditions for local environmental improvement	D5, D7	2.9
BALEE-M079	Regarding ships, ensuring environmental safety at sea	D8, D5, D2, D10	2.4
BALEE-M002-02	Avoiding the increase in the load of hazardous substances in aquaculture	D8, D9	2.4; 2.11

A more detailed description of the measures is discussed in chapter 5.1 of the SEA report.

2. Overview of the impacted environment

The assessment of the environmental status of Estonian maritime area was last updated in 2018 (Ministry of the Environment, 2019a). In order to provide an overview of the current situation, the last assessment has been used as a basis, and if necessary, it has been supplemented with information from the other sources.

2.1 Natural environment

The maritime area under jurisdiction of the Republic of Estonia is altogether 36 622 km^2, of which 14 487 km^2 is coastal sea, about 10 714 km^2 is territorial sea and 11 421 km^2 falls within the economic zone. The length of Estonian maritime area's shoreline is about 4015 km. Estonian maritime area is situated in the northeastern part of the Baltic Sea and consists of parts of many major basins in the Baltic Sea, that are quite different in terms of natural conditions: the Gulf of Finland, open part of the West Estonian islands and the Gulf of Riga, (incl Väinameri Sea, which is situated in the West Estonian archipelago).

The coastal sea is divided into 16 coastal water bodies: Narva-Kunda bay coastal water, Eru-Käsmu coastal bay water, Hara and Kolga bay coastal water, Muuga-Tallinn-Kakumäe bay coastal water, Pakri bay coastal water, Hiiu shoal coastal water, Haapsalu bay coastal water, Matsalu bay coastal water, Soela strait coastal water, Kihelkonna bay coastal water, Pärnu Bay coastal water, Kassari-Õunaku bay coastal water, Väinameri coastal water, coastal water of the northwestern part of the Gulf of Riga, coastal water of the northeastern part of the Gulf of Riga and coastal water of the central part of the Gulf of Riga (Figure 2.1). All coastal water bodies in Estonia have bad status (Estonian Environment Agency, 2022). According to the Regulation No 19 (16.04.2020) of the Minister of the Environment, coastal water bodies are divided into 6 different type of water bodies according to their certain natural characteristics (RT I, 21.04.2020, 61).

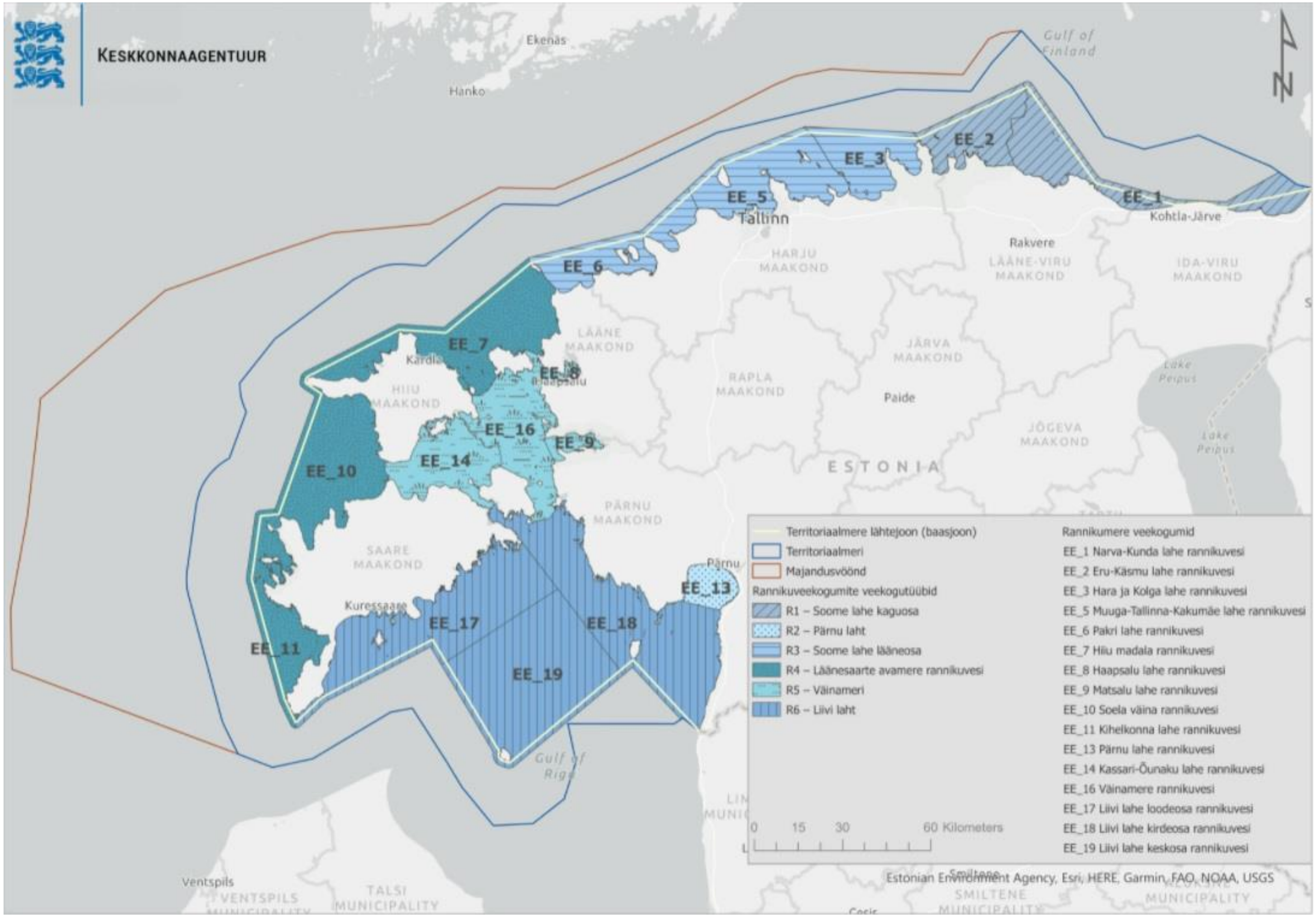

Figure 2.1. Division of Estonian maritime area (Estonian Environment Agency, 2022).

Territoriaalmere lähtejoon (baasjoon) – baseline of the territorial sea (baseline); *territoriaalmeri* – territorial sea; *majandusvöönd* – economic zone. *Rannikuveekogumite veekogutüübid* – coastal water bodies' types of water bodies: R1 – *Soome lahe kaguosa* – the southeastern part of the Gulf of Finland; R2 – *Pärnu laht* – Pärnu Bay; R3 – *Soome lahe lääneosa* – the western part of the Gulf of Finland; R4 – *Läänesaarte avamere rannikuvesi* – coastal water of the open part of West Estonian islands; R5 – *Väinameri* – Väinameri Sea; R6 – *Liivi laht* – the Gulf of Riga.

Rannikumere veekogumid – coastal water bodies: EE_1 *Narva-Kunda lahe rannikuvesi* – Narva-Kunda bay coastal water; EE_2 *Eru-Käsmu lahe rannikuvesi* – Eru-Käsmu coastal water; EE_3 *Hara ja Kolga lahe rannikuvesi* – Hara and Kolga bay coastal water; EE_5 *Muuga-Tallinna-Kakumäe lahe rannikuvesi* – Muuga-Tallinn-Kakumäe bay coastal water; EE_6 *Pakri lahe rannikuvesi* – Pakri bay coastal water; EE_7 *Hiiu madala rannikuvesi* – Hiiu shoal coastal water; EE_8 *Haapsalu lahe rannikuvesi* – Haapsalu bay coastal water; EE_9 *Matsalu lahe rannikuvesi* – Matsalu bay coastal water; EE_10 *Soela väina rannikuvesi* – Soela strait coastal water; EE_11 *Kihelkonna lahe rannikuvesi* – Kihelkonna bay coastal water; EE_13 *Pärnu lahe rannikuvesi* – Pärnu Bay coastal water; EE_14 *Kassari-Õunaku lahe rannikuvesi* – Kassari-Õunaku bay coastal water; EE_16 *Väinamere rannikuvesi* – Väinameri coastal water; EE_17 *Liivi lahe loodeosa rannikuvesi* – coastal water of the northwestern part of the Gulf of Riga; EE_18 *Liivi lahe kirdeosa rannikuvesi* – coastal water of the northeastern part of the Gulf of Riga; EE_19 *Liivi lahe keskosa rannikuvesi* – coastal water of the central part of the Gulf of Riga.

2.1.1 Depth of the water and seabed topography

Estonian maritime area is quite shallow – about a third of maritime area is deeper than 60 metres. Depth of the water in Estonian maritime area range from 0 to 180 metres (Figure 2.2). The average depth of the Gulf of Finland is 38 m (the deepest point is 124 m), the depth of the Gulf of Riga is mostly less than 30 m, but it reaches over 50 in the central part of the gulf. Väinameri is the shallowest of the typical areas of the Estonian coastal sea, where the depth of the water is mostly less than 10 m. The open part of West Estonian islands has water depth of 10-40 m within the range of coastal sea. The deepest point of Estonian maritime area is located west of Hiiumaa on the border of the Estonian economic zone, reaching 249 metres.

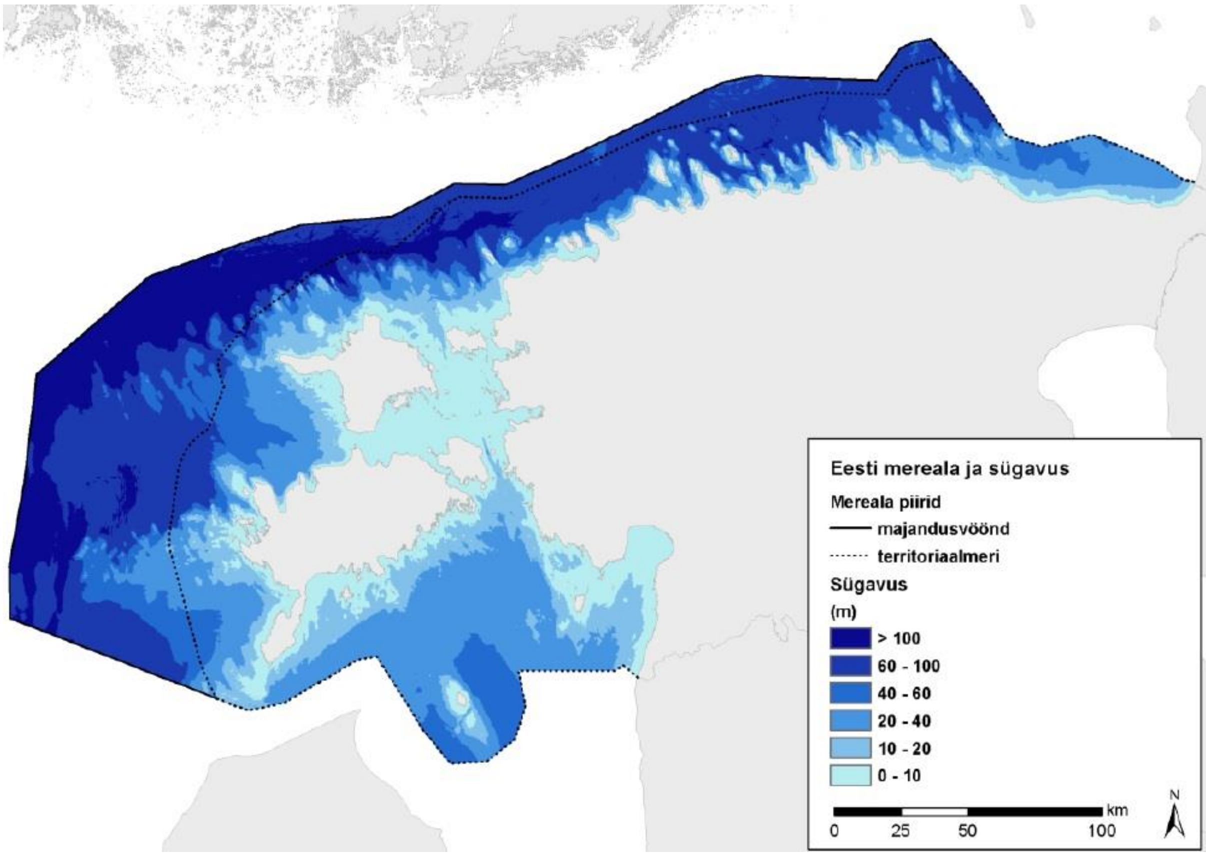

Figure 2.2. Estonian maritime area and the depth of water in it (Estonian Maritime Administration, 2017; Ministry of the Environment, 2019a).

Eesti mereala ja sügavus – Estonian maritime area and its depth. *Mereala piirid* – borders of maritime areas: *majandusvöönd* – economic zone; *territoraalmeri* – territorial sea. *Sügavus (m)* – depth (m).

Detailed knowledge of the seabed comes only from those points where measurements and analyses have been conducted, but marine benthal deposit have not been systematically mapped in Estonia and, therefore, Estonian seabed can be described using modelled data. According to the modelling results by the University of Tartu, Estonian Marine Institute, Estonian maritime area has to the greatest extent muddy sediments. Sand and mixed sediment (mixture of hard and soft substrate) is also common. To a lesser extent, there are areas with stony or rocky surface (Figure 2.3).

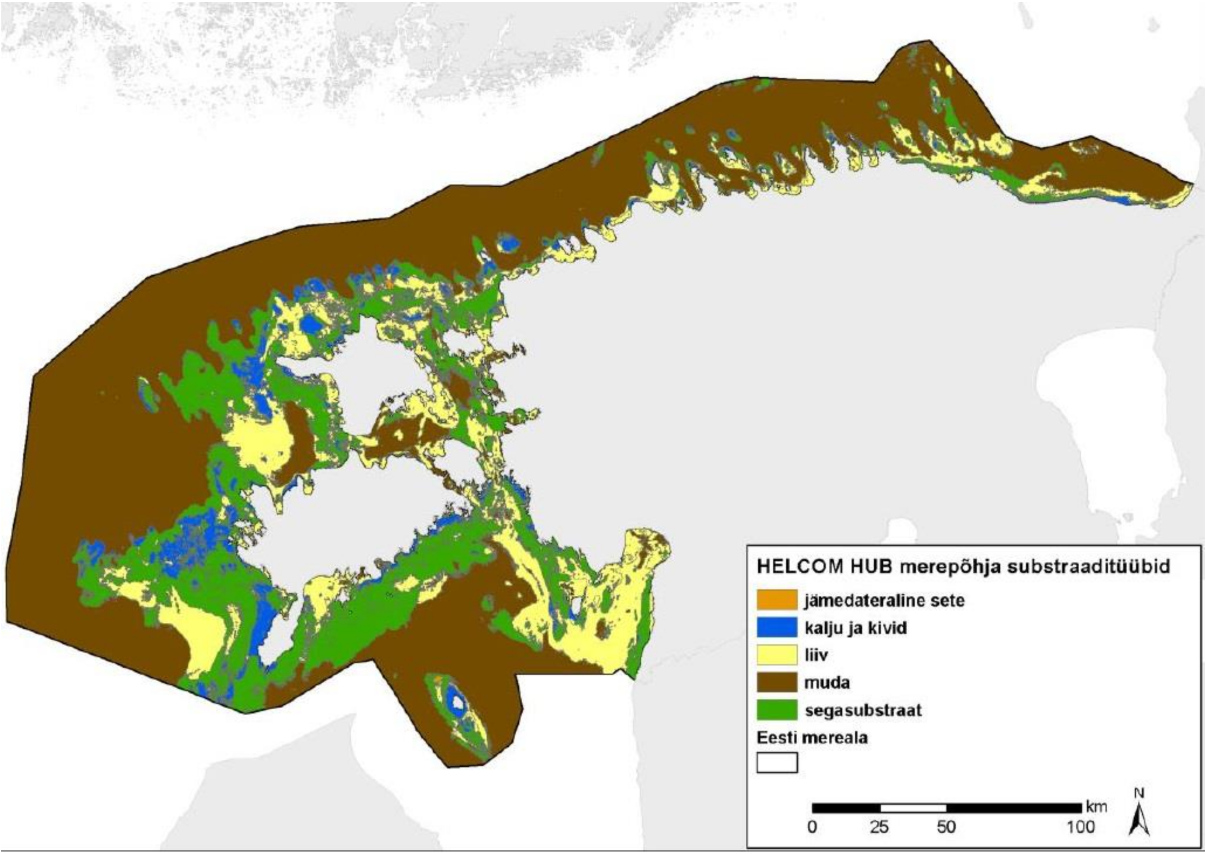

Figure 2.3. Seabed substrate types according to HELCOM HUB system (University of Tartu, Estonian Marine Institute, 2018; Ministry of the Environment, 2019a).

HELCOM HUB merepõhja substraaditüübid – HELCOM HUB seabed substrate types: *jämedateraline sete* – coarse sediment; *kalju ja kivid* – rocks and boulders; *liiv* – sand; *muda* – muddy sediment; *segasubstraat* – mixed substrate. *Eesti mereala* –Estonian maritime area.

2.1.2 Salinity and temperature of water, and ice conditions

The inflow of salt water into the Baltic Sea takes place through the Danish straits, but at the same time fresh water is also added to the sea from rivers. Due to its lower density, less salty water remains into surface layer and flows out of the sea in surface layer as well. But the saltier water from the North Sea sinks into the deep layers of the sea, as a result of which the water column of the Baltic Sea is also vertically stratified. In the case of a continuously stratified water column, the transport of nutrients and oxygen between the near-bottom water layer and surface layers is hindered. Water mixing conditions in Estonian maritime area are such that in Väinameri Sea the water is constantly mixed, the coastal waters of the open Baltic Sea, the Gulf of Riga and the eastern and central parts of the Gulf of Finland are stratified in summer and mixed in winter, and the western part of the Gulf of Finland and the open Baltic Sea are constantly stratified. Salinity of water in Estonian maritime area is within the range of 0–8 g/kg — in south-eastern part of the Gulf of Finland 2,5–6 g/kg, in western part of the Gulf of Finland 4,5–6,5 g/kg, in the open part of West Estonian islands 6–7 g/kg, in Väinameri Sea 3–6,5 g/kg, in the Gulf of Riga 4–6 g/kg and in Pärnu Bay 3–5,5 g/kg.

In the Gulf of Riga and in Väinameri Sea, which are both connected to the open sea, there is a greater fluctuation of water temperature compared to the open part of the West Estonian islands and the Gulf of Finland. There are also differences between deeper and more open parts and shallow bays. The shallow parts of the sea warm up quickly in the spring and cool down much faster in the autumn than the open sea. In summer, the water temperature in Väinameri Sea and in the Gulf of Riga is 2–3 °C higher than in the open part of West Estonian islands, being in the deeper open sea and in the Gulf of Finland from July to August on average 15–17 °C in the surface layer and 2–5 °C in the near-bottom layer. The Väinameri Sea warms up to the bottom by July-August and the Gulf of Riga warms up to the bottom at the distance of 10-20 km from the coast. Due to water temperature in the Baltic Sea, there occurs seasonal stratification of water from May until September. The importance of stratification is primarily related to the prevention of vertical transport of nutrients and dissolved oxygen.

The presence of ice cover is of decisive importance for the distribution of benthic habitats and contributes to the development of oxygen deficiency in semi-closed bays in winter. During the last 100 years, the annual maximum ice cover in the Baltic Sea has decreased by 20%, while the duration of the ice cover has also decreased. Ice cover in Estonian maritime area occurs every year at least in Pärnu Bay and in Väinameri Sea, being the parts of the Estonian coastal sea with the longest duration of ice cover. During tough winters, the whole Estonian maritime area is covered with ice. The deeper parts of the sea in the open sea of the West Estonian islands and the western part of the Gulf of Finland cool down longer in autumn, which is why ice starts to form there much later than in the Väinameri Sea and in the Gulf of Riga.

2.1.3 Water transparency and oxygen concentration

Seawater transparency is lower in coastal sea areas. The Gulf of Riga has a high natural concentration of humic substances, which are carried there from drained peatlands and forest areas by rivers, and the transparency of the water there is naturally low.

The oxygen regime in the deep layers of the Baltic Sea is largely influenced by the amount of salt water inflowing through the Danish straits. Large inflows (on average every 10 years), during which a sufficiently large amount of salty and oxygen-rich water is added, are very important. Since 1950s, the entire Baltic Sea region has seen a trend of continuous growth of oxygen deficit, and since 2001, the expansion of areas of oxygen deficiency and lack of oxygen. It is estimated that ~18% of the Baltic Sea is oxygen-deficient and ~28% is oxygen-poor. In the Gulf of Finland and the Gulf of Riga, the lack of oxygen is seasonal, while in the northern basin of the open Baltic Sea there is a long-term oxygen deficiency. The Väinameri Sea is shallow and its water is well mixed, which is why there is no lack of oxygen.

2.1.4 Currents, waves, upwelling and water level

The currents of the Estonian coastal sea are very variable and depend to a large extent on local winds. The characteristic current speed in the surface layer of the Estonian maritime area is 10–20 cm/s, maximum current speeds (over 1 m/s) have been recorded in straits and along the coast. In the Estonian coastal sea, the highest current speeds are recorded in Soela Strait (up to 2 m/s). Currents with a speed of 40-50 cm/s can occur in deeper layers of the sea. During the summer months, the sea area is vertically stratified, which is why the vertical distribution of currents is also characterized by stratification.

During the last 50 years, an increase in southwesterly and westerly winds, an increase in wind strength and an increase in storminess have been observed at the Baltic Sea. Storm surge may cause changes in shoreline. In the case of prevailing southwesterly and northwesterly winds, Estonian coastal sea is divided into regions based on the influence of waves on it — the Gulf of Finland and the open part of West Estonian islands are strongly affected, the Gulf of Riga is weakly affected, and the Väinameri Sea is relatively sheltered from the influence of waves.

The area with the most intensive occurrence of upwelling is the coastal sea of Finland in the western part of the Gulf of Finland. The Väinameri Sea is shallow and its water is well mixed, which is why no upwelling is observed there.

The Baltic Sea is a body of water with very weak tidal phenomena, and the height of tides in the Estonian coastal sea usually does not exceed a few centimetres. 75% of the time, the water level in the Estonian coastal sea remains within ± 30 cm of the average. However, water level variability is greatest in semi-enclosed bays (e.g. Pärnu and Narva bays), and maximum water levels occur in autumn and winter with more frequent storms and stronger westerly winds. The minimum water level occurs in spring and summer and is related to a somewhat higher proportion of easterly winds. Low water levels, or bogs, are associated with persistent easterly winds, when the entire Baltic Sea water level drops, being about 50 cm below average at the outer border of the Estonian coastal sea. Low water levels, or wind setdowns, are related to steady easterly winds, when water level in the entire Baltic Sea drops, being about 50 cm below average at the outer border of the Estonian coastal sea.

2.1.5 Biodiversity

Compared to other aquatic ecosystems, there are relatively few animal and plant species living in the Baltic Sea. The biodiversity of the Baltic Sea consists of a unique mixture of marine and freshwater species adapted to brackish water conditions and a few true brackish water species. In the northern and eastern part of the Baltic Sea, where salinity is low, fewer marine species can spread, and marine habitats, especially in estuaries and coastal waters, are dominated by freshwater species (Ministry of the Environment, 2021).

2.1.5.1 Ichthyofauna

There are about 100 different fish species living in the Baltic Sea, many of which are originally from lakes and rivers. There are also species that live in the Atlantic Ocean as well, but some of them cannot reproduce due to the low salinity of the water in the Baltic Sea and are much smaller than their counterparts living in the ocean (Estonian Society of Marine Biology, April 2022). There are an estimated 75 fish species in Estonian waters, about 30 marine fish species are found in coastal waters. The water surrounding Estonia is brackish water and that is why it is a good habitat for many freshwater fish species as well (Ministry of the Environment, 2022). Fish fauna of Estonian maritime area is quite diverse, but at the same time it is under strong human impact. Pelagic communities of the Baltic Sea are dominated by Baltic herring and sprat. The most typical species in benthic communities of the Baltic Sea is flounder and typical representatives of coastal waters are bullheads (e. g. four-horned sculpin, shorthorn sculpin and sea scorpion) (Ministry of the Environment, 2019a).

The salinity of the Estonian sea areas is physiologically quite tolerable for the adults of our freshwater fish and also for the juvenile fish of some species (e.g. perch and pikeperch). Compared to inland water bodies, there is much more space in the sea and therefore much more food, which is why many freshwater fish have adapted to spend a certain part of their lives in the sea. However, for breeding they prefer to migrate to freshwater. Moving between several environments with different salinity is a normal way of life for many fish species around the world. Spawning in rivers and living in the sea as adults is characteristic of migratory fish.

Semi-migratory fish breed exclusively or mainly in freshwater, but spend much of their adult life in low salinity coastal waters (University of Tartu, Estonian Marine Institute, 2015).

Historically, eel was one of the most common fish species in Estonian coastal waters (Eel Management Plan, 2009). Currently, the eel stock is in a bad state both in the Baltic Sea and in Europe as a whole, and the population is not solely affected by fishing. The decline of eel stocks is also thought to be due to river pollution and creating migration barriers (dams, etc), wider spread of fish parasites and environmental changes that have affected eel's spawning grounds and migratory conditions. At the same time, eel mortality in the Baltic Sea due to cormorants may be in the same range as eel mortality due to commercial eel fishing. In 2017, Pärnu Bay was the only larger Estonian sea area where the commercial eel catch increased compared to the previous year, but in 2018, the eel catch decreased in all parts of Estonian sea area. In most areas where eel monitoring is done, no eel has been caught for many years (University of Tartu, Estonian Marine Institute, 2019).

Fishing is also discussed in more detail in ch 2.3.2 Fishing.

In assessing the environmental status of the Estonian maritime area (Ministry of the Environment, 2019a), spawning stock biomass was estimated for Baltic herring and sprat, and relative abundance of flounder, salmon, perch and pikeperch was estimated. Spawning stock biomass of Baltic herring corresponds to a good environmental status in both populations. Sprat's spawning stock biomass and the abundance of flounder have also good status. But the indicators for salmon, perch and pikeperch are unfavourable (Figure 2.4).

Indikaatori kood	Indikaatori nimetus	Seisund
D3C2.1	Räime (*Clupea harengus membras*) Läänemere avaosa asurkonna kudekarja biomass	HKS saavutatud
D3C2.2	Räime (*Clupea harengus membras*) Liivi lahe asurkonna kudekarja biomass	HKS saavutatud
D3C2.3	Kilu (*Sprattus sprattus balticus*) kudekarja biomass	HKS saavutatud
D3C2.4	Sugukūpsete lestade (*Platichthys flesus*) arvukusindeks seirepüükides	HKS saavutatud
D3C2.5	Lõhi (*Salmo salar*) laskujate arvukus võrreldes maksimaalse loodusliku potentsiaalse arvukusega	HKS pole saavutatud
D3C2.6	Sugukūpsete ahvenate (*Perca fluviatilis*) arvukusindeks seirepüükides	HKS pole saavutatud
D3C2.7	Sugukūpsete kohade (*Sander lucioperca*) arvukusindeks seirepüükides	HKS pole saavutatud

Figure 2.4. Fish distribution and abundance indicators and status assessments (Ministry of the Environment, 2019a).

***Indikaatori kood* – indicator code. *Indikaatori nimetus* – name of the indicator**: *Räime (Clupea harengus membras) Läänemere avaosa asurkonna kudekarja biomass* – spawning stock biomass of Baltic herring (*Clupea harengus membras*) in the open Baltic Sea population; *Räime (Clupea harengus membras) Liivi lahe asurkonna kudekarja biomass* – spawning stock biomass of Baltic herring (*Clupea harengus membras*) in the Gulf of Riga population; *Kilu (Sprattus sprattus Balticus) kudekarja biomass* – spawning stock biomass of sprat (*Sprattus sprattus Balticus*); *Sugeküpsete lestade (Platichthys flesus) arvukusindeks seirepüükides* – abundance index of sexually mature flounders (*Platichthys flesus*) in monitoring fisheries; *Lõhi (Salmo salar) laskujate arvukus võrreldes maksimaalse loodusliku potentsiaalse arvukusega* – the abundance of salmon (*Salmo salar*) smolts compared to maximum natural potential abundance; *Suguküpsete ahvenate (Perca fluviatilis) arvukusindeks seirepüükides* – abundance index of sexually mature perches (*Perca fluviatilis*) in monitoring fisheries; *Suguküpsete kohade (Sander lucioperca) arvukusindeks seirepüükides* – abundance index of sexually mature pikeperches (*Sander lucioperca*) in monitoring fisheries.

***Seisund* – status**: *HKS saavutatud* – good environmental status achieved *HKS pole saavutatud* – good environmental status not achieved.

The sex and age composition of commercial fish was assessed for flounder, large perches and pikeperch, but none of the assessed species taken separately separately, nor the mean maximum length of all species have achieved good the good environmental status. As for fishing mortality, only fishing mortality of Baltic spring spawning herring in the open sea and the ratio of the biomass of commercial flounder fishing to the biomass of monitoring fishing have achieved the level of good environmental status; according to the other indicators, good status has not been achieved (Figure 2.5).

Indikaatori Kood	Indikaatori nimetus	Seisund
D3C1.1	Kevadkuduräime (*Clupea harengus membras*) Eesti mereala (v.a. Liivi laht) asurkonna kalastussuremus	HKS saavutatud
D3C1.2	Kevadkuduräime (*Clupea harengus membras*) Liivi lahe asurkonna kalastussuremus	HKS pole saavutatud
D3C1.3	Kilu (*Sprattus sprattus balticus*) kalastussuremus	HKS pole saavutatud
D3C1.4	Lesta (*Platichthys flesus*) kutselise kalapüügi saagi biomassi suhe seirepüükide biomassiga	HKS saavutatud
D3C1.5	Ahvena (*Perca fluviatilis*) kutselise kalapüügi saagi biomassi suhe seirepüükide biomassiga	HKS pole saavutatud
D3C1.6	Koha (*Sander lucioperca*) kutselise kalapüügi saagi biomassi suhe seirepüükide biomassiga	HKS pole saavutatud
D1C5	Lõhi (*Salmo salar*) laskujate arvukus võrreldes maksimaalse loodusliku potentsiaalse arvukusega	HKS pole saavutatud

Figure 2.5. Indicators characterizing reproductive capability and mortality of fish, and status assessments (Ministry of the Environment, 2019a).

***Indikaatori kood* – indicator code. *Indikaatori nimetus* – name of the indicator**: *Kevadkuduräime (Clupea harengus membras) Eesti mereala (v. a. Liivi laht) asurkonna kalastussuremus* – fishing mortality of Baltic spring spawning herring's (*Clupea harengus membras*) population in Estonian maritime area (except the Gulf of Riga); *Kevadkuduräime (Clupea harengus membras) Liivi lahe asurkonna kalastussuremus* – fishing mortality of Baltic spring spawning herring's (*Clupea harengus membras*) population in the Gulf of Riga; *Kilu (Sprattus sprattus Balticus) kalastussuremus* – fishing mortality of sprat (*Sprattus sprattus Balticus*); *Lesta (Platichthys flesus) kutselise kalapüügi saagi biomassi suhe seirepüükide biomassiga* – the biomass of commercial flounder (*Platichthys flesus*) fishing to the biomass of monitoring fishing; *Ahvena (Perca fluviatilis) kutselise kalapüügi saagi biomassi suhe seirepüükide biomassiga* – the biomass of commercial perch (*Perca fluviatilis*) fishing to the biomass of monitoring fishing; *Koha (Sander lucioperca) kutselise kalapüügi saagi biomassi suhe seirepüükide biomassiga* – the biomass of commercial pikeperch (*Sander lucioperca*) fishing to the biomass of monitoring fishing; *Lõhi (Salmo salar) laskujate arvukus võrreldes maksimaalse loodusliku potentsiaalse arvukusega* – the abundance of salmon (*Salmo salar*) smolts compared to maximum natural potential abundance.

***Seisund* – status**: *HKS saavutatud* – good environmental status achieved *HKS pole saavutatud* – good environmental status not achieved.

The status of fish marine habitats has not been systematically assessed due to a lack of data. Also, the rate of fish mortality due to accidental bycatch has not been assessed. The status of migratory fish spawning habitats has only been assessed by the number of salmon (*Salmo salar*) smolts in rivers flowing into the sea, compared to the maximum natural potential abundance, but it is indicating an unfavourable situation.

2.1.5.2 Mammals

The following mammals are living in the Baltic Sea: ringed seal, harbour seal and grey seal, and harbour porpoise (HELCOM, 2018a, 2018b). Harbour seal gets into Estonian waters rather accidentally. During the 20th century, the abundance of harbour porpoise has decreased catastrophically and this species practically does not get into Estonian waters anymore (Ministry of the Environment, 2019a). Therefore, in this chapter and further on, only grey seals and ringed seals are addressed among mammals.

Of all mammals living in the Baltic Sea, grey seal has the largest size and the greatest abundance. According to the Nature Conservation Act, it is a protected category III species. Grey seals are freely moving throughout the Baltic Sea, their core areas are mainly located at the central part of the Baltic Sea. Mostly areas of archipelagos bordering with the open sea are inhabited, using sea shallows as well as islands (which usually have no plant cover) above water as their rookeries. The animals are quite timid in their rookeries, but during the cold seasons they come to harbours and river mouths. Grey seals live in herds and herds of several thousand can gather in rookeries. Describing the distribution and abundance of grey seals is complicated, as it is a very widely migrating species, and their distribution is primarily associated with habitats that have not yet been sufficiently clearly defined. In Estonian maritime area, the grey seal is mainly distributed in its western part, their larger rookeries and calving areas being in the waters of the West Estonian archipelago. Distribution of grey seals during breeding is related to the presence of ice during the breeding season (February-March), and the distribution of suitable ice types is directly related to the nature of winter. During average and warmer than average winters the main breeding areas are located in the western and southern coast of Saaremaa, in the eastern and central part of the Gulf of Finland, and less often in the sea of the northern coast of Hiiumaa. If there is no ice, grey seals calve on islands that are mostly located in the same area (except in the Gulf of Finland) (Estonian Environmental Board, 2022).

According to the Nature Conservation Act, ringed seal is a protected category II species. Ringed seal is a species with sporadic spread in the Baltic Sea, with subpopulations comprising distribution areas at the coasts of Estonia on the Väinameri Sea/the Gulf of Riga and the Gulf of Finland. The key habitats for ringed seals in Estonia are in the Väinameri Sea, where there are their main resting areas during the ice-free period, and in the Gulf of Riga, where the animals feed. The resting areas of ringed seals are related to rocky shallows at coast and in archipelagos. For the successful reproduction, ringed seals need stable sea ice covered with snow, that is located far enough from coast so that they can hide from predators and eagles moving on the ice. During the formation of ice (usually in mid-January), the animals move away from the coast, to the edge of fast ice, where moving ice begin to form ridged ice. Migration areas of ringed seals cover a larger sea area with both irregular searching movements as well as regular migrations (e.g. between resting and feeding areas) (MTÜ (NGO) Pro Mare, 2019).

Assessing the environmental status of the Estonian maritime area (Ministry of the Environment, 2019a), the abundance, distribution area and distribution pattern of grey and ringed seals were observed (Figure 2.6). Grey seals living in Estonian waters are one part of the entire population of the Baltic Sea. Their abundance in our waters is usually slightly less than one-sixth of the total population, but the status assessment is given regarding the entire Baltic Sea. As for the abundance of grey seals, good environmental status has been achieved: the abundance of the species in the entire Baltic Sea is approximately 30,000 individuals, which exceeds the threshold value of 10,000 individuals. In terms of grey seal distribution area and distribution pattern, good environmental status has been achieved, because the distribution is continuous along the coast and the relative abundance in inhabited parts of the sea is increasing in line with the growth of the population in the Baltic Sea. The total maximum number of ringed seals in Estonian maritime area, which makes up the majority of the southern economic unit, does not exceed 1,500 individuals (15% of the set threshold value) and there is no increasing trend in abundance, therefore the number of ringed seals does not meet the criteria for good environmental status. Also, the spread of ringed seals in the Estonian part of the Gulf of Finland has significantly decreased over the past 50 years as a result of the lack of ice conditions necessary for the species and direct human activity, which is why the spread of ringed seals has retreated eastward to the waters of Russia. Therefore, regarding the spread of ringed seals, the good environmental status has not been achieved.

Indikaatori kood	Indikaatori nimetus	Seisund
D1C2.1	Hallhülge arvukus	HKS
D1C2.2	Viigerhülge arvukus	HKS pole saavutatud
D1C4.1	Hallhülge levikuala	HKS
D1C4.2	Viigerhülge levikuala	HKS pole saavutatud
D1C4.3	Hallhülge levikumuster	HKS
D1C4.4	Viigerhülge levikumuster	HKS pole saavutatud

Figure 2.6. Indicators estimating the abundance and spread of grey seals and ringed seals, and corresponding status assessments (Ministry of the Environment, 2019a).

***Indikaatori kood* – indicator code. *Indikaatori nimetus* – name of the indicator**: *Hallhülge arvukus* – abundance of grey seals; *Viigerhülge arvukus* – abundance of ringed seals; *Hallhülge levikuala* – distribution area of grey seals; *Viigerhülge levikuala* – distribution range of ringed seals; *Hallhülge levikumuster* – distribution pattern of grey seals; *Viigerhülge levikumuster* – distribution pattern of ringed seals.

***Seisund* – status**: *HKS saavutatud* – good environmental status achieved *HKS pole saavutatud* – good environmental status not achieved.

2.1.5.3 Avifauna

The Baltic Sea has also avifauna which is very rich in species. They are divided into two large groups: migratory birds and breeding birds. Migratory birds are on their way north in spring and south in autumn, but breeding birds stay in the Baltic Sea region for nesting and hatching their young (Estonian Society of Marine Biology, April 2022). The importance of the Estonian coastal sea for aquatic birds is primarily due to its geographical location, as it lies directly on one of the important branches of the Eastern Atlantic migration route. This branch is used by most arctic aquatic bird species on their way from Arctic breeding grounds in Eurasia to wintering grounds, latter reaching as far as South-Africa. Estonian sea shallows are suitable migration stops for them, where fat reserves are replenished for further migration, and wintering areas. (Estonian Ornithological Society (BirdLife Estonia), 2019)

Together with marine mammals and some fish species, birds form the last link in marine food chains. In Estonian maritime area, birds feed on invertebrates, fish and aquatic plants, typical species are gulls, terns and diving ducks (e.g. herring gull, common gull, Arctic tern and long-tailed duck), while on the coastline, dabbling ducks and wading-birds (e.g. mallard and oystercatcher) are typically represented.

The importance of aquatic birds and their migratory stops in our maritime area can be addressed from two points of view (Estonian Ornithological Society (BirdLife Estonia), 2019):

1) Birds are an integral part of the marine ecosystem. Bird species directly related to the sea are often characterized by a strong tendency to gather into flocks, and in our conditions birds form especially large groups in nesting sites during their migration.

Birds present in large numbers at such places can have an impact on the entire marine ecosystem (e.g. diving ducks can significantly reduce benthic biomass under certain conditions);

2) Estonian sea areas are an integral part of the area used by bird species during their life cycle.

Mass migration of aquatic birds may occur at low height (in the height zone of artificial structures) above the sea. The spring migration of aquatic birds begins at the end of February and ends at the beginning of June, while the mass migration occurs cyclically from mid-April to early June. The primary direction of migration during the spring migration is predominantly northeast for most species, but the actual direction of flight varies from northwest to east, depending on the landscape and wind direction. The autumn migration of most aquatic birds begins in mid-August and ends in December, while some aquatic birds stay in the Estonian sea area to winter. The primary direction of migration during autumn migration is southwest for most species, but the actual direction of flight varies from west to south. Some species also have summer moult migration, which lasts from the second half of July to the beginning of August. Also, birds fly significantly higher at night (mostly higher than 500 m) than during the day (varies between 4-300 m, depending on the bird) (Estonian Ornithological Society (BirdLife Estonia), 2016).

Bird areas important for the open sea bird species to make a stop in Estonia are Kabli, Kahtla-Kübassaare, Koorunõmme, Vilsandi, Tagamõisa, Kura kurk (Irbe Strait), Küdema bay, Nõva-Osmussaare, Pakri and Pärnu Bay bird areas, and bird areas in Väinameri Sea. For the rest of the bird areas, the marine part has been added based on stopover sites located in coastal waters or areas important for birds nesting on the coast and small islands. Outside the boundaries of bird areas, important stopover sites are located in protected areas (Apollo sea shallow nature reserve) and limited-conservation areas (Hiiu shoal and Gretagrund limited-conservation areas) (Estonian Ornithological Society (BirdLife Estonia), 2019). From the point of view of Estonian avifauna and their protection, migratory birds that stop at sea during their migration are one of the most important groups, with endangered bird species of Estonia, Europe and of the world making stops at the sea (Estonian Ornithological Society (BirdLife Estonia), 2017).

In the case of avifauna, good environmental status is considered achieved if at least 75% of the species belonging to the group reach the value of the level of good environmental status on a species-by-species basis. During the nesting season, however, aquatic birds as a whole do not have good status: 64% of the species considered had good status (16 out of 25 species) (Figure 2.7). Of the five species groups, one had good status (birds feeding in pelagic layers) and four had unfavourable status (wading-birds, surface feeder birds, benthos feeder birds and herbivorous birds) (Kuus and Luigujõe, 2018).

Liigirühm		Seisund Eesti merealal	Seisund Läänemeres tervikuna
Kahlajad		HKS pole saavutatud: heas seisundis 67% liikidest (4 liiki 6-st), [red]	HKS pole saavutatud [red]
	Naaskelnokk (*Recurvirostra avosetta)*	HKS on saavutatud [green]	HKS pole saavutatud [red]
Pinnatoidulised linnud		HKS pole saavutatud: heas seisundis 67% liikidest (6 liiki 9-st), [red]	HKS pole saavutatud [red]
	Tõmmukajakas (*Larus fuscus)*	HKS pole saavutatud [red]	HKS on saavutatud [green]
	Kalakajakas (*Larus canus)*	HKS on saavutatud [green]	HKS pole saavutatud [red]
Põhjatoidulised linnud		HKS pole saavutatud: heas seisundis 50% liikidest (2 liiki 4-st), [red]	HKS pole saavutatud [red]
Taoimtoidulised linnud		HKS pole saavutatud: heas seisundis 33% liikidest (1 liik 3-st). [red]	HKS on saavutatud [green]
	Hallhani (*Anser anser)*	HKS pole saavutatud [red]	HKS on saavutatud [green]
Pelaagilistes kihtides toituvad linnud		HKS 100% liikidest (3 liiki 3-st) [green]	HKS on saavutatud [green]

Figure 2.7. Status of nesting birds in Estonian maritime area and in the Baltic Sea as a whole (Ministry of the Environment, 2019a).

***Liigirühm* – species group. *Seisund Eesti merealal* – status in Estonian maritime area. *Seisund Läänemeres tervikuna* – status in the Baltic Sea as a whole**.
Kahlajad – wading-birds: *HKS pole saavutatud: heas seisundis 67% liikidest (4 liiki 6-st)* – good environmental status not achieved: 67% of species have good status (4 out of 6 species); *HKS pole saavutatud* – good environmental status not achieved. *Naaskelnokk (Recurvirostra avosetta)* – pied avocet (*Recurvirostra avosetta*): *HKS on saavutatud* – good environmental status achieved; *HKS pole saavutatud* – good environmental status not achieved.
Pinnatoidulised linnud – surface feeder birds: *HKS pole saavutatud: heas seisundis 67% liikidest (6 liiki 9-st)* – good environmental status not achieved: 67% of species have good status (6 out of 9 species); *HKS pole saavutatud* – good environmental status not achieved. Tõmmukajakas (Larus fuscus): lesser black-backed gull (Larus fuscus) – *HKS pole saavutatud* – good environmental status not achieved; *HKS on saavutatud* – good environmental status achieved. *Kalakajakas (Larus canus)* – common gull *(Larus canus)* – *HKS on saavutatud* – good environmental status achieved; *HKS pole saavutatud* – good environmental status not achieved.
Põhjatoidulised linnud – benthos feeder birds: *HKS pole saavutatud: heas seisundis 50% liikidest (2 liiki 4-st)* – good environmental status not achieved: 50% of species have good status (2 out of 4 species); *HKS pole saavutatud* – good environmental status not achieved.
Taimtoidulised linnud – herbivorous birds: *HKS pole saavutatud: heas seisundis 33% liikidest (1 liik 3-st)* – good environmental status not achieved: 33% of species have good status (1 out of 3 species); *Hallhani (Anser anser)* – greylag goose *(Anser anser)*: *HKS pole saavutatud* – good environmental status not achieved; *HKS on saavutatud* – good environmental status achieved.

Pelaagilistes kihtides toituvad linnud – birds feeding in pelagic layers*: HKS 100% liikidest (3 liiki 3-st)* – 100% of the species have good environmental status (3 out of 3 species)*; HKS on saavutatud* – good environmental status achieved.

As for wintering birds, 94% of the considered species have good status (16 out of 17) (Figure 2.8), only Steller's eider (*Polysticta stelleri*) had unfavourable status, being also globally the most endangered species among those wintering in Estonian maritime area. The status of wintering birds in Estonian maritime area is similar to their status in the Baltic Sea as a whole, only two species have different status.

Liigirühm	Seisund Eestis	Seisund Läänemeres tervikuna
Pinnatoidulised linnud	HKS 100% liikidest	HKS on saavutatud
Põhjatoidulised linnud	HKS 75% liikidest	HKS on saavutatud
Kirjuhahk *(Polysticta stelleri)*	HKS pole saavutatud	HKS pole saavutatud
Merivart (*Aythya marila)*	HKS on saavutatud	HKS pole saavutatud
Taoimtoidulised linnud	HKS 100% liikidest	HKS on saavutatud
Lauk (*Fulica atra)*	HKS on saavutatud	HKS pole saavutatud
Pelaagilistes kihtides toituvad linnud	HKS 100% liikidest	HKS on saavutatud

Figure 2.8. Status of wintering birds in Estonian maritime area and in the Baltic Sea as a whole (Ministry of the Environment, 2019a).

***Liigirühm* – species group. *Seisund Eesti merealal* – status in Estonian maritime area. *Seisund Läänemeres tervikuna* – status in the Baltic Sea as a whole**.
Pinnatoidulised linnud – surface feeder birds: *HKS 100% liikidest* – 100% of the species have good environmental status; *HKS on saavutatud* – good environmental status achieved.
Põhjatoidulised linnud – benthos feeder birds: *HKS 75% liikidest* – 75% of the species have good environmental status; *HKS on saavutatud* – good environmental status achieved. *Kirjuhahk (Polysticta stelleri)* – Steller's eider (*Polysticta stelleri*): *HKS pole saavutatud* – good environmental status not achieved.
Merivart (Aythya marila) – greater scaup (*Aythya marila*): *HKS on saavutatud* – good environmental status achieved; *HKS pole saavutatud* – good environmental status not achieved.
Taimtoidulised linnud – herbivorous birds: *HKS 100% liikidest* – 100% of the species have good environmental status; *HKS on saavutatud* – good environmental status achieved. *Lauk (Fulica atra)* – coot (*Fulica atra*): *HKS on saavutatud* – good environmental status achieved; *HKS pole saavutatud* – good environmental status not achieved.
Pelaagilistes kihtides toituvad linnud – birds feeding in pelagic layers: *HKS 100% liikidest* – 100% of the species have good environmental status; *HKS on saavutatud* – good environmental status achieved.

Due to insufficient data, it is not possible to make an assessment of the gender and age composition of sea birds, reproductive capability, survival rate and mortality of sea birds, and their behaviour (including migration) or habitats.

2.1.5.4 Habitats, and phytobenthos and zoobenthos

In the conditions of the Baltic Sea, the Estonian maritime area is very diverse in terms of habitats. Of 25 marine benthic habitats according to EBHAB (*Eastern Baltic marine benthic habitats*) classification, 18 are represented in the Baltic Sea. There are also 6 habitat types listed in Annex 1 of the European Union Habitats Directive in Estonian maritime area — reefs, sandy shoals, shallow inlets, estuaries, coastal lagoons and large bays.

An important factor of a habitat type – seabed character – is very different in the Baltic Sea and in its eastern part on the coast of the Baltic States, but broadly they can be distinguished as hard and soft bottom habitat types. Types of hard bottoms include crystalline basement, hard and soft sedimentary rocks, reefs, rocky bottom, gravel bottom, hard clay bottom, gravel-shell bottom and mussel bottom. A soft bottom may be covered with sand, mud, peat or mixed sediments. The most typical plants of benthic habitats are eelgrass and various green, brown and red algae. In the sea, there are generally only a few plants on the sandy bottom, but dense clumps of algae grow on the rocks. Rocky bottoms and reefs are preferred by large algae species and animals that attach to the seabed. Soft bottom is better suited for vascular plants and animal species living in the soil. Species diversity is higher in shady areas, small river mouths and bays, but only a few species can adapt to the difficult living conditions of areas under the direct influence of waves. Compared to the other Baltic states, Estonian seabed habitats are more diverse (Baltic Environmental Forum Estonia, 2009).

Seabed loss and disturbance, and its pressure factors are described in ch 2.2.7 Seabed loss and disturbance.

Compared to the other regions of the Baltic Sea, phytobenthos of Estonian coastal sea is not very rich in species. Over time, at least 50 algae species have been found in Estonian sea waters, typical representatives are, for example, bladderwrack (*Fucus spp*), muskgrass (*Chara spp*) and eelgrass (*Zostera marina*). The Baltic Sea has very low salinity and the marine ecosystem is quite young, which is why the benthic animal communities are species-poor and some functions (e. g. filter feeders, predators, etc.) are represented by only one or two species. However, more than 1700 phytoplankton species have been identified in the Baltic Sea, the species composition of which varies in different years and seasons. In saltier water diatoms and dinoflagellates dominate, in fresher water green algae and cyanobacteria. There are also more than 1100 zooplankton species identified in the Baltic Sea.

Algae grow in zones, with green algae growing in the lowest zone, then brown algae, and red algae in the deepest zone. Algae provide shelter for invertebrates and fish. Of invertebrates, zooplankton is represented in the Baltic Sea (the biggest representative is common jellyfish), amphipoda can be found in shore waters, and in abyssal zone, and under suitable conditions, in the different depth layers of the sea, saduria entomons can also be found. Mussels are also found at the bottom of the Baltic Sea, Baltic macoma and blue mussel are common in Estonian waters (Estonian Society of Marine Biology, April 2022).

An overview of the overall status of biodiversity, marine food webs and habitats (descriptors D1, D4 and D6) in the Estonian maritime area is summarized in Figure 2.9. According to the Ministry of the Environment (2019a), birds and benthic habitats in Estonian maritime area have good environmental status, but mammals, fish and pelagic habitats have bad status. Regarding biological diversity, one has to admit that good environmental status has not been achieved, as both mammals, fish and pelagic habitats have unfavourable status. Also, food webs do not have good environmental status, because none of the evaluation criteria reached good environmental status. Only the status of seabed habitats corresponds to a good environmental status.

Ökosüsteemi komponent	Komponendi seisundi-hinnang	Liigirühm/elupaigatüüp	Seisundihinnang
Linnud	HKS saavutatud	Taimtoidulised linnud	HKS saavutatud
		Kahlajad	HKS saavutatud
		Pinnatoidulised linnud	HKS saavutatud
		Pelaagilistes kihtides toituvad linnud	HKS saavutatud
		Põhjatoidulised linnud	HKS pole saavutatud
Imetajad	HKS pole saavutatud	Hülged	HKS pole saavutatud
Kalad	HKS pole saavutatud	Rannikumere kalad	HKS pole saavutatud
		Avamere kalad	HKS pole saavutatud
Pelaagiline elupaik	HKS pole saavutatud	Rannikumere pelagiaal	HKS pole saavutatud
		Avamere pelagiaal	HKS pole saavutatud
Merepõhja elupaigad	HKS saavutatud	Karid	HKS saavutatud
		Liivamadalad	HKS saavutatud
		Laugmadalikud	HKS saavutatud

Figure 2.9. Overall status assessment of marine environment by ecosystem components (based on descriptors D1, D4 and D6) (Ministry of the Environment, 2019a).

***Ökosüsteemi komponent* – ecosystem component. *Komponendi seisundi-hinnang* – status assessment of the component. *Liigirühm/elupaigatüüp* – species group/habitat type. *Seisundihinnang* – status assessment.**

Linnud – birds: *taimtoidulised linnud* – herbivorous birds; *kahlajad* – wading-birds; *pinnatoidulised linnud* – surface feeder birds; *pelaagilistes kihtides toituvad linnud* – birds feeding in pelagic layers: *HKS saavutatud* – good environmental status achieved; *HKS saavutatud* – good environmental status achieved. *Põhjatoidulised linnud* – benthos feeder birds: *HKS saavutatud* – good environmental status achieved; *HKS pole saavutatud* – good environmental status not achieved.
Imetajad – mammals: *hülged* – seals: *HKS pole saavutatud* – good environmental status not achieved.
Kalad – fish: *rannikumere kalad* – coastal fish; *avamere kalad* – fish in the open sea: *HKS pole saavutatud* – good environmental status not achieved.
Pelaagiline elupaik – pelagic habitat: *rannikumere pelagiaal* – coastal pelagial; *avamere pelagiaal* – open sea pelagial – *HKS pole saavutatud* – good environmental status not achieved.
Merepõhja elupaigad – seabed habitats: *karid* – reefs; *liivamadalad* – sandy shoals; *laugmadalikud* – shallow inlets: *HKS saavutatud* – good environmental status achieved.

2.1.6 Protected natural objects and Natura 2000 sites

According to the Nature Conservation Act, the protected natural objects are protected areas, limited-conservation areas, protected species and fossils, species' protection sites, individual protected natural objects and natural objects protected at the local government level. Protected area is an area maintained in a state unaltered by human activity or used subject to special requirements where the natural environment is preserved, protected, restored, researched or introduced. National parks, nature conservation areas and landscape conservation areas are considered to be protected areas. A limited-conservation area is an area designated for the conservation of habitats (RT I, 16.06.2021, 3).

The protected area in Estonia is 23% of the total area (land and water areas together), including 27% of the territorial sea being under protection and 18,7% of the maritime area including the economic zone is protected (Estonian Environment Agency, 2021). As of 2017, the Estonian Natura 2000 network consists of 66 bird areas and 542 nature areas, with a total area of 14,863 km^2. A little less than half of the Natura sites are located in the sea, and 17% of Estonia's terrestrial area is covered by Natura 2000 sites (Ministry of the Environment, 2022d).

According to the EELIS database (Estonian Nature Information System, Estonian Environment Agency), as of 08.03.2022, 52 limited-conservation areas in Estonia include maritime area, the largest sea area have Kura kurk (Irbe Strait) limited-conservation area (KLO2000316; sea area 189 447,1 ha), Pärnu Bay limited-conservation area (KLO2000286; sea area 101 605,2 ha), West-Estonia Väinameri Sea limited-conservation area (KLO2000241; sea area 66 199 ha) and Hiiu Väinamer Sea limited-conservation area (KLO2000340; sea area 60 253,4 ha). There are no limited-conservation areas in only two coastal water bodies: Eru-Käsmu Bay and Matsalu Bay coastal waters.

304 protected areas in Estonia include sea area, the largest area has Puhtu-Laelatu Nature Reserve (KLO1100235; sea area 1340,9 ha). There are no protected areas only in five coastal water bodies (Pakri Bay, Hiiu shoal, Soela Strait, central part of the Gulf of Riga, Pärnu Bay). There is one protected area (Apollo sea shallow nature reserve) in territorial sea as well (KLO1000674; sea area 5216,8 ha).

There are species' protection sites in four Estonian coastal water bodies: Pakri Bay, Hiiu shoal, Soela Strait and north-western part of the Gulf of Riga. Of species' protection sites, which include or are located as a whole in sea area, the largest are Klaasirahu grey seal (sea area 2688,4 ha) and Pujuderahu grey seal (mereala 2398,5 ha) species' protection sites.

Of Natura 2000 sites, 105 include maritime area (Figures 2.10 and 2.11), with Väinameri bird area (RAH0000133; sea area 225 497,3 ha) and nature area (sea area 210 646,7 ha), Kura Kurk/Irbe Strait bird area (RAH0000132; sea area 191 680,8 ha) and Pärnu Bay bird area (RAH0000131; sea area 106 487,8 ha) having the largest maritime areas. There are no Natura 2000 nature areas only in Pärnu Bay coastal water body, bird areas are in all coastal water bodies. In territorial sea there are both kind of Natura 2000 sites: Kura Kurk/Irbe Strait bird area, Gretagrund nature area (RAH0000674; total area 14 727,7 ha) and Hiiu shoal nature area (RAH0000134; total area 4508 ha), Gretagrund nature area as a whole is located in territorial sea.

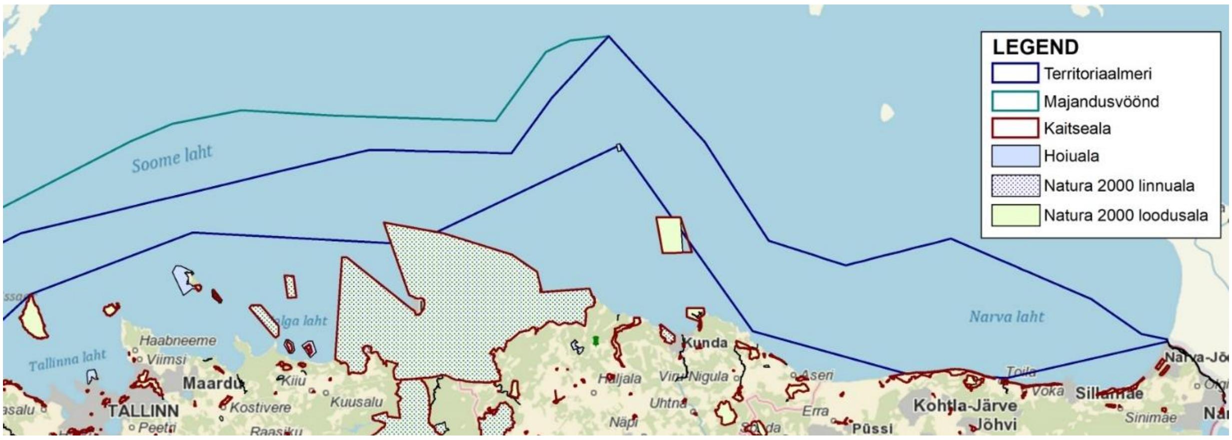

Figure 2.10. Protected areas and limited-conservation areas, and Natura 2000 nature and bird areas in North-Estonian and East-Estonian maritime area (EELIS database (Estonian Nature Information System, Estonian Environment Agency), as of 08.03.2022).

Territoriaalmeri – territorial sea*; Majandusvöönd* – economic zone*; Kaitseala* – protected area*; Hoiuala* – limited-conservation area*; Natura 2000 linnuala* – Natura 2000 bird area*; Natura 2000 loodusala* – Natura 2000 nature area.

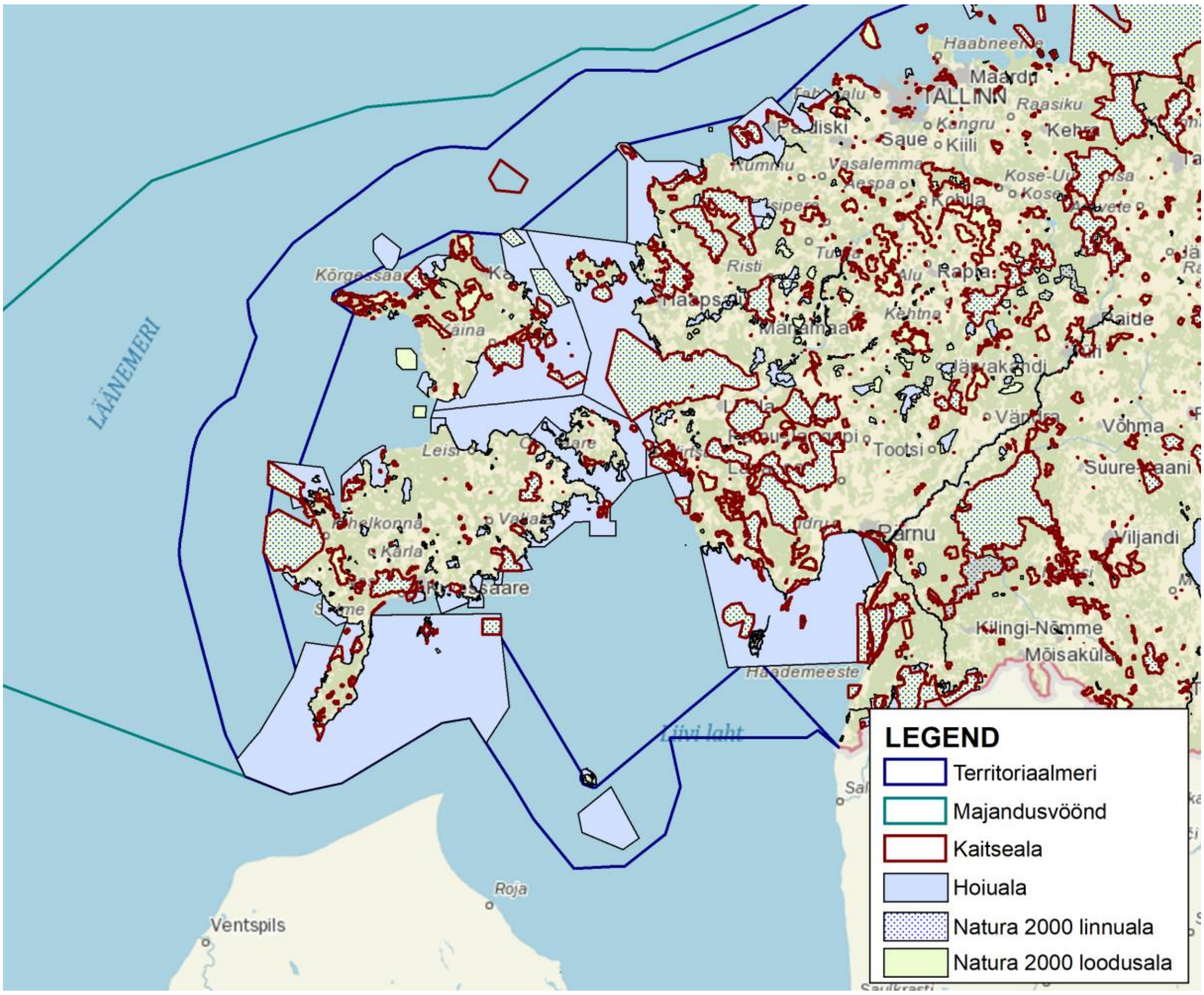

Figure 2.11. Protected areas and limited-conservation areas, and Natura 2000 nature and bird areas in North-Estonian and West-Estonian maritime area (EELIS database (Estonian Nature Information System, Estonian Environment Agency), as of 08.03.2022).

Territoriaalmeri – territorial sea*; Majandusvöönd* – economic zone*; Kaitseala* – protected area*; Hoiuala* – limited-conservation area*; Natura 2000 linnuala* – Natura 2000 bird area*; Natura 2000 loodusala* – Natura 2000 nature area.

Areas of international importance in Estonian maritime area, which are also areas protected by HELCOM (Baltic Marine Environment Protection Commission) are Hiiu shoal (RAH0000669), Väinameri Sea (RAH0000673), Lahemaa (RAH0000065), Pakri (RAH0000671), Vilsandi (RAH0000002), Pärnu Bay (RAH0000672) and KuraKurk/Irbe Strait (RAH0000670) (Figure 2.12).

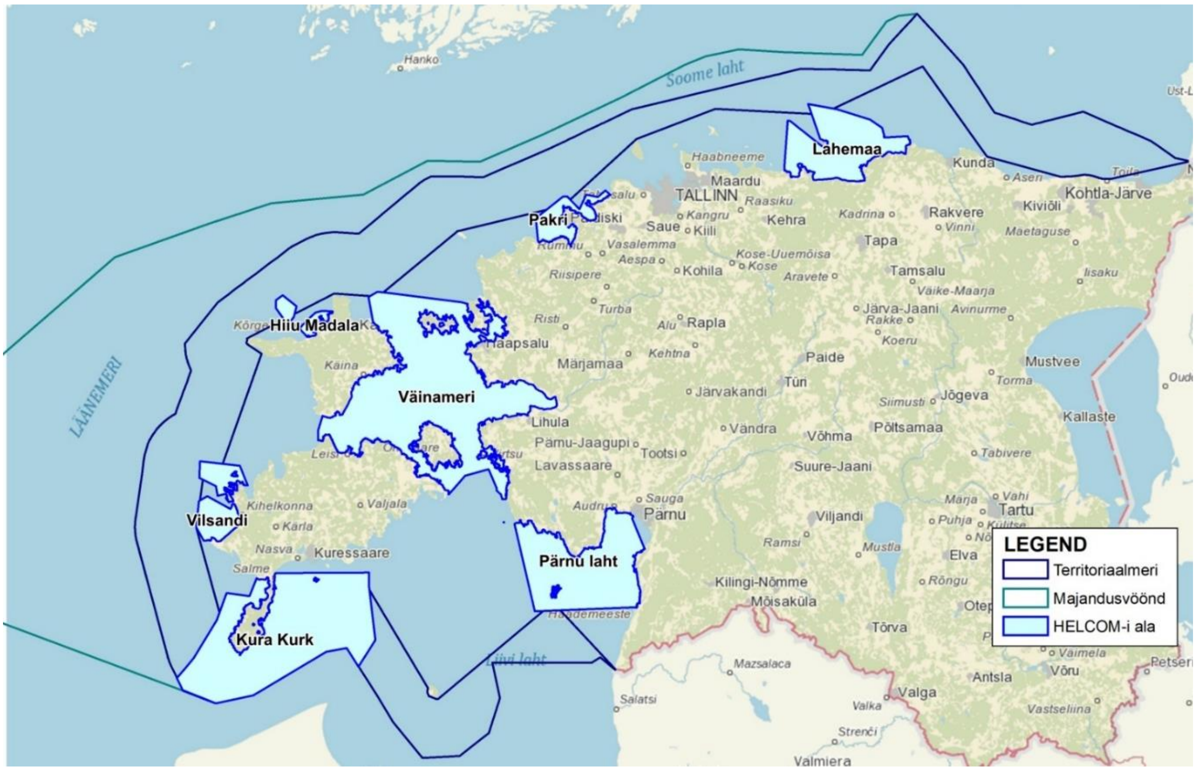

Figure 2.12.1 HELCOM areas in Estonian maritime area (EELIS database (Estonian Nature Information System, Estonian Environment Agency), as of 08.03.2022).

Territoriaalmeri – territorial sea*; Majandusvöönd* – economic zone*; HELCOM-i ala* – HELCOM area.

2.1.7 Mineral resources

There are nine mineral deposits in Estonian maritime area: Haapsalu, Käina, Kõpu, Hiiumadala, Nasva, Naissaare, Kuradimuna, Ihasalu and Letipea. Only two of these mineral deposits, the Haapsalu and Käina mineral deposits, have sea mud as their main mineral resource, while the rest have sand. Mining permits have been issued for the Haapsalu deposit, Tagalahe mining claim (permit no. KMIN-010), the Käina deposit, Käina sea mud quarry (permit no. KMIN-015) and Käina II sea mud quarry (permit no. KMIN-076), the Nasva deposit, Nasva sand quarry mining claim (permit no. KMIN-118) and the Naissaare deposit, mining claim of the Naissaare II sand quarry (permit no. KMIN-089) (EELIS database (Estonian Nature Information System, Estonian Environment Agency), 08.03.2022).

2.2 Pressure factors on the natural environment

There are approximately 85 million people living on the shores of the Baltic Sea, whose activities on land and water have impact on functioning of the Baltic Sea. The impact of some factors is amplified by the slow water exchange of the Baltic Sea, as a result of which, for example, organic substances accumulate and dissolve very slowly (HELCOM, 2018a).

2.2.1 Eutrophication

Eutrophication in the Baltic Sea has been a problem since the 1980s, though, after that, the input of nutrients to the sea has decreased. Nevertheless, in 2015, the input of nitrogen was 7%

and the input of phosphorus was 44% above the permitted limit value, approximately 30% of nitrogen comes from the atmosphere, approximately one third also from natural processes. The annual input of nutrients into the Baltic Sea is estimated at 826,000 tons of nitrogen and 30,900 tons of phosphorus (HELCOM, 2018a). The main source of nitrogen is diffuse load from the land, mainly from agriculture. Also from different types of transport (including shipping), water management, wastewater treatment plants, industrial water and from nearby oceans as well. Phosphorus comes mainly from household and industrial wastewater, and also from fertilizers (European Commission, 2021a).

In a study conducted by Tallinn University of Technology (2021a) „Links between the water quality standards in inland and marine waters and their compatibility", the extent of the natural variability of nutrient contents between coastal sea water types was studied and it was found that the phosphate content in the Gulf of Finland has risen higher in the open sea than in coastal water bodies. In all regions of the open sea, the concentrations of phosphates exceed the limit values (agreed within the framework of HELCOM), including the Northern basin of the open part of the Baltic Sea, where the concentration of phosphates exceeded limit value more than four times. According to the data of the last ten years, the values of nitrite-nitrate content in all studied areas are also higher than the limit values, including the highest contents in the Gulf of Riga, where the limit values are exceeded more than twice.

The main consequence of eutrophication is the proliferation of algae, including potentially toxic blue-green algae, or cyanobacteria. As a result of the proliferation of algae, the transparency of the water decreases, as well as sunlight reaching the deeper water layers of the sea, which in turn affects the living organisms there. Also, the content of organic substances in water and sediment increases, which can be accompanied by a lack of oxygen, which has an impact on living organisms. Mass proliferations of short-lived filamentous algae, formation of loose algal mats and oxygen deficiency under algal mats are also observed in the coastal sea (Ministry of the Environment, 2019a). Eutrophication can also have impact on socio-economic environment through the decrease in fish stocks (Baltic Environmental Forum Estonia, 2009).

Due to human-induced excess nutrients entering the Baltic Sea in the past, a significant amount of phosphorus has accumulated in the bottom sediments. In case of lack of oxygen or low oxygen level, phosphate is released from the sediments, which increases the total load of nutrients to the marine ecosystem and further contributes to the continuation of the vicious cycle of eutrophication in the Baltic Sea. Over the past twenty years, however, the release of nutrients into the water has decreased in almost all parts of the Baltic Sea, while nitrogen release has decreased by 12% and phosphorus release by 26%. The reduction has been achieved primarily by measures imposed on point sources of pollution (e. g. sewage treatment plants, industrial plants) and by limiting the spread of nitrogen through the air, especially in the context of reducing emissions from the energy and transport sectors. However, during the same period, no significant reduction in emissions from diffuse sources has been observed, and nutrients from these sources account for almost 35% of pollution entering the sea via rivers. Despite overall progress regarding nitrogen emissions, emissions still need to be reduced, especially in shipping. Ammonia emissions have remained at their previous levels and have recently even slightly increased, indicating the need for more effective emission reduction measures in the agricultural sector (HELCOM, 2021a).

According to the assessment of the environmental status of the Estonian maritime area (Ministry of the Environment, 2019a), most of the Estonian maritime area did not achieve good status in terms of nutrient concentration. Only Eru- Käsmu coastal water body in the Gulf of Finland had good status, the rest of the sea areas had either poor (7 water bodies), bad (7 water bodies) or very bad (6 water bodies) status. Taking into account both the concentration of nutrients as well as the indicators of direct and indirect impacts of plant nutrients, according to the overall assessment of the impact of aggregated nutrients, the water bodies of the Estonian maritime area and offshore basins have poor (6 water bodies), bad (8 water bodies) or very bad (7 water bodies) status (Figure 2.13). Therefore, the Estonian maritime area has not achieved good environmental status in terms of eutrophication. Compared to the assessments of the previous period (2012), when the assessment was given to the sea area as a whole, the status assessment in 2018 is similar and there has been no apparent deterioration of the status or movement towards a good environmental status.

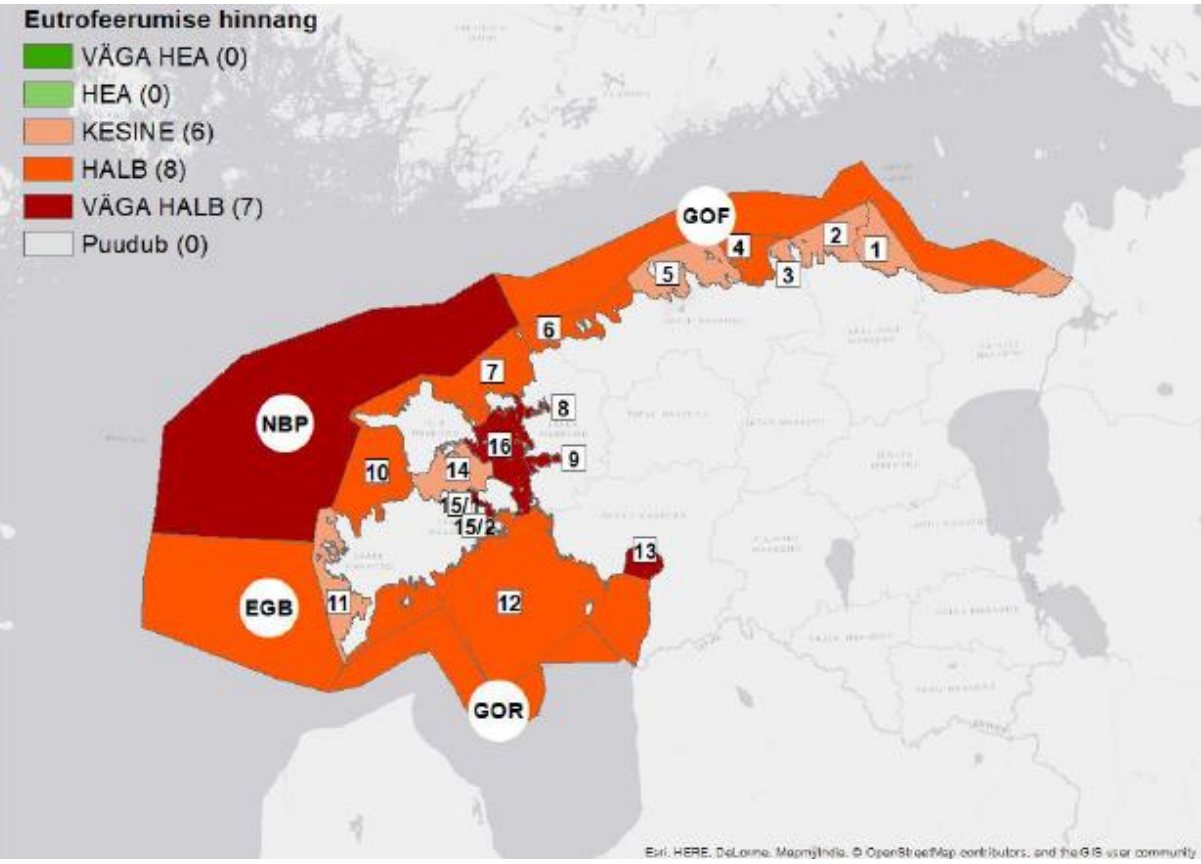

Figure 2.13. Overall assessment of eutrophication, where GOF - Gulf of Finland, NBP - Northern Basin of the open part of the Baltic Sea, EGB - Eastern Gotland Basin, GOR - Gulf of Riga (Ministry of the Environment, 2019a).
***Eutrofeerumise hinnang* – assessment of eutrophication**. *VÄGA HEA* – very good*; HEA* – good*; KESINE* – poor*; HALB* – bad*; VÄGA HALB* – very bad*; Puudub* – missing.

2.2.2 Hazardous substances

Chemicals, heavy metals, pharmaceuticals, etc. reach the Baltic Sea from several different sources (including via water and air), including ship repair, cargo ports, residual pollution sources, wastewater treatment plants, waste water leakages, exhaust gases, pesticides, etc. Although some are easily visible to the eye (e.g. oil slicks), the presence of other substances can only be noticed after the damage has already been done. Many pollutants break down slowly and their impact can be greatly increased when they reach the food web (HELCOM, 2018a). Many compounds are highly volatile and can cross long distances through the air, thereby contributing to the pollution of the marine environment of the Baltic Sea – even if their use is prohibited in HELCOM countries (HELCOM, 2021a).

The Baltic Sea is still strongly affected by hazardous substances, in particular the levels of polybrominated diphenyl ethers (PBDEs), mercury and caesium-137 are still high in all parts of the sea. New pollutants of concern (such as certain pharmaceuticals) have also been found in almost all components of the marine environment. There is still little data on new pollutants of concern and other indicator substances, which is why it is currently not possible to get a comprehensive understanding of the extent of pollution in the Baltic Sea. However, many substances are getting less and less into the Baltic Sea, and some of the most toxic compounds are now prohibited. However, many pollutants remain in the sediments and can get into the water again, for example, during dredging of the seabed or disposal of contaminated sediments at the sea. In this way, they can enter food webs of the marine ecosystem. In addition to that, chemicals and conventional ammunition dumped at sea are still buried on the seabed. There are thousands of substances potentially harmful to the environment in the Baltic Sea, of which only a few hundred are under constant monitoring (HELCOM, 2021a)

Pollution caused by pharmaceutical residues, together with the resulting potential threats to ecosystems and people, is an increasing problem, with pharmaceutical residues reaching the environment during the production, consumption and disposal of pharmaceuticals. The environmental levels and sources of pharmaceutical residues were studied within the framework of the project *Clear Waters from Pharmaceuticals* in drainage basins of one or two rivers of various Baltic Sea countries (including Estonia). The results of the study showed the widespread distribution of pharmaceutical residues in the environment, including in rivers, lakes, coastal waters, sediments and soils. Most often, residues of the anti-epileptic agent carbamazepine were detected, which were found in 100% of coastal water samples. Other pharmaceutical residues frequently found in surface water included tramadol and diclofenac (NSAIDs and pain relievers), cetirizine (asthma and allergy medicines), and venlafaxine and citalopram (psychotropic agents). Many pharmaceutical residues were also found in the sediments of Baltic Sea estuaries and the Pärnu River. The study showed that some of the analyzed pharmaceutical residues, especially some hormones and antibiotics, are present in the environment at dangerous levels. Pharmaceutical residues can negatively affect organisms living in sediments, while several pharmaceutical residues contributed to the combined ecological risk (Henning, Putna-Nimane, Kalinowski et al, 2020).

Pollutants reduce the quality of water in the Baltic Sea and can cause enormous damage to the functioning of the sea. In addition to reducing water quality, pollution can also have impact on living organisms or biological processes. More and more connections are being established between different disease outbreaks and pollutants that affect individual aquatic individuals or even populations (European Comission, 2021b).

Baltic herring (*Clupea harengus membras*), sprat (*Sprattus sprattus Balticus*), flounder (*Platichthys flesus*), Baltic flounder (*Platichtys solemdali*), perch (*Perca fluviatilis*), Atlantic salmon (*Salmo salar*) and river lamprey (*Lampetra fluviatilis*) are commercially caught fish species in Estonia. At the same time, according to the recommendation of the European Commission (2016/688), Baltic herrings, sprats, salmons and river lampreys are fish species for which the content of dioxins, dioxin-like PCBs and non-dioxin-like PCBs from a certain age and size in particular geographical areas is expected not to comply with established limit values of Regulation (EC) no. 1881/2006. In a project conducted by a private company Estonian Environmental Research Center (*Eesti Keskonnauuringute Keskus OÜ*) (2020), the content of pollutants (e. g. lead, cadmium, mercury, dioxins, organotin, etc.) was analyzed in the aforementioned fish species that were caught in different locations (the Gulf of Finland, the Gulf of Riga, the open part of the Baltic Sea). Based on the results of the analysis, regarding food safety, there are mostly no problems with lead, cadmium and mercury in the fish of the Baltic Sea. In one sample of the Gulf of Riga, the maximum value of lead exceeded the established limit value, and the maximum value of cadmium in almost all samples of river lampreys exceeded the limit value for food safety. Regarding food safety, there are also mostly no problems with the content of dioxins and PCBs in the fish of the Baltic Sea. Salmons, however, stood out in terms of high levels of dioxins and PCBs. But regarding environmental quality, the content of PBDEs (polybrominated diphenyl ethers) in the fish of the Baltic Sea can be considered problematic (private company Estonian Environmental Research Center (*Eesti Keskonnauuringute Keskus OÜ*) (2020).

In assessing the environmental status of the Estonian maritime area (Ministry of the Environment, 2019a), the status of fifteen coastal water bodies was assessed as bad, because in all of them the level of mercury in perches exceeded the limit value established by the environmental quality standard (Directive 2013/39/EU). Only Eru-Käsmu coastal water body was not considered as having bad chemical status, but for this reason that during the assessment period no monitoring was conducted there and therefore, data on mercury content in perches of this water body is missing. Mercury level was the highest in perches of Matsalu bay, exceeding the limit value more than nine times. Besides mercury, bad status of Pärnu Bay coastal water body was also caused by anthracene, bromodiphenyl ethers, DEHP and tributyltin cation; nickel and tributyltin cation in Muuga-Tallinn-Kakumäe coastal water body; and nickel in the Gulf of Riga and Kihelkonna coastal water bodies. It is important to point out here, however, that the reliability of the assessments is generally low due to the small number of samples analysed.

In terms of radioactivity, the status of Gulf of Riga is assessed as bad due to high caesium-137 content in Baltic herring, the status of Gulf of Finland is assessed as bad due to high caesium-137 content in Baltic herring and flounder, but for both species, the results show a slight downward trend. The Gulf of Finland has also bad status due to the high content of caesium-137 in the water, but its trend is clearly decreasing as well. Based on the content of caesium-137, the status of the sediments in the Gulf of Finland can be assessed as good, but despite this, the overall assessment of the Gulf of Finland is bad. Here it is also important to point out that the reliability of the assessment for the Gulf of Riga is low, for the Gulf of Finland it is average.

The impact of hazardous substances on the biota was assessed on the basis of white-tailed eagle's productivity – white-tailed eagle's nesting success and brood size are good, so this indicator shows good status. Regarding Baltic herring and river lamprey dioxins and dioxin-like PCBs, the content of pollutants in natural seafood in the Gulf of Riga and the Gulf of Finland exceeds the limit values established by the Regulation (EC) No. 1881/2006 for food safety. In the mouth of the Gulf of Finland, the content of the same substances in flounder exceeds the limit value. The content of the rest of the pollutants and/or the same substances in other organisms are either within the limit or have not been analyzed, and on the basis of this criterion, good environmental status has not been achieved. Due to the lack of regular monitoring, the reliability of the status assessment is low.

In the previous status assessment of the maritime area (2012), regarding hazardous substances, the status was assessed as mostly good, but due to the lack of data, it was not possible to give an assessment with regard to many substances. The most important difference was the situation regarding heavy metals in the marine environment and the concentration of dioxins in fish, which in the previous period were assessed as good. The assessments were conducted with different methodologies, so it is not possible to determine with certainty whether it is an actual deterioration of good environmental status or a more accurate assessment. Probably more accurate results were obtained with the 2018 assessment, because the status is stably bad, neither signs of improvement nor deterioration have been observed.

2.2.3 Marine litter (incl micro-litter)

Marine litter, including micro-litter, comes from a variety of sources in land and at the sea. Marine litter is a visible problem on the coasts of the Baltic Sea, but it also occurs in deeper water layers in different sizes. Litter with larger size can be harmful to animals if swallowed or entangled in it. Micro-litter, invisible to human eye, returns to humans through the food chain. Approximately 70% of the garbage in the Baltic Sea is made up of plastic, which is a separate problem due to the nature of the material and its slow decomposition. Although marine litter is harmful to the environment, it also has impact on the social environment, affecting people's activities (e. g. tourism, free-time activities) and health. It can also have a negative impact on fishing gear (e. g. by breaking a net), contaminate the caught fish and also affect navigation. There may also be a link between marine litter and the spread of alien species (HELCOM, 2018a).

Garbage can get into the sea from beaches, rivers, wastewater, during fishing, as a result of recreation and tourism activities, illegally or accidentally littering, as a result of ship accidents, underwater mining and other activities (European Commission, 2021c). Shipping, fisheries, aquaculture and offshore facilities can be sources of marine litter, for example, through accidental or deliberate discharges from cargo or cruise vessels. Micro-litter, including plastic micro-particles, get into the marine environment mainly through wastewater, untreated or insufficiently treated precipitation water and snowmelt water. Its source can also be the breakdown of larger plastic garbage in the environment (HELCOM, 2021a). Fishing nets piled up on the seabed have a significant negative impact on the environment, as various animal species nesting or hunting in the sea get entangled in them. Marine litter has a long-term negative impact – initially larger litter breaks down into micro-litter over time, and different chemical effects can occur during the degradation process (HELCOM, 2018a).

In a study conducted by the University of Tartu, Estonian Marine Institute (2020a) „Marine Litter of Small Estonian Islands" it was concluded that the proportion of plastic in the amount of garbage collected on islands without permanent human settlement was between 12-80%, but together with foam plastic, it made up 30-90% of the garbage (Figure 2.14). The limit to determine the good environmental status is defined as the presence of up to 20 items of garbage on a 100 m long coastline, and the studied small islands had achieved good environmental status during the study period. However, it was pointed out that the reduction in the amount of garbage on the coastline was expected to be due to litter clean-up and was not due to a reduction in marine pollution. Here it is important to note that the amount of plastic in bird nests correlates with the garbage pollution load in the area, and during the study, it was found that in up to approximately 75% of the found nests, depending on the region, using garbage was observed. During the study, littering of islands with as many different locations as possible was observed, and based on the results, it can be said that littering the islands of the Gulf of Riga and the Väinameri Sea is considerably less than littering the islands open to the open part of the Baltic Sea.

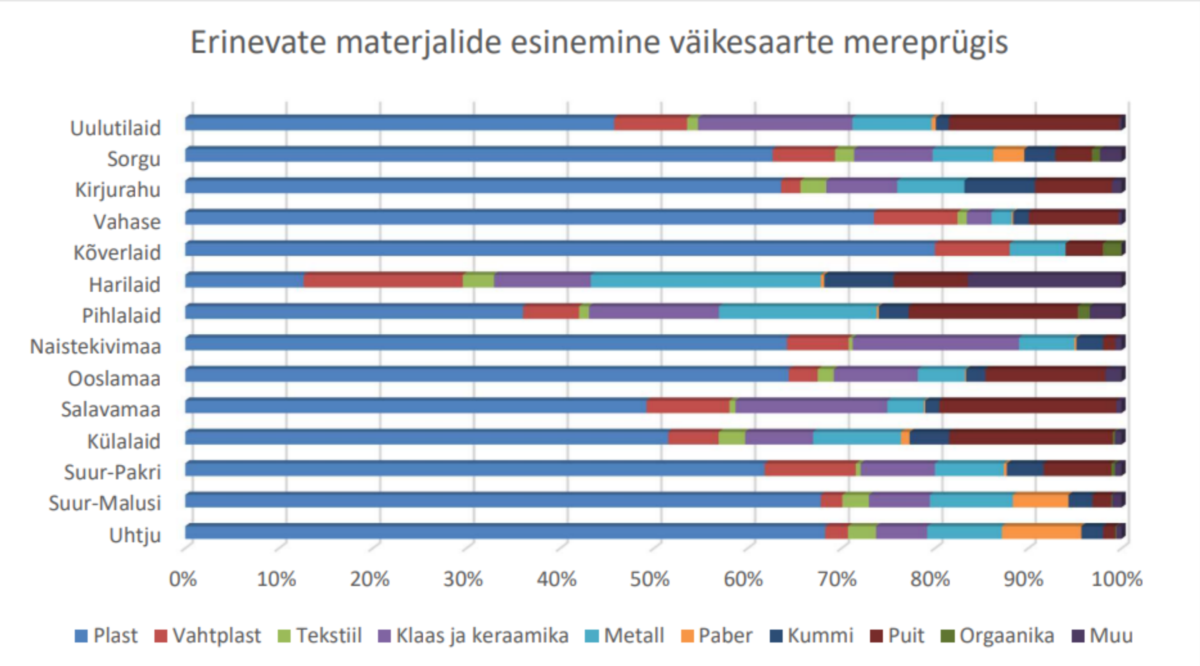

Figure 2.14. Distribution of various materials among the litter found on Estonian small islands, shown for each island (University of Tartu, Estonian Marine Institute, 2020a).
***Erinevate materjalide esinemine mereprügis* – Occurrence of different materials in marine litter**.
Plast – *plastic;* vahtplast – *foam plastic;* tekstiil – *textile;* klaas ja keraamika – *glass and ceramics;* metall – *metal;* paber – *paper;* kummi – *rubber;* puit – *wood;* orgaanika – *organic material;* muu – *other*.

The main possible sources of marine litter, especially microplastics getting into the marine environment in the coastal area of Estonia are cosmetics and hygiene products, plastic industries, synthetic textiles, transport, construction, artificial turf fields, fishing, maritime activities and maritime tourism, and industries. But their main distribution routes are via sewage treatment plants (wastewater and sewage sludge), precipitation water and snow removal from settlements, atmospheric deposition, rivers, ports and beaches. In the surface layer of the Estonian marine environment, monitoring of micro-litter has been carried out in different seasons from the open part of the Gulf of Tallinn, the central part of the Gulf of Finland, the open part of the Baltic Sea, the Gulf of Riga, the Väinameri Sea, the inflow area of the Pärnu and Narva rivers, and the outlet area of the Tallinn and Sillamäe wastewater treatment plants. The results show that the amounts of microplastics in the surface layer of the Estonian maritime area vary by region, season and year, but the average annual amounts have remained below 0,3 particles/m^3 in different regions. In 2018, it was the first time when micro-litter samples were collected throughout the whole water column in the central part of the Baltic Sea, the Gulf of Riga and the open part of the Gulf of Finland. The amounts of micro-litter were larger in the central part of the Baltic Sea (3,9 particles m^{-3}) and in the open part of the Gulf of Riga (3,3 particles m^{-3}). 27-45% of the total amount of micro-litter was made up of microplastics, of which the largest part (32-63%) was pieces of paint, followed by plastic fibers (30-45%) and plastic pieces (5-24%). The amount of micro-litter in fauna (fish and shellfish) caught in different regions of the Estonian maritime area was also analysed. The results showed that microplastics was detected in 43% of the analyzed juvenile flounders and in 24% of the adult flounders, while in sprats microplastics was detected in 8% of the analyzed fish. When comparing fish by lifestyle, the digestive tracts of benthic fish contained more microplastics than pelagic fish. Regarding mussels, microplastic fibers were found in six individuals out of 39 mussels analyzed (Lips et al, 2020).

In assessing environmental status of the Estonian maritime area (Ministry of the Environment, 2019a), the composition, amount and spatial distribution of macro-litter (larger than 5 mm) and micro-litter (smaller than 5 mm) were assessed. As for macro-litter, good environmental status has not been achieved regarding litter found on the coastline. Status of the beaches of the Gulf of Finland and the Gulf of Riga can be assessed as bad, and status of the beaches of the open part of the Baltic Sea as poor. The assessment regarding macro-litter on the seabed shows a good status for all natural parts of the sea and for 2/3 of the areas affected by human activities, so the status assessment regarding macro-litter on the seabed is good. In terms of the composition, amount and spatial distribution of macro-litter, the overall status assessment for the Gulf of Finland is bad and for the Gulf of Riga and for the open part of the Baltic Sea poor, which is why a good environmental status has not been achieved as a whole. Micro-litter was assessed only in the surface layer of the sea, as it was not possible to give an assessment of the bottom sediments due to the lack of data. The assessment showed a good environmental status for all studied parts of the sea, which is why in terms of the composition, quantity and spatial distribution of micro-litter, the good environmental status of the sea was considered achieved. However, based on Laas&Lips (2022), later studies have shown that although mostly the amounts of micro-litter are decreasing, an increase in the amounts of micro-plastics has also been found. For example, compared to the first measurements (2016-2017), larger amounts of microplastics have been found in individual stations of all basins, which, based on the monitoring data of 2018, resulted in the conclusion that in the Northern basin of the open part of the Baltic Sea, good environmental status has not been achieved.

In the previous status assessment of maritime area (2012), no assessment was made of the indicators related to marine litter, so it is not possible to say unequivocally whether the status has improved, worsened or remained the same.

2.2.4 Underwater noise

Anthropogenic underwater noise can increase natural noise levels to polluting levels. Underwater sounds are heard much further from the source of the sound, and two types of noise can be distinguished – continuous and impulse noise. Anthropogenic continuous noise can come from car traffic on bridges, wind turbines located in water, shipping, etc. But continuous noise can prevent communication between animals and the signals necessary for orientation. Impulse noise can be caused by underwater blasting and similar short-term noise-generating activities. Such noise can scare animals away from places that are important to them (e. g. feeding, nesting and spawning areas). There is also a risk that the animals would temporarily or permanently lose their hearing, but on which they are dependent as a means of orientation, communication and hunting (HELCOM, 2018a; OceanCare, April 2022).

Depending on the distance between the source and the receiver, four zones are used to assess the impact of noise on marine biota, in which the noise (Klauson and Laanearu, 2018):

1) is audible;
2) induces behavioral responses in marine animals;
3) increases the stress of marine animals and disrupts their development ;
4) masks the communication of marine animals;
5) brings about injury and/or death.

Dangerous zone is in the vicinity of the noise source, within which the sound pressure is high enough to cause tissue damage in a living organism, causing a temporary increase in the hearing threshold, a permanent increase in the hearing threshold, or even more serious damage (e. g.

death of a living organism). So significant damage is caused by impulse noise, the harmful impact of continuous noise is limited to the aforementioned impacts 1-4 (Klauson and Laanearu, 2018).

Aquatic animals have a complex anatomy to detect sound. Marine mammals of the Baltic Sea (grey seal, ringed seal and harbour porpoise) have developed underwater hearing abilities. Some fish species in the Baltic Sea (e. g. Atlantic herring and cod) have good hearing (mostly at low frequencies), the ability to generate sound and the ability to respond to sounds. Little is known about how the other fish species and most of the invertebrates in the Baltic Sea hear and use sound. Nevertheless, it is assumed that for most marine species, underwater sound is likely to be part of their communication during some life cycle (Klauson and Laanearu, 2018).

According to status assessment regarding underwater noise (Tallinn University of Technology, 2018), anthropogenic noise in the Gulf of Finland exceeds the high natural noise level 5% of the time, and this is due to shipping fairways located in the middle of the gulf. In Estonian open sea area, the natural noise level is higher than in the Gulf of Finland and there is less anthropogenic noise. The Gulf of Riga and Väinameri Sea are the quietest areas of the Estonian maritime area (Klauson and Laanearu, 2018). Important habitats for seals are located in the Gulf of Finland and Väinameri Sea, so ship traffic can generate high-frequency noise levels that can disturb the local population of seals. At the same time, there is also a sufficiently large sea area with natural sound levels where marine animals are not significantly disturbed by ship noise (Ministry of the Environment, 2019a).

The assessment of the environmental status of the Estonian maritime area (Ministry of the Environment, 2019a) assessed the spatial extent, duration and level of impulse sound and continuous low-frequency sound. Anthropogenic impulse sound in the Estonian maritime area has been mapped (Figure 2.15), but there are no agreed assessment methodologies yet. Based on the insufficiency of existing assessments of how impulse noise impacts marine biota, it is not possible to assess whether a good environmental status has been achieved in terms of impulse sound or not.

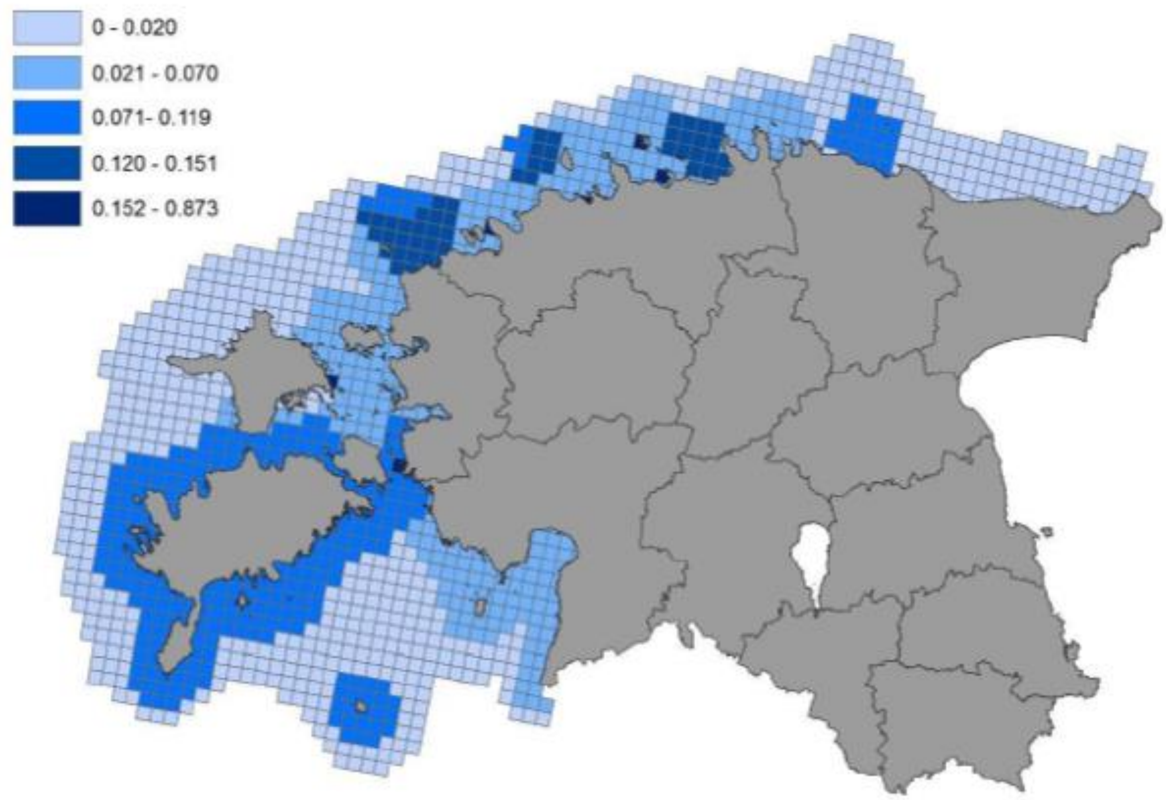

Figure 2.15. A map of cumulative pressures characterizing anthropogenic impulse noise impacting the marine environment. The value of the index is between 0 and 1, with a higher value reflecting greater pressure (Tallinn University of Technology, Department of Marine Systems, 2016; Ministry of the Environment, 2019a).

Anthropogenic continuous sound in the Estonian maritime area has also been mapped (Figure 2.16), but there are no agreed assessment methodologies yet. Based on the insufficiency of existing assessments of how low-frequency continuous noise impacts marine biota, it is not possible to assess whether a good environmental status has been achieved in terms of continuous sound or not.

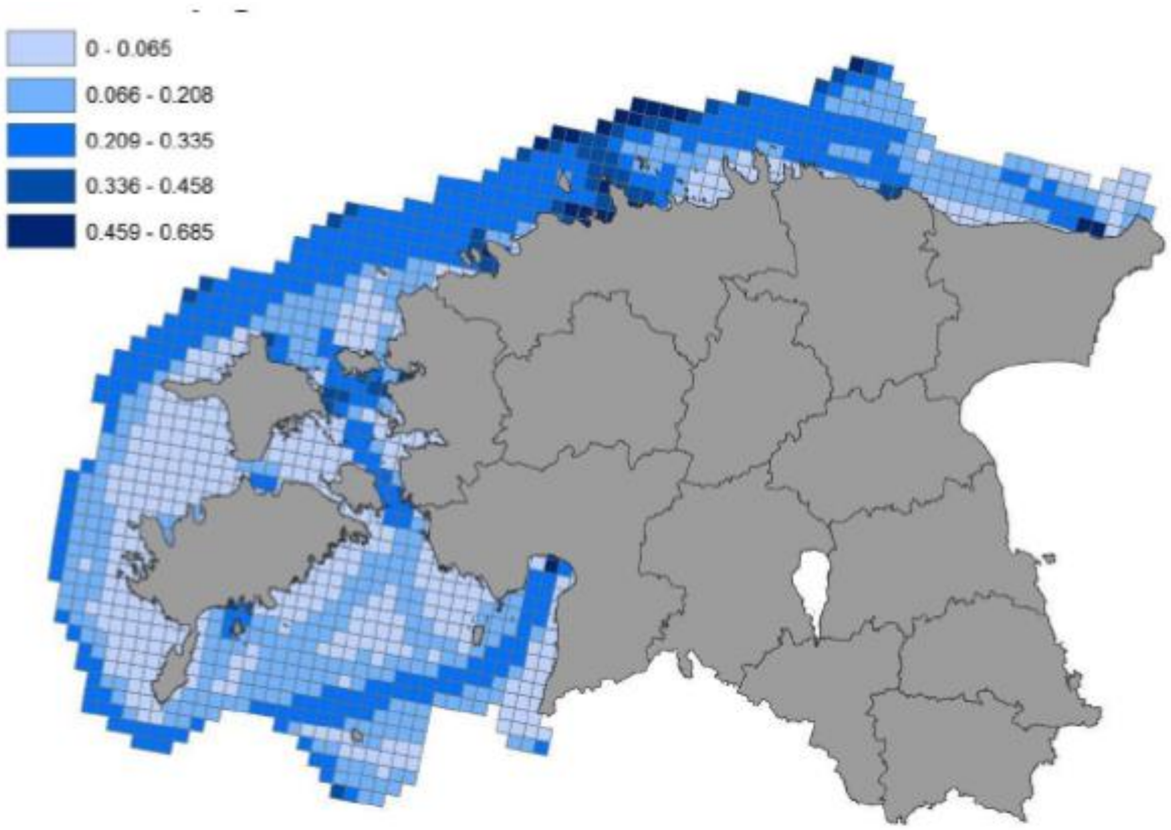

Figure 2.16. A map of cumulative pressures characterizing anthropogenic continuous noise impacting the marine environment. The value of the index is between 0 and 1, with a higher value reflecting greater pressure (Tallinn University of Technology, Department of Marine Systems, 2016; Ministry of the Environment, 2019a).

In the previous status assessment of maritime area (2012), no assessment was made of the indicators related to underwater noise, so it is not possible to say unequivocally whether the status has improved, worsened or remained the same.

2.2.5 Alien species

Alien species reach the Baltic Sea as a result of human activities, especially in ballast water by fishing and maritime transport. Approximately 140 alien species or species of unknown origin have found their way to the Baltic Sea. Over time, alien species adapt to new environmental conditions and may begin to spread very widely, becoming invasive and also affecting the food chain. There may also be a risk of affecting biological diversity and ecosystems (HELCOM, 2018a; European Commission, 2021d).

Ships carrying cargo arriving from outside the Baltic Sea have brought and continue to bring alien species with them. That is why in cooperation with Tallinn University of Technology and the University of Tartu, a ship ballast water survey was conducted (2020), in which microbiological and molecular genetic samples were taken from the ballast water of ships coming from outside the Baltic Sea (before arriving at the port, the ship had to have visited ports outside the Baltic Sea). As a result of the study, it was found that the greatest variability in the species richness of microbes occurred especially in samples taken from the North Sea, the ballast samples of the Atlantic Ocean and the samples of Muuga harbour, although the level of species richness was generally similar in all samples. The core community of ballast water from different locations was also described, which describes the most abundant taxa in the microbial community. The core community of Muuga harbour was most similar to the Baltic Sea and Kattegat ballast water core communities, containing mostly representatives from the following orders: *Microtrichales*, *Frankiales*, *Flavobacteriales* and *Corynebacteriales*. Also, the core community of Muuga harbour differed from that of the Baltic Sea only in terms of the abundance of *Campylobacteriales* bacteria. However, the core communities of the North Sea and Atlantic Ocean ballast water were the most distinctive, where *Campylobacteriales* was the dominant order in the Atlantic Ocean ballast water, and numerous representatives of *Enterobacteriales* were present in the North Sea ballast water. (Künnis-Beres and Kisand, 2020).

It follows from the status assessment regarding alien species (University of Tartu, 2018) that two new alien species (*Laonome sp* and *Rangia cuneata*) have been registered in the Estonian maritime area during the last years, which were probably brought here by human activities, therefore, regarding the indicator *the number of new alien species introduced into nature through human activities in the period under assessment (6 years)*, good environmental status has not been achieved. Also, good environmental status has not been achieved regarding the indicators *the proportion of alien species in benthic macroinvertebrate community* and *the level of biological pollution*, but good environmental status has been achieved regarding the indicator *the proportion of alien species in pelagic zooplankton community*. It was also pointed out in the status assessment that due to the static arrangement of the monitoring stations, it is not possible to assess the extent of habitats affected by alien species. However, based on monitoring/scientific results so far, several habitats have been affected by alien species (based on EUNIS 2004 classification): rocky bottom of moderately open circalittoral of the Baltic Sea (A4.5), sublittoral muddy bottom (A5.3), sublittoral mixed sediment (A5.4), bottom dominated by sublittoral macrophytes (A5.5), completely mixed water column with reduced salinity (A7.2) and partially mixed water column with reduced salinity and medium or long residence time (A7.4) (Martin and Ojaveer, 2018).

In the previous maritime area's status assessment period (2012), a good environmental status was not achieved in terms of alien species. Decision (EU) 2017/848 of the European Commission, 17 May 2017, provides for the criteria and methodological standards for the good environmental status of the maritime area, as well as the specifications and standard methods for monitoring and assessment. With the same decision, decision 2010/477/EU, which previously defined the previous criteria for good environmental status, was repealed (Martin and Ojaveer, 2018). Based on the new criteria, which are somewhat different from the previous ones, it is difficult to make a direct comparison of whether the status improved, worsened or remained the same. Therefore, changes cannot be clearly determined.

2.2.6 Fishing for living resources

Fishing for living resources has been an important source of income for people living on the shores of the Baltic Sea. The catch is used both for food and as raw material in other industries (e.g. fish oil production). However, stocks should be used sustainably so that fishing/hunting is also possible in the future. This is also one of the reasons why overfishing of living resources may be harmful to the environment. Overfishing may lead to a significant reduction in stocks or even extinction of some species. This in turn may have also an impact on food chain. The European fishing sector currently depends on young and small fish that are caught before they are able to reproduce (HELCOM, 2018a; European Commission, 2021e)

Large areas of the Baltic Sea are involved in fishing and it has direct impact on the species caught as well as the species and habitats to be protected (Figure 2.17). Most commercial fish stocks in the Baltic Sea currently do not have good status in terms of biomass, and fish mortality is a concern for many fish stocks. Fishing also causes changes in the food web, changes the size and age distribution of the population and reduces the reproductive capability and resistance of both fish and other marine organisms (HELCOM, 2021a).

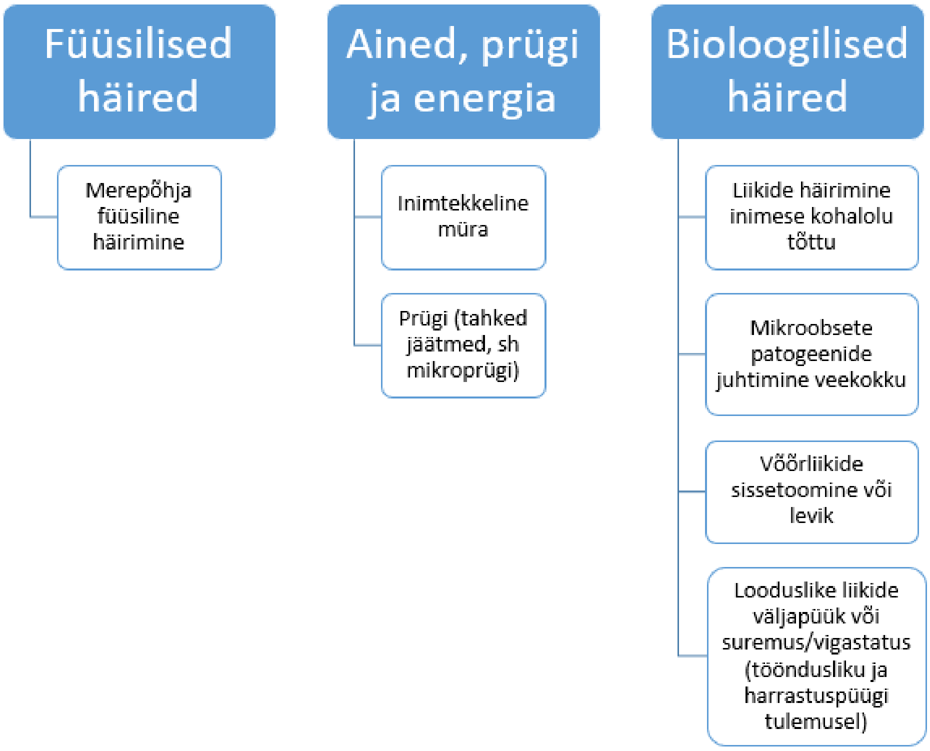

Figure 2.17. Pressures caused by the harvesting of living resources (including plants) (Ministry of the Environment, 2019a).
***Füüsilised häired* – physical disturbances**: *merepõhja füüsiline häirimine* – physical disturbance of seabed.
***Ained, prügi ja energia* – substances, litter and energy**: *inimtekkeline müra* – anthropogenic noise; *prügi (tahked jäätmed, sh mikroprügi)* – litter (solid waste, incl micro-litter).
***Bioloogilised häired* – biological disturbances**: *liikide häirimine inimese kohalolu tõttu* – disturbance of species due to human presence; *mikroobsete patogeenide juhtimine veekokku* – the introduction of microbial pathogens into the water body; *võõrliikide sissetoomine või levik* – the introduction or spread of alien species; *looduslike liikide väljapüük või suremus/vigastatus (tööndusliku ja harrastuspüügi tulemusena)* – catching or mortality/injury of wild species (as a result of commercial and recreational fishing).

A socio-economic overview of fisheries and aquaculture is presented in ch 2.3.2 Fishing and 2.3.3 Aquaculture.

In assessing the environmental status of the Estonian maritime area (Ministry of the Environment, 2019a), assessments of good environmental status were given based on the catch or mortality/injury of natural species as a result of commercial fishing. Of the fish assessed (Baltic herring, sprat, flounder, perch, pikeperch, salmon), the good status was achieved only regarding fishing mortality of Baltic spring spawning herring in the open sea and the ratio of the biomass of commercial flounder fishing to the biomass of monitoring fishing (Figure 2.18). As for the rest of the indicators, the good environmental status has not been achieved. There is no assessment of the impact of recreational fishing, but its impact is probably smaller than that of commercial fishing.

Indikaatori kood	Indikaatori nimetus	Seisund
D3C1.1	Kevadkuduräime (*Clupea harengus membras*) Eesti mereala (v.a. Liivi laht) asurkonna kalastussuremus	HKS saavutatud
D3C1.2	Kevadkuduräime (*Clupea harengus membras*) Liivi lahe asurkonna kalastussuremus	HKS pole saavutatud
D3C1.3	Kilu (*Sprattus sprattus balticus)* kalastussuremus	HKS pole saavutatud
D3C1.4	Lesta (*Platichthys flesus*) kutselise kalapüügi saagi biomassi suhe biomassiga seirepüükides	HKS saavutatud
D3C1.5	Ahvena (*Perca fluviatilis*) kutselise kalapüügi saagi biomassi suhe biomassiga seirepüükides	HKS pole saavutatud
D3C1.6	Koha (*Sander lucioperca*) kutselise kalapüügi saagi biomassi suhe biomassiga seirepüükides	HKS pole saavutatud
D1C5	Lõhi (*Salmo salar*) laskujate arvukus võrreldes maksimaalse loodusliku potentsiaalse arvukusega	HKS pole saavutatud

Figure 2.18.2 Indicators and assessments characterizing the fishing mortality of commercial fishing (Ministry of the Environment, 2019a).

***Indikaatori kood* – indicator code**. ***Indikaatori nimetus* – name of the indicator:** *Kevadkuduräime (Clupea harengus membras) Eesti mereala (v. a. Liivi laht) asurkonna kalastussuremus* – fishing mortality of Baltic spring spawning herring's (*Clupea harengus membras*) population in Estonian maritime area (except the Gulf of Riga); *Kevadkuduräime (Clupea harengus membras) Liivi lahe asurkonna kalastussuremus* – fishing mortality of Baltic spring spawning herring's (*Clupea harengus membras*) population in the Gulf of Riga; *Kilu (Sprattus sprattus Balticus) kalastussuremus* – fishing mortality of sprat (*Sprattus sprattus Balticus*); *Lesta (Platichthys flesus) kutselise kalapüügi saagi biomassi suhe biomassiga seirepüükides* – the biomass of commercial flounder (*Platichthys flesus*) fishing to the biomass of monitoring fishing; *Ahvena (Perca fluviatilis) kutselise kalapüügi saagi biomassi suhe biomassiga seirepüükides* – the biomass of commercial perch (*Perca fluviatilis*) fishing to the biomass of monitoring fishing; *Koha (Sander lucioperca) kutselise kalapüügi saagi biomassi suhe biomassiga seirepüükides* – the biomass of commercial pikeperch (*Sander lucioperca*) fishing to the biomass of monitoring fishing; *Lõhi (Salmo salar) laskujate arvukus võrreldes maksimaalse loodusliku potentsiaalse arvukusega* – the abundance of salmon (*Salmo salar*) smolts compared to maximum natural potential abundance.
Seisund – ***status***: HKS saavutatud – *good environmental status achieved* HKS pole saavutatud – *good environmental status not achieved*.

In assessing environmental status, the mortality rate of seabirds and seals due to accidental bycatch was assessed as well, but the available data is not sufficiently reliable, therefore, data on avifauna cannot be used for a species-specific assessment of the mortality rate due to bycatch. However, there is reason to assume that it is an important pressure factor for several species. According to official statistics, bycatch of seals is minimal. Due to insufficient data, it is not possible to unequivocally decide whether bycatch is a significant pressure factor for seabirds or seals, but it can be assumed that this is the case.

2.2.7 Seabed loss and disturbance

Seabed is an important factor for biological diversity of marine biota and for the resources necessary for life. As a result of human activity, the structure there may be changed, such activities include underwater mining, certain fishing methods, pollution, introduction of alien species, etc. Some activities have direct impact on seabed, while others have an indirect impact (e.g. reducing water transparency), with some activities being permanent, others temporary. According to the latest data (2011-2016), less than 1% of the original natural habitat of the Baltic Sea has been lost, but about 40% has been disturbed (HELCOM, 2018a; European Commission, 2021f).

In addition to shipping, fishing and other activities, sinking of dangerous objects into the sea (e.g. ammunition thrown into the sea, combat equipment and shipwrecks containing oil) is also a factor that disturbs the seabed. In the course of such activities, hazardous substances can be released, which is why such objects are sources of pollution. They also become physical obstacles on the seabed, endangering also people working at the sea (HELCOM, 2021a).

Assessing the environmental status of the Estonian maritime area (Ministry of the Environment, 2019a) was based on the spatial distribution and area of direct physical disturbance of the seabed. For this purpose, the areas of all seabed-disturbing activities (dredging, dumping at sea, mining, red algae trawling, and facilities) were summed up. In terms of physical disturbance of the seabed, environmental status of the Estonian maritime area can be considered good, because the proportion of the disturbed area of all habitat types is less than the conditional threshold of 10% (Figure 2.19). However, it is important to point out that for the large shallow bay habitat type, the proportion of disturbed area is just below the threshold, and the reliability of the assessment is not high. Nevertheless, there is no reason to consider disturbance of the seabed as a significant damage to the status of the sea in Estonia. Good environmental status was also achieved in the previous assessment period (2012).

Indikaatori kood	Indikaator	Hinnang
D6C3.1	Füüsiliselt häiritud elupaigatüübi liivamadalad (kood 1110) pindala	96.1 km2 ehk 3,2% kogu elupaigatüübi pindalast Eesti merealal;
D6C3.2	Füüsiliselt häiritud elupaigatüübi jõgede lehtersuudmed (kood 1130) pindala	1,1 km2 ehk 1,6% kogu elupaigatüübi pindalast;
D6C3.3	Füüsiliselt häiritud elupaigatüübi laugmadalikud (kood 1140) pindala	12,3 km2 ehk 6,4% kogu elupaigatüübi pindalast;
D6C3.4	Füüsiliselt häiritud elupaigatüübi laiad madalad lahed (kood 1160) pindala	19,4 km2 ehk 9,7% kogu elupaigatüübi pindalast;
D6C3.5	Füüsiliselt häiritud elupaigatüübi karid (kood 1170) pindala	24.0 km2 ehk 0,68% kogu elupaigatüübi pindalast.

Figure 2.19. Indicators characterizing the extent of the damaged seabed habitat type, and status assessments (Ministry of the Environment, 2019a).

***Indikaatori kood* – indicator code. *Indikaatori nimetus* – name of the indicator. *Hinnang* – assessment.**
Füüsiliselt häiritud elupaigatüübi liivamadalad (kood 1110) pindala – 96,1 km^2 ehk 3,2% kogu elupaigatüübi pindalast Eesti merealal: the area of physically disturbed habitat type sandy shoals (code 1170) – 96,1 km^2 or 3,2% of the total area of the habitat type
Füüsiliselt häiritud elupaigatüübi jõgede lehtersuudmed (kood 1130) pindala – 1,1 km^2 ehk 1,6% kogu elupaigatüübi pindalast: the area of physically disturbed habitat type estuaries (code 1170) – 1,1 km^2 or 1,6% of the total area of the habitat type
Füüsiliselt häiritud elupaigatüübi laugmadalikud (kood 1140) pindala – 12,3 km^2 ehk 6,4% kogu elupaigatüübi pindalast: the area of physically disturbed habitat type shallow inlets (code 1170) – 12,3 km^2 or 6,4% of the total area of the habitat type
Füüsiliselt häiritud elupaigatüübi laiad madalad lahed (kood 1160) pindala – 19,4 km^2 ehk 9,7% kogu elupaigatüübi pindalast: the area of physically disturbed habitat type large shallow bays (code 1170) – 19,4 km^2 or 9,7% of the total area of the habitat type
Füüsiliselt häiritud elupaigatüübi karid (kood 1170) pindala – 24,0 km^2 ehk 0,68% kogu elupaigatüübi pindalast: the area of physically disturbed habitat type reefs (code 1170) – 24.0 km^2 or 0,68% of the total area of the habitat type.

In order to assess the physical loss of the seabed, the assessment of the environmental status of the Estonian maritime area (Ministry of the Environment, 2019a) described the spatial distribution and area of the physical loss of the natural seabed, summing up the areas of all such activities and facilities (ports, dams, cables, dredging, dumping and coastal protection structures), the result of which has been physical loss of the natural seabed. The proportion of the lost area of all assessed habitat types is significantly below the conditional threshold of good environmental status (up to 5% destroyed), which is why direct physical loss of the seabed is not a significant factor among the factors damaging the status of the Estonian maritime area (Figure 2.20). The pressure on the seabed was also mostly at a good level in the previous assessment period (2012), but due to updating the indicators in the meantime, a detailed comparison between the periods is complicated.

Indikatori kood	Indikaator	Hinnang
D6C4.1	Loodusliku merepõhja inimtekkelise füüsilise kao tõttu hävinud elupaigatüübi liivamadalad (kood 1110) pindala	18.1 km2 ehk 0.61% kogu elupaiga modelleeritud pindalast;
D6C4.2	Loodusliku merepõhja inimtekkelise füüsilise kao tõttu hävinud elupaigatüübi jõgede lehtersuudmed (kood 1130)	0,009 km2 ehk 0,012% kogu elupaigatüübi pindalast;
D6C4.3	Loodusliku merepõhja inimtekkelise füüsilise kao tõttu hävinud elupaigatüübi laugmadalikud (kood 1140) pindala	1,7 km2 ehk 0,91% kogu elupaigatüübi pindalast;
D6C4.4	Loodusliku merepõhja inimtekkelise füüsilise kao tõttu hävinud elupaigatüübi laiad madalad lahed (kood 1160)	0,59 km2 ehk 0,30% kogu elupaigatüübi pindalast;
D6C4.5	Loodusliku merepõhja inimtekkelise füüsilise kao tõttu hävinud elupaigatüübi karid (kood 1170) pindala	6,5 km2 ehk 0,18% kogu elupaigatüübi pindalast.

Figure 2.20. Indicators characterizing the proportion of habitat type destroyed due to human activity, and status assessments (Ministry of the Environment, 2019a).

***Indikaatori kood* – indicator code. *Indikaatori nimetus* – name of the indicator. *Hinnang* – assessment.**
Loodusliku merepõhja inimtekkelise füüsilise kao tõttu hävinud elupaigatüübi liivamadalad (kood 1110) pindala – 18,1 km^2 ehk 0,61% kogu elupaiga modelleeritud pindalast: the area of sandy shoals (code 1110) habitat type destroyed due to anthropogenic physical loss of the natural seabed – 18,1 km^2 or 0,61% of the total modeled area of the habitat
Loodusliku merepõhja inimtekkelise füüsilise kao tõttu hävinud elupaigatüübi jõgede lehtersuudmed (kood 1130) pindala – 0,009 km^2 ehk 0,012% kogu elupaiga pindalast: the area of estuaries (code 1130) habitat type destroyed due to anthropogenic physical loss of the natural seabed – 0,009 km^2 or 0,012% of the total area of the habitat
Loodusliku merepõhja inimtekkelise füüsilise kao tõttu hävinud elupaigatüübi laugmadalikud (kood 1140) pindala – 1,7 km^2 ehk 0,912% kogu elupaiga pindalast: the area of shallow inlets (code 1140) habitat type destroyed due to anthropogenic physical loss of the natural seabed – 1,7 km^2 or 0,91% of the total area of the habitat
Loodusliku merepõhja inimtekkelise füüsilise kao tõttu hävinud elupaigatüübi laiad madalad lahed (kood 1160) pindala – 0,59 km^2 ehk 0,30% kogu elupaiga pindalast: the area of large shallow bays (code 1160) habitat type destroyed due to anthropogenic physical loss of the natural seabed – 0,59 km^2 or 0,30% of the total area of the habitat
Loodusliku merepõhja inimtekkelise füüsilise kao tõttu hävinud elupaigatüübi karid (kood 1170) pindala – 6,5 km^2 ehk 0,18% kogu elupaiga pindalast: the area of reefs (code 1170) habitat type destroyed due to anthropogenic physical loss of the natural seabed – 6,5 km^2 or 0,18% of the total area of the habitat

Regarding changes in hydrographical conditions, the spatial distribution and area of the changes were described, taking into account port facilities and the Dam of Väike väin (Väike Strait). To assess the changes, hydrographical changes were linked to specific habitats (Figure 2.21). Hydrographical changes do not pose a significant threat to the Estonian marine environment, because the proportion of the hydrographically changed area of all assessed habitat types is less than the conditional threshold of 10%. In the previous assessment of the status of the maritime area (2012), no assessment of the hydrographical conditions was made, so it is not possible to compare the changes that have occurred.

D7C2.1	Hüdrograafiliselt muudetud elupaigatüübi liivamadalad (kood 1110) pindala	23,4 km2 ehk 0,79% kogu elupaigatüübi pindalast.
D7C2.2	Hüdrograafiliselt muudetud elupaigatüübi jõgede lehtersuudmed (kood 1130) pindala	0,26 km2 ehk 0,37% elupaiga pindalast.
D7C2.3	Hüdrograafiliselt muudetud elupaigatüübi laugmadalikud (kood 1140) pindala	9,6 km2 ehk 5,1% kogu elupaigatüübi pindalast.
D7C2.4	Hüdrograafiliselt muudetud elupaigatüübi laiad madalad lahed (kood 1160) pindala	13,5 km2 ehk 6,7% elupaigatüübi pindalast.
D7C2.5	Hüdrograafiliselt muudetud elupaigatüübi karid (kood 1170) pindala	6,3 km2 ehk 0,18% elupaigatüübi pindalast.

Figure 2.21. Indicators and corresponding assessments characterizing the extent of benthic habitat adversely impacted by permanent hydrographical changes (Ministry of the Environment, 2019a).

Hüdrograafiliselt muudetud elupaigatüübi liivamadalad (kood 1110) pindala – 23,4 km^2 ehk 0,79% kogu elupaigatüübi pindalast: the area of hydrographically modified habitat type sandy shoals (code 1110) – 23,4 km^2 or 0,79% of the total area of the habitat type
Hüdrograafiliselt muudetud elupaigatüübi jõgede lehtersuudmed (kood 1130) pindala – 0,26 km^2 ehk 0,37% elupaiga pindalast: the area of hydrographically modified habitat type estuaries (code 1130) – 0,26 km^2 or 0,37% of the total area of the habitat type
Hüdrograafiliselt muudetud elupaigatüübi laugmadalikud (kood 1140) pindala – 9,6 km^2 ehk 5,1% kogu elupaigatüübi pindalast: the area of hydrographically modified habitat type shallow inlets (code 1140) – 9,6 km^2 or 5,1% of the total area of the habitat type
Hüdrograafiliselt muudetud elupaigatüübi laiad madalad lahed (kood 1160) pindala – 13,5 km^2 ehk 6,7% elupaigatüübi pindalast: the area of hydrographically modified habitat type large shallow bays (code 1160) – 13,5 km^2 or 6,7% of the total area of the habitat type
Hüdrograafiliselt muudetud elupaigatüübi karid (kood 1170) pindala – 6,3 km^2 ehk 0,18% elupaigatüübi pindalast: the area of hydrographically modified habitat type reefs (code 1170) – 6,3 km^2 or 0,18% of the total area of the habitat type

2.2.8 The Dam of Väike Väin (Väike Strait)

Väike Väin (Väike Strait) is a shallow sea area between Saaremaa and Muhu islands, and it has also been designated as a Väike Väin limited-conservation area to protect various habitats, plant and bird species. Väike Väin belongs also to the Natura 2000 network (Väike Väin nature area, the Väinameri Sea bird area). Väike Väin is a habitat for many species of fish, seals and birds, with many aquatic birds using the shallow strait, nearby coastal meadows and islets as stopover sites and for searching food during migration. The dam of Väike Väin was completed in 1896 and it has probably had a strong impact on the natural environment of the Väike Väin until now, as the dam has a blocking effect and separates the waters of the Gulf of Riga and the Väinameri Sea (Tallinn University of Technology, 2021b).

In 2021, Tallinn University of Technology conducted a study on the impact of alternatives to the dam of Väike Väin, as a result of which it was found that the dam of Väike Väin is an object with a significant negative environmental impact, including that the hydrodynamic regime of the strait was significantly changed by the construction of the dam. With the construction of the dam, the sea area was closed to the currents and exchange of substances passing through the strait, and the waves were reduced, which is why the accumulation of sediments, including the accumulation of organic sediment, has occurred near the dam. Water and sediments near the dam have high concentrations of total nitrogen, probably due to the presence of the dam. The dam is also a migration barrier to fish. The impact of land transport can be seen in the content of hazardous substances in the sediments near the dam, but their concentrations are mostly below the target and limit values.

As one of the measures of the Estonian Marine Strategy's programme of measures, the construction of the openings of the road dam of Väike Väin to improve the water exchange and to open the strait as a fish migration route is intended, the impact of which was assessed in the study by Tallinn University of Technology in 2021. The impact analysis showed that the impact of the construction of openings on the marine environment and the socio-economic environment would be positive. It would have a positive impact on, inter alia, the distribution of water masses, the average concentrations of substances such as nitrogen and phosphorus would probably decrease over a longer period of time, the lack of oxygen would decrease during the colder period, through the improvement of water exchange and the partial restoration of hydrodynamic activity, there would be a positive impact on benthos, and fish migration routes would also be opened. The small potential negative impact on the Väike Väin limited-conservation area may to a certain extent be increased by the construction of openings due to somewhat increased small vessel traffic in the area, but the positive impact of the construction of openings on marine habitats outweighs the negative impact. Considering the above, the construction of openings is recommended as a measure to improve the environmental status of the coastal sea.

2.2.9 Climate change

The main factor affecting Estonia's climate is the geographical position of the country, including its bordering with the Baltic Sea, which warms the coastal region and islands in winter and cools it in spring. According to the future climate scenarios of Estonia prepared by the Estonian Environment Agency (2015), the surface temperature of the Baltic Sea will increase by 2,9°C for the years 2071–2100 compared to the period 1961–1990, while the warming will be most noticeable in the Gulf of Finland. In addition to water level of the world ocean, the water level of the Baltic Sea is affected by rising of the land after the ice age, changes in wind speed and direction, seawater salinity and temperature, with the biggest changes in the water level being in the Gulf of Finland and the Gulf of Riga (6-8 cm).

The impact of climate change is already visible in the Baltic Sea: the water temperature is rising, ice conditions are worsening and the annual average amount of precipitation in the northern part of the Baltic Sea is increasing. All these changes affect the sea, its ecosystems and ecosystem services, including human activities (e. g. fishing). Among other things, several species of wintering birds remain more to the north for winter, and the number of fish in the sea that prefer warmer water has also increased. A more detailed overview is provided in table 2.1.

Table 2.1. Climate change parameters of the Baltic Sea region, current situation and the situation in future (HELCOM, 2021b)

Parameter	Current situation	Future
Direct parameters		
Air temperature	The air temperature in the Baltic Sea region has risen more than the world average. The biggest rise of temperature has occurred in the spring period.	The air temperature will continue to rise, with an estimated 1.4-3.9 °C by the end of the century. The rise is greater in the north.
Water temperature	Of territorial seas, the water temperature of the Baltic Sea has increased the most, and in the period 1990–2018, +0,59 °C per ten years.	Globally, the water temperature is increasing more and more, while the surface water temperature of the Baltic Sea will increase by 1,1–3,2 °C by the end of the century compared to the period 1976–2005. No matter how much water temperatures rise by the end of the century, surface water temperatures will exceed natural variability.
Air circulation	There are no significant trends in the North Atlantic Oscillation (NAO)[1] over the past century, the Atlantic Multidecadal Oscillation (AMO)[2] is transitioning into a negative (cooler) phase.	The NAO will most likely still show high variability, and it is possible that it will turn a bit more towards a positive phase that includes more frequent wet but mild winters. AMO is very sensitive to climate change.
Ice conditions	Over the past 100+ years, the presence and duration of ice cover has decreased by almost 30%.	The presence of ice cover will decrease by 6,400–10,900 km^2 per decade, the thickness of the ice and the duration of the ice cover will most likely also decrease.
Solar radiation	Cloudiness has decreased and there are weak but significant negative trends (0,5 – 1,9% per decade).	Future changes are uncertain, but models show a slight increase in solar radiation in the Baltic Sea region.
Water salinity	There are no statistically significant trends, but since the 1980s the salinity of the bottom water layer in the	Due to various factors, there are currently no possible strong changes identified.

[1] The North Atlantic Oscillation (NAO) is the opposite air pressure fluctuations between the minimum in Iceland and the maximum in the Azores, the corresponding air pressure variation is expressed as the NAO index. Air pressure fluctuations determine the strength of the westerly flow from the North Atlantic to the Northern Europe.
[2] The Atlantic Multidecadal Oscillation (AMO) theoretically describes the variability of surface water temperature in the North Atlantic Ocean over several decades.

Parameter	Current situation	Future
	Baltic Sea has increased and the salinity of the surface water layer has decreased.	
Stratification of water	A large part of the water in the Baltic Sea is stratified.	Theoretically, there will be even greater stratification of water, but the final result will be due to the warming of the surface water level and the amount of fresh water and salt water inflow.
Precipitation	The amount of precipitation has increased during the winter period.	The total amount of precipitation will increase, especially in the winter period (in the north).
Rate of flow in rivers	During the 20th century, the rate of flow in rivers has increased in winter and decreased in spring. In the northern area of the Baltic Sea, the increased flow is due to the increase in air temperature and precipitation.	As the air temperature warms, a 2-22% increase in the rate of flow is expected (especially in the north).
CO_2 system	The Baltic Sea acts as a CO_2 receiver in summer and as an emitter in winter. Due to eutrophication, the production of organic matter and remineralization has increased, which has also increased the fluctuations in the pH level of the water.	The increase in atmospheric CO_2 concentration is one of the main factors affecting the seawater CO_2 system and causing ocean acidification. The changes will also have an impact on aquatic organisms, but there is a lot of uncertainty regarding the extent and direction of the impact with current knowledge.
The amount of nutrients	The amounts of nutrients (including nitrogen) reaching the Baltic Sea have decreased significantly since the 1980s. Nitrogen emissions have declined since the beginning of the 21st century, but regarding phosphorus, the amounts and trends are uncertain.	According to the projections, the amount of nutrients reaching the Baltic Sea through rivers will increase precisely in the northern area of the Baltic Sea, with nutrients from land most likely having greater impact than greenhouse gases.
Seawater level	In the northern part of the Baltic Sea, the rise of land is higher than the average sea level rise. Extraordinary floods caused by strong winds especially threaten low coastal areas.	Sea level rise will accelerate. A long-term trend of relative sea-level decline due to post-glacial rebound is being replaced by a rising trend due to climate change.

Parameter	Current situation	Future
Wind	There are no long-term trends.	According to the projections, the wind speed will increase in autumn and decrease in spring. Wind speed may increase in areas that are no longer covered with ice.
Waves	There are no long-term trends.	Changes in wave heights are directly related to wind changes. According to the projections, the wave height may have increased by 5% by the year 2100, especially in the northern and eastern parts of the Baltic Sea.
Sediments	In the northern coastal areas of the Baltic Sea, rising of land up to +9 mm per year has been observed, and due to the moving sediments, the southern and eastern coastal areas are more vulnerable to waves and wind.	The sea level is rising and this is accompanied by increased sediment movement in coastal areas. The rate of change depends on sea level rise and the frequency and trajectory of storms.
Indirect parameters: ecosystem		
Oxygen	In coastal waters, oxygen conditions have improved in some places, but the lack of oxygen is still an important problem in the Baltic Sea.	Due to the warming of the seawater, the oxygen conditions may further deteriorate, the possible changes are mainly related to the amount of nutrients reaching the sea.
Microbes	There are no long-term trends, but with the warming of surface water, the distribution areas of *Vibrio spp* bacteria have expanded.	Bacterial transformation of organic matter, CO_2 production and oxygen use will be intensified.
Benthos	During the last decades, the benthos has changed a lot due to the temperature, water salinity, oxygen conditions and the amount of precipitation.	Depending on the species, the benthos can change significantly. The factors influencing it are temperature rise, amount of precipitation, sea water level, oxygen conditions, etc.
Coastal and migratory fish	On the one hand, higher water temperature has improved spawning conditions, but on the other hand, warm winters	Conditions are improving for species with a spring spawning period and worsening for species with an

Parameter	Current situation	Future
	and worse ice conditions have also worsened conditions for some species.	autumn spawning period. As the water temperature changes, there may be changes in the size of smaller fish.
Fish fauna of the open sea and seabed	Due to the increased temperature and lack of oxygen, the reproduction of fish and their feeding areas have decreased, including the quality of food.	Changes in parameters affect different species of fish in different ways, i.e. their spawning period may shift earlier, the size of fish may change, etc.
Sea birds	The wintering areas have shifted further north, spring migrations start earlier. Seabirds are also affected by climate conditions outside the Baltic Sea region.	Wintering areas will be shifting further north, rising sea levels and increased risk of erosion will reduce nesting areas and breeding opportunities.
Marine mammals	Due to the worsened ice conditions, the reproduction of ringed seals (and to a lesser extent also grey seals) has decreased.	The ice conditions will further deteriorate, and thus the conditions for marine mammals will also deteriorate.
Alien species	Climate change may be favourable to alien species.	The spread and growth of alien species may increase due to the rise in temperature and the decrease in water salinity.
Marine protected areas	Climate change has impact on habitats as well as species. For example, mild winters and deteriorated ice conditions limit the breeding opportunities of ringed seals.	As a result of deteriorating ice conditions, rising water levels, erosion and floods, some marine protected areas may lose their previous function.
Nutrient concentrations and eutrophication	The impacts of nitrogen and phosphorus due to climate change cannot be clearly defined, but as a result of eutrophication, low areas with limited water exchange are more susceptible to oxygen deficit.	Changes in nutrient loads reaching the sea affect seawater nutrient concentrations. As the seawater warms, the lack of oxygen in the bottom layers may increase. Blue-green algae proliferation areas will be increasing.
Functioning of the ecosystem	In recent decades, algal blooms have become more and more frequent, as a result of which the functioning of the	As the water temperature increases, primary production may increase. If the amount of nutrients reaching the sea does not

Parameter	Current situation	Future
	ecosystem has also deteriorated.	decrease, significant changes in the ecosystem will continue.
Indirect parameters: human use		
Wind farms	Climate conditions do not affect the construction of wind farms.	In order to meet the climate goals, it is necessary to significantly increase the capacity and productivity of wind farms, which in turn requires comprehensive environmental analyses taking various aspects into account.
Coast protection	It is increasingly understood that the construction of so-called heavy structures for the purpose of coastal protection is not sustainable.	Coastal protection strategies must consider climate change. Rising of the sea level is accompanied by the risk of erosion and the accumulation of sediments, which in turn will increase costs for coastal protection. Wider use of innovative solutions is necessary.
Shipping	During the last decades, the sizes and quantities of ships in the Baltic Sea have increased.	According to the projections, the annual number of cargo ships will increase by 2,5% and the number of passenger ships by 3,9%. Less ice means less need for ice breaking, but at the same time, the ice is more mobile. Stronger winds and larger waves can contribute to the icing of ships.
Tourism	Due to the increase in temperature, the number of tourists visiting the northernmost coastal regions of Europe has increased, but the number of tourists has decreased in the winter period.	The northernmost region of the Baltic Sea will be more attractive region for tourists.
Fishing	Trawl fishing period has shifted to an earlier time in some places, but ice fishing has decreased due to worse ice conditions.	The trawl fishing period in the northern Baltic Sea region will be longer, but the ice fishing will decrease even more.

Parameter	Current situation	Future
Aquaculture	Fish species are unlikely to be affected by changes in water salinity, but are affected by nutrients reaching the sea. Warmer water temperature increases the chances of growing different fish species. Mussels and marine algae are affected by both warmer water and lower salinity.	Any increase in temperature, combined with increased amounts of algae, has an impact on aquaculture. Aquaculture can be combined with offshore wind farms.
Carbon storage	There is no comprehensive knowledge of it, but it has been observed that the combination of climate change and human activity has a negative impact on carbon storage of ecosystems.	Due to climate change, the negative impacts will increase, but it is potentially possible to improve the functioning of marine ecosystems by 2050 if the right measures are used.
Marine and coastal ecosystem services	There are no clear trends/relationships between cultural ecosystem services and tourism/recreation with climate change.	The period of use of cultural ecosystem services will be longer. The opportunities for recreational fishing (especially ice fishing) will be decreasing.

2.3 Socio-economic environment

The Estonian maritime sector as a whole has been relatively little studied, but according to previous studies and examples from the other countries, the Estonian maritime cluster can be divided into the following sub-clusters (Ministry of Economic Affairs and Communication, 2022):

- shipping;
- ports;
- fishing and aquaculture;
- shipbuilding;
- hydraulic construction and dredging, including technical and information systems of ports ;
- energetics;
- boating and recreation;
- maritime services and intermediary activities;
- public sector, research and education.

The most important strengths of the Estonian maritime sector are favourable geographical location and natural conditions, good digital technological capabilities and business climate, as well as good level of passenger shipping and small shipbuilding. But the main weaknesses are that the maritime sector is not clearly defined, the development of a multimodal (port-road-railway) transport network, „bottlenecks“ in transport infrastructure, the capacity of the maritime state administration does not match the potential of the maritime economy, and the lack of qualified and sufficient labour force that would meet the expectations of the labour market. There is also strong competition with the ports of the other countries along the Baltic Sea. An education system that does not meet the needs of the labour market and the lack of interest of students have also become a problem, and as a result, the maritime sector is threatened by a downward trend in the number of specialists (Ministry of Economic Affairs and Communication, 2022).

2.3.1 Infrastructure

According to the State Port Register, there are 230 ports in Estonia (State Port Register, 2022), most of them are located in the coastal sea, and shallow water, moving sediments and changing weather conditions create their own specific characteristics and technical requirements for each port. The length of the public shipping lanes of the Estonian coastal sea is 527 km, and in addition to them, 165 km of access roads to the coastal sea and inland waters. Estonian maritime area and navigable inland waters are marked with 1522 navigation marks (Ministry of Economic Affairs and Communication, 2021). 329 key ports have been identified for the development of the pan-European transport network (TEN-T network), the priority development of which should ensure a functioning port network. From Estonia, Muuga Harbour, Paldiski South Harbour, Paljassaare Harbour, Tallinn's Old City Harbour, Port of Kunda, Port of Pärnu, the ports of Heltermaa and Rohuküla, and the ports of Virtsu and Kuivastu belong to the general TEN-T network (Ministry of Economic Affairs and Communication, 2022).

Maritime transport throughout the European Union has a large proportion and importance for the functioning of the economy: 77% of European international trade and 35% of EU internal trade takes place by sea (Figure 2.22). Although maritime trade has considerable economic and social benefits, it also has an impact on the environment and human health. Shipping is considered one of the most environmentally friendly modes of transport (e.g. low CO_2 emissions based on the distance traveled and the weight of the goods; total greenhouse gas emissions in the EU 13.5%), but nevertheless it has an impact on air and water quality, and on the biodiversity of seas and estuaries. Also, due to maritime transport, the level of underwater noise has more than doubled, and half of the alien species introduced into European seas have been brought by maritime transport (European Environment Agency and European Maritime Safety Agency, 2021).

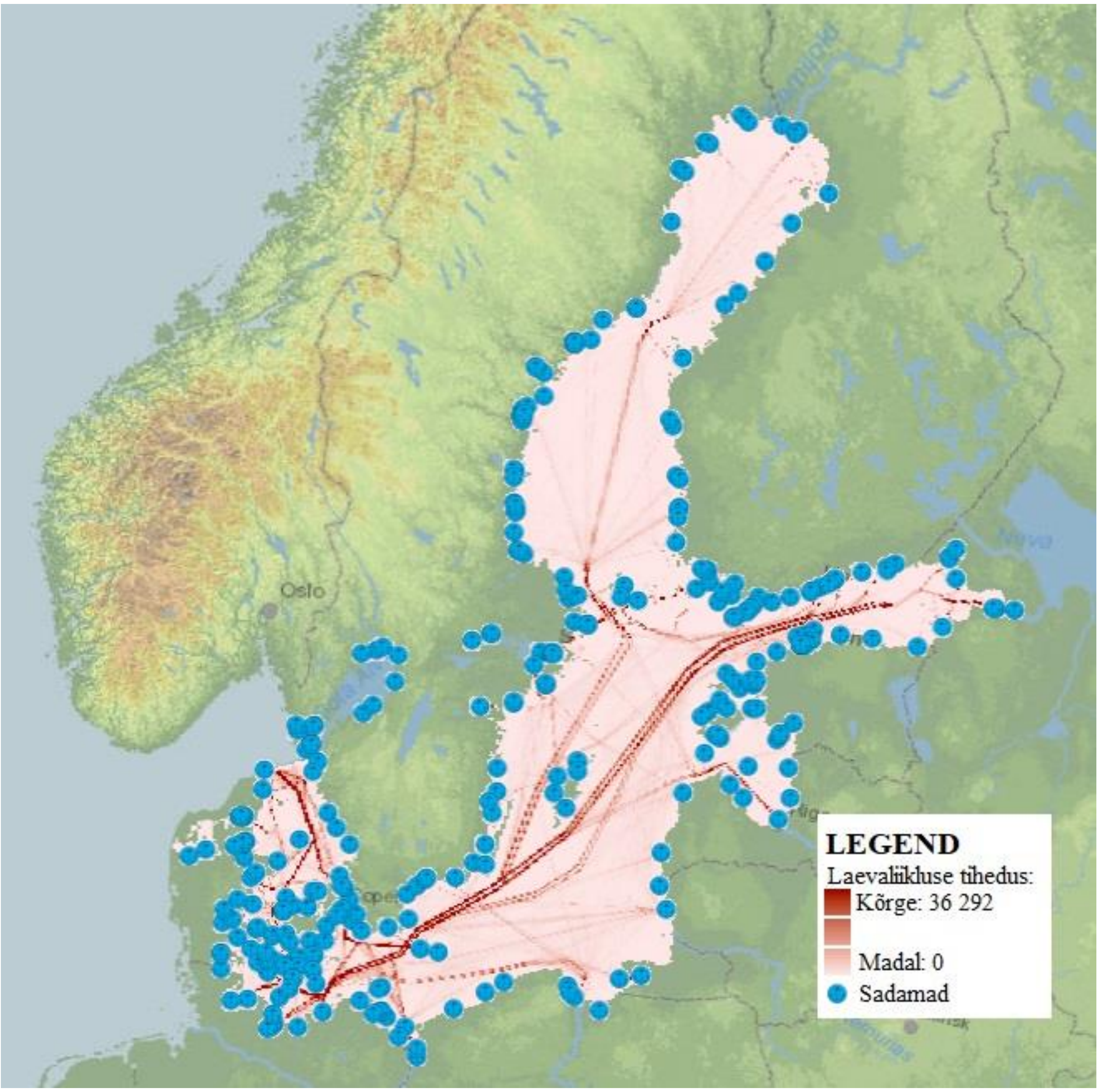

Figure 2.22. Density of marine traffic in the Baltic Sea as of 2016, considering all types of vessels (HELCOM BASEMAPS, 2022).
Laevaliikluse tihedus – density of marine traffic*: kõrge* – high*; madal* – low. *Sadamad* – ports.

2.3.2 Fishing

Estonian fishermen catch most of their catches from the Baltic Sea, while coastal fishing takes place in the sea within 12 nautical miles or up to the 20-metre isobath. Economically the most important species of coastal and trawl fishing are sprat, Baltic herring, perch, pikeperch, smelt, flounder, garfish, roach, gibel karp and vimba bream (Table 2.2) (Ministry of the Environment, 2019a).

Table 2.2. Fishing at the Baltic Sea in total (in tonnes) (Statistics Estonia, 2022).

Fish species	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Baltic herring	32317,48	33768,70	35152,67	34726,05	32832,69	28607,97
Sprat	23953,57	23686,94	26545,95	29625,55	30649,16	24309,73

Fish species	2015	2016	2017	2018	2019	2020
Perch	1522,82	1373,55	1290,55	1136,73	979,16	748,68
Smelt	435,24	699,43	410,60	425,24	623,99	964,06
Other fish	134,55	194,23	250,43	241,42	244,28	326,45
Flounder	239,34	200,61	186,53	168,90	149,66	175,92
White bream / Roach	124,84	140,04	119,58	132,55	158,25	183,41
Garfish	115,94	70,00	176,76	74,87	130,09	126,67
Vimba bream	92,93	73,43	88,01	97,33	118,71	80,46
Pikeperch	83,02	106,71	56,08	65,96	52,14	20,04
Pike	51,79	41,61	40,36	68,07	76,31	76,91
Ide	15,97	26,95	35,76	49,09	50,42	48,11
Eelpout	0,91	0,31	68,33	69,42	30,75	34,77
Cod	182,62	1,92	0,87	0,98	1,86	1,41
Whitefish	19,49	18,27	16,20	17,39	16,21	25,24
Trout	16,20	20,06	17,47	16,62	17,05	17,13
Salmon	5,59	6,83	8,89	8,15	8,44	10,77
Bream	8,23	6,61	7,63	9,44	8,85	6,28
Burbot	5,09	3,82	3,16	2,25	2,02	1,25
Eel	0,84	0,79	0,69	0,50	0,98	1,52
River lamprey	0,21	0,09	0,12	0,08	0,13	0,04
TOTAL	**59326,67**	**60440,89**	**64476,64**	**66936,58**	**66151,14**	**55766,85**

In the Gulf of Finland, the main types of fishing gear used for coastal fishing are traps and gillnets, and mostly Baltic herring is caught with them. In 2020, the total catch from the Gulf of Finland was 1306 tons, exceeding the catch of the previous year and the average catch of the period 2007-2020. On the offshore coast of Saaremaa and Hiiumaa, gill nets, traps, seine nets and, to a very small extent, long lines are used for fishing. In the past, long lines were mainly used for eel fishing, but due to the low eel stock, the importance of this type of fishing gear has decreased. In 2020, mostly flounder was caught in the open sea, while the total catch on the offshore coast of Saaremaa and Hiiumaa somewhat exceeded the average for the period 2007-2020. In Väinameri Sea, fish is mostly caught with gill nets and traps, and the role of longlines and seine nets is small there, while the catch is dominated by freshwater fish species. The increase in the proportion of using traps in catching fish in recent years most likely indicates an increase in fishing effort, but the catch is unlikely to be sustainable due to increased fishing effort. In the Gulf of Riga (except Pärnu Bay) the most common fishing gear is gillnets and traps, to a lesser extent seine nets and longlines are also used, and in recent years mostly Baltic herring and perch have been caught. Fish catches of 2020 in the Gulf of Riga were the smallest in recent times, the main reason for it was the poor catch of Baltic herring. In Pärnu Bay, both gill nets, traps, seine nets and longlines are used as fishing gear, in recent years mostly Baltic herring and perch have been caught. In terms of catch volume and catch value, Pärnu Bay is undoubtedly the most important coastal fishing area in Estonia. The fish catch in Pärnu Bay has fluctuated greatly in recent years, with the total catch in 2020 being below the average for the period 2007-2020. The size of the total catch is most affected by the mass species Baltic herring and smelt, without taking them into account, the fish catch in 2020 was above average (Fisheries Information Centre, 2021).

As of 2020, there were 71 companies operating in Estonia whose main field of activity was the processing and preservation of fish, crustaceans and molluscs.

2.3.3 Aquaculture

In 2020, 48 operating companies engaged in fish and crayfish farming were registered as aquaculture producers (Fisheries Information Centre, 2021). In Estonia, mostly rainbow trout is grown for human consumption. Due to the small size of the Estonian market, there is no commercial fish farming for producing fish roe. But the majority of Estonian fish farming production comes from freshwater farms (University of Tartu, Estonian Marine Institute, 2020b).

In 2018 fish farming in fish cages was started again in Estonia. Private company Redstorm began rainbow trout farming in Tagalaht bay in Saaremaa and since 2019 fish farming with maximum weight gain of 100 t was planned. According to the representatives of private company Redstorm, the weight gain in 2019 reached 100 t indeed. Fish sales of private company Redstorm amounted 121 t in 2019 . Estonian Agriculture and Fisheries Development Programme 2030 has set an objective that the strategic goal for developing sustainable offshore aquaculture is to increase the capacity of offshore aquaculture to 10000 t/yr, based on the principle that juvenile grow-out before stocking is grown mainly in terrestrial fish farms

Mussels are usually cultivated in water column, and different types of floating substrates are used as materials for mussel farms. In Estonian maritime area, there are basically only two important species of mussels that attach to substrates. A thorough three-year environmental monitoring in all six mussel farms in the Baltic Sea did not detect any significant negative environmental impact in any aspect. However, the impact cannot be ruled out in the case of very large farms (area >1 km^2), but establishing such large farms is not yet realistic in Estonia and reasonable in terms of nature conservation. The toxin content of mussels in the Estonian maritime area is very low, which is why the products can be used for human consumption and/or animal feed. The cultivation of mussels in Estonia is effective, economically profitable, and mussel farms remove large amounts of nutrients (University of Tartu, Estonian Marine Institute, 2020b).

In parts of the Baltic Sea where there is fresher water, including Estonia, economic activity in algae cultivation has not yet started, there are individual experimental farms, the activity of which can be considered as sectoral development phase. Of algae, macroalgae are best suited for aquaculture, they grow very fast, use the most nutrients and can compete with other species for resources. Perspective macroalgae species for aquaculture in Estonian conditions would be bladderwrack (*Fucus vesiculosus*), furcellaria (*Furcellaria lumbricalis*), Cladophora (*Cladophora glomerata*) and sea lettuce (*Ulva intestinalis*). At the moment, the only type of macroalgae used industrially in Estonia is furcellaria, which is either collected from the coast or trawled from the seabed (University of Tartu, Estonian Marine Institute, 2020b).

2.3.4 Blue economy

Blue economy is economic activity related to oceans, seas and coasts that creates opportunities for people’s livelihoods and creates jobs, while maintaining the health of marine and coastal ecosystems. Sustainable blue economy allows society to benefit from the seas and coastal areas while allowing the marine environment to recover. Therefore, human activities must be managed in such a way as to ensure the health and economic viability of water bodies. In the European Union, contributions are made to the growth of the blue economy through various marine resources, offshore wind farms, activities in the port, maritime transport and maritime tourism. Various renewable energy resources (e. g. wave energy, floating solar panels, etc.), the use of non-traditional marine organisms (e.g. algae, bacteria), removal of salts from water, etc. are seen as promising sources of growth in the blue economy (European Commission, 2021g).

A blue economy and water resources research group has also been established at Tallinn University of Technology, the purpose of which is to carry out development activities related to production technologies and valorization of raw materials of coastal areas and aquatic environment (Tallinn University of Technology, Estonian Maritime Academy, 2022).

2.3.5 Maritime cultural heritage

According to the National Registry of Cultural Monuments, there are a total of 106 underwater monuments in the Estonian maritime area (National Registry of Cultural Monuments, 2022). Shipwrecks form the largest part of underwater monuments (Figure 2.23), the majority of which are protected as archaeological monuments. Shipwreck sites consist of the remains of the ship itself, cargo, furnishings, utility items and personal belongings of the sailors, which form the archaeological cultural layer characteristic of the wreck site. In addition to the wrecks of watercraft, ports and boat harbour sites have been preserved in the sea (Estonian National Heritage Board, 2022).

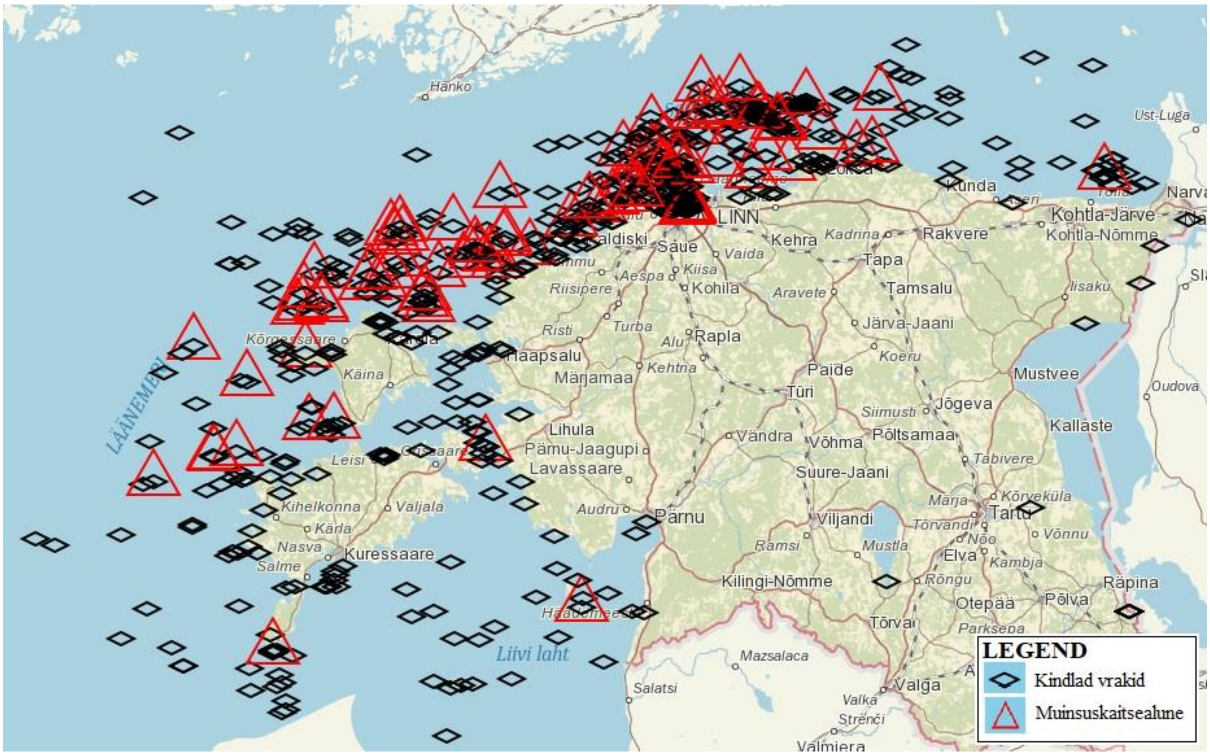

Figure 2.23. Shipwrecks in the Estonian maritime area (Estonian Hydrographic Information System, 2022.
Kindlad vrakid – definitely known shipwrecks. *Muinsuskaitsealune* – heritage protection site

The main purpose of underwater monument protection is to ensure its preservation in its original location. Therefore, it is important to reduce the negative impact of human activities and to avoid activities (such as anchoring, trawling, dredging, dumping at sea and reckless immersion) on the underwater monument and its protection zone that would directly cause damage to its preservation (Estonian National Heritage Board, 2022).

Underwater monuments entail various problems of management, protection and preservation, for solving of which the Government of the Republic of Estonia approved joining the UNESCO

Convention on the Protection of Underwater Cultural Heritage in October 2020. The convention entered into force for Estonia on 02.02.2021 (Estonian National Commission for UNESCO, April 2022). The objectives and general principles of the convention include (RT II, 24.11.2020, 1):

- to ensure and strengthen the protection of underwater cultural heritage;
- preserve underwater cultural heritage for the benefit of humanity;
- the preservation *in situ* of underwater cultural heritage shall be considered as the first option before allowing or engaging in any activities directed at this heritage;
- recovered underwater cultural heritage shall be deposited, conserved and managed in a manner that ensures its long-term preservation;
- underwater cultural heritage shall not be commercially exploited;
- responsible non-intrusive access to observe or document *in situ* underwater cultural heritage shall be encouraged to create public awareness, appreciation, and protection of the heritage except where such access is incompatible with its protection and management.

In the case of activities aimed at underwater cultural heritage, among other things, environmental conservation principles must be developed, which are sufficient so as not to unnecessarily disturb the seabed and marine biota (RT II, 24.11.2020, 1).

In addition to the material (including underwater) cultural heritage, an important part is also intangible cultural heritage related to the sea (including the traditional coastal lifestyle, etc; see also ch 5.2.6).

2.3.6 International cooperation, and research and development activities

Estonia has acceded to a total of 33 maritime conventions, of which 28 are United Nations (UN) conventions, 2 are regional agreements and 3 are International Labour Organization (ILO) conventions (Transport Administration, 2021). The protection of the Baltic Sea is organized in cooperation with the Baltic Sea countries, and the Baltic Marine Environment Protection Commission has been established for this purpose (HELCOM) (Ministry of the Environment, 2022c).

Research and educational institutions have supporting role in maritime affairs, as these institutions provide companies and institutions belonging to the maritime sector with competent personnel and contribute to finding and implementing innovative solutions for the companies. They also offer competence in sectoral research (Kikas & Lips, 2018). Maritime education is provided at all levels in Estonia (Ministry of Economic Affairs and Communication, 2022). The main active educational and research institutions in Estonia are the Tallinn University of Technology and its specific sub-institutes (Marine Systems Institute, Estonian Maritime Academy and Kuresaare College), the University of Tartu, Estonian Marine Institute; Estonian Nautical School and Reval Safety Training (Kikas & Lips, 2018). Maritime studies are mainly conducted at Tallinn University of Technology, and fisheries-related specialties can be studied at Estonian University of Life Sciences and Tallinn University of Technology (Educational portal, 2022). Major university-affiliated marine research institutions are dedicated to research and analysis of the status of the marine environment and teaching maritime education to new generations. At the same time, continuing education also plays an important role in maritime education, as sailors must regularly attend further training courses with the aim of renewing their certificates necessary for seafaring (Kikas & Lips, 2018). Estonian maritime education, and research and development activities are at a modern level, but one of the dangers of the maritime sector is the lack of interest of students, which may bring about a downward trend in the number of maritime specialists (Ministry of Economic Affairs and Communication, 2022).

Continuous monitoring of the environmental status of the Estonian maritime area and the factors affecting it is conducted within the framework of marine monitoring sub-programme of the national environmental monitoring programme (Estonian Envitonment Agency, 2019). The tasks and objectives of marine monitoring are determined by the Regulation No. 3 of the Minister of the Environment (23.01.2017): „Requirements and procedures for the implementation of the national environmental monitoring programme its and sub-programmes“ (RT I, 25.01.2017, 9). The user community of marine monitoring data is wide ranging from researchers and students to officials and ordinary citizens. Monitoring data is the basis for developing environmental protection and environmental policies, and assessing their effectiveness and planning activities. Updating the marine monitoring subprogram, the marine monitoring data collection programme according to the MSRD, the water monitoring programme according to the water policy framework directive, the HELCOM monitoring and assessment strategy, the habitat directive and other relevant monitoring requirements have been taken into account (Estonian Envitonment Agency, 2019). In order to fully implement the Baltic Sea Action Plan, according to HELCOM, it would be necessary to study or increase knowledge in the areas of biodiversity, human factors and scientific approaches. Studying the abovementioned topics and their sub-topics is more likely to ensure the achievement of good environmental status and creates opportunities for carrying out regional projects, which in turn increases the sharing of experience and knowledge between countries (HELCOM, 2021c).

3. SEA methodology

SEA is conducted according to EIA&EMSA and relevant guidance materials available. During SEA possible impact, both unfavourable (negative) as well as favourable (positive) impact accompanying the implementation of a strategic planning document will be assessed. An environmental impact is significantly unfavourable (negative) if it is expected to exceed the environmental tolerance of the site, cause irreversible changes in the environment or endanger human health and well-being, cultural heritage or property. An environmental impact is significantly favourable (positive) if it is expected to significantly reduce the environmental load of the site (e. g. reduce environmental pollution or resource use) or measures are taken to preserve or improve the status of natural areas, improve human health and well-being and preserve cultural heritage or property.

Two main methodical approaches have been used in conducting SEA: compliance analysis and analysis of externalities.

Compliance analysis represents the assessment of the measures set in the programme of measures, to what extent the programme of measures is in accordance and comply with relevant objectives set in other strategic documents. In the course of the compliance analysis, it will be analysed whether the developed goals and measures contribute or do not contribute to the achievement of various international, European Union and Estonian national political environmental goals. In compliance analysis comparison is made between objectives and measures of the programme of measures, and other environmental objectives of the same level of generalization in this particular field or related strategic development documents. The compliance analysis is presented in SEA report chapter 4 as a table.

If necessary, proposals are made to supplement the programme of measures.

The analysis of externalities is an approach that compares the planned activities in terms of the spectrum of externalities. In the course of this analysis an overview of the current state of the field and the main problems is provided, and it will be analysed which areas of the natural and social environment and to what extent would be affected by the measures planned for implementing the priorities of the programme of measures. Both direct as well as indirect impact will be assessed. If necessary, proposals shall be made to supplement the programme of measures.

In the course of the analysis of externalities the impacts are primarily assessed qualitatively (in a descriptive way) in relation to various fields of impact. Given the strategic level of the programme of measures and that often there is lack of sufficiently detailed information on the planned measures, it is difficult to make quantitative assessments and therefore, concerning many environmental fields, it is not possible to make quantitative assessments. Assessments made in SEA are generally divided into short-term and long-term assessments, with main focus on long-term impacts.

Estonian Marine Strategy's programme of measures 2022-2027, which is the subject of the SEA, is related to the national or general level, which sets measures to achieve good status of marine environment. Therefore, the areas of impact to be assessed are defined based on the features necessary to achieve good environmental status of the maritime area developed in advance in the programme of measures. Based on the EU Marine Strategy Framework Directive (2008/56/EC), 11 qualitative descriptors are taken into account when determining good environmental status: biological diversity (D1), alien species (D2), commercial fish and other species (D3), food web (D4), eutrophication (D5), seabed integrity (D6), hydrographic conditions (D7), pollutant content (D8), pollutants in seafood (D9), marine litter (D10) and energy, including underwater noise (D11). These descriptors are addressed in SEA as areas of impact of the natural environment.

In the course of the analysis of externalities, the expected accompanying impact will be assessed:

The expected accompanying impact on the natural environment (including aquatic environment, atmosphere, seabed and coasts) associated with the implementation of the programme of measures:

- impact on biological diversity, food webs, benthic communities and communities in water column, and on commercial fish and other species (descriptors D1, D3, D4 and D6);
- impact related to alien species (descriptor D2)
- impact on marine habitats (seabed integrity and hydrographic conditions) and other physical indicators of the marine environment (underwater noise), including impact on protected natural objects and conservation objectives and integrity of Natura 2000 sites (descriptors D6, D7, D11);
- impact on seawater quality, including eutrophication, impact on the content of pollutants in the aquatic environment and the content of pollutants in seafood, the impact of marine litter (descriptors D5, D8, D9 and D10).

The expected accompanying impact on the social environment associated with the implementation of the programme of measures:

- impact on human health, well-being (especially on employment and maritime-related business, and on research and development) and property;
- impact on maritime cultural heritage and traditional coastal lifestyle.

In addition to the above, the impact of climate change on the implementation of additional measures proposed in Marine Strategy’s programme of measures will be analyzed in the SEA.

The assessment of cumulative impact will be conducted after the assessment of externalities. Cumulative impact or combined impact is defined as the accumulation (merging or combination) of impacts of various areas of human activity that can begin to have significant impact on the environment. Although taken separately, the individual impacts may be insignificant, but they may, over time, combine from one or more sources and lead to a deterioration/improvement in the status of natural resources. While analysing relations to other strategic documents it will appear what are the activities of the other fields that might have combined impact (cumulative impact) with the measures of Marine Strategy’s programme of measures.

As the SEA is based on the degree of accuracy of the strategic planning document, the impacts are also assessed at a significantly more general level than, for example, at the level of a zoning plan or an activity license, and in the course of SEA no additional studies are conducted. Assessments are based on current monitoring, statistics and research data available.

Natura impact assessment

The assessment of the impacts of Marine Strategy's programme of measures on the international Natura 2000 network is conducted in accordance with paragraphs 3 and 4 of Article 6 of the Habitats Directive and § 45 of the EIA&EMSA (Environmental Impact Assessment and Environmental Management System Act). The assessment is based on the guide „Guidelines for conducting a Natura assessment in the implementation of Article 6 (3) of the Habitats Directive in Estonia (Estonian Association of Impact Assessment/*KeMÜ,* 2019) and the new version of the European Commission's Natura assessment guide.

Natura assessment is conducted at the stage of preparing the SEA report, in accordance with the degree of accuracy of Marine Strategy's programme of measures. Broadly speaking, the aim of Natura assessment is to identify sensitive or vulnerable areas or other potential threats or conflicts with Natura 2000 network sites, so that they can be taken into account in later stages of the planning process. Natura assessment is presented as a separate chapter in SEA (ch 5.2.7).

3.1 Reaching the solution for the programme of measures

In Estonia, organizing the protection and use of the sea is based, like in other EU countries, on the Marine Strategy Framework Directive (2008/56/EC). The main objective of the directive is to maintain or achieve good environmental status of maritime area by 2020 at the latest. Each country in EU must develop and implement a marine strategy in its own maritime area to promote the sustainable use of the seas and preserve marine ecosystems.

The implementation of the Marine strategy takes place in six-year cycles, where one cycle consists of three main stages: 1. stage – assessing the status of the maritime area and setting targets, 2. stage – development and implementation of marine monitoring programme and 3. stage – preparation and implementation of marine programme of measures. Each of the aforementioned stages of the Marine strategy is updated every six years.

The last assessment of the status of the maritime area was conducted in 2018. According to the assessment, a good environmental status would not be achieved in the Estonian maritime area by 2020. Following the status assessment and the setting of targets, the current marine monitoring and data collection programme was updated in 2020, with the aim of ensuring a dataset for a sufficiently thorough assessment of the environmental status of the Estonian maritime area in 2024.

The current Marine Strategy's programme of measures was approved in 2017. The interim report on the implementation of the programme of measures was prepared in 2018-2019. Taking into account the results of the previously described stages, Marine Strategy's programme of measures will be updated in 2020-2022, within the framework of which an updated Estonian Marine Strategy's programme of measures will be prepared for the period 2022-2027. This programme of measures is the object of the SEA. Chapters 1 and 5.1 of the SEA report provide a more detailed overview of the specific objectives and planned measures of the programme of measures. Updating the programme of measures is carried out by *Eesti Keskkonnauuringute Keskus OÜ* (a private company Estonian Environmental Research Centre) in cooperation with other experts in the field.

By the time of publishing SEA programme for the programme of measures, a lot of substantial work had already been done in the working group drafting the programme of measures, and a preliminary list of necessary new measures had also been completed. The measures were taken as an input for the preparation of the SEA report. Further, the preparation of the SEA took place in parallel with the preparation of the programme of measures, with the SEA report taking into account the additionally planned measures added during the time between preparing the programme of measures and preparing the SEA report. The results of the SEA will be integrated into the programme of measures after the stage of making the SEA report public.

The programme of measures does not envisage various broad-based development scenarios accompanying the implementation of the Marine Strategy, as the objectives have been agreed on in the European Union and set out in the EU Marine Strategy Framework Directive. The programme of measures also does not envisage different alternative courses of action. So the impact analysis focuses on assessing the measures described in the programme of measures to the degree of accuracy set by the programme of measures. If necessary, the SEA expert group makes recommendations for specifying/supplementing the set measures or regarding some measures, draws attention to the issues that need special attention.

Non-implementation of the programme of measures and its measures, i. e. the baseline scenario, is not presented in the SEA report and the possible impacts thereof are not assessed. It is assumed that the baseline scenario, i. e. non-implementation of additional measures necessary to achieve the status of the marine environment, will in any case have greater adverse impact either on the environment, human health and well-being, property or cultural heritage.

4. Compliance analysis, i. e. relations of measures of the programme of measures to the other strategic documents

In this chapter (Table 4.1) relations of the programme of measures to other strategic documents are analyzed, i.e. a compliance analysis is performed. Compliance analysis is assessing to what extent the new measures set out in the programme of measures are in accordance and consistent with relevant goals set out in the other strategic documents. In the course of the compliance analysis, it is analyzed whether the developed new measures contribute or do not contribute to the achievement of various international, European Union and Estonian national environmental policy goals.

According to the analysis carried out during the preparation of the SEA programme, Estonian Marine Strategy's programme of measures 2022-2027 may have relations to the following other strategic development documents of the European Union and Estonia:

- European Union Sustainable Development Strategy;
- European Union Strategy for the Baltic Sea Region ;
- European Union's 2020-2030 Climate and Energy Policy Framework;
- European Union Biodiversity Strategy for 2030;
- European Green Deal;
- European Union's Farm to Fork Strategy to promote a fair, healthy and environmentally friendly food system;
- Building a climate-resilient Europe – a New EU Strategy for Climate Change Adaptation;
- Chemicals strategy for sustainability. Towards creating a non-toxic environment;
- HELCOM Baltic Sea Action Plan (2021) ;
- HELCOM Baltic Sea Marine Litter Action Plan (2021);

- HELCOM Baltic Sea Underwater Noise Action Plan (2021);
- HELCOM Baltic Sea Maritime Spatial Planning Action Plan (2021);
- HELCOM Baltic Sea Regional Nutrient Recycling Strategy (2021);
- HELCOM Baltic Sea Research and Development Programme (2021);
- HELCOM Guidelines for Sea-Based Measures to Manage Internal Nutrient Reserves in the Baltic Sea Region (2021);
- UNESCO programme for West Estonian Archipelago Biosphere programme area
- Estonia 2035+ strategy;
- Estonian Marine Strategy;
- General Principles of Climate Policy until 2050;
- Estonia's 2030 National Energy and Climate Plan;
- Climate Change Adaptation Development Plan until 2030 ;
- Estonian Environmental Strategy 2030 ;
- Estonian National Strategy on Sustainable Development “Sustainable Estonia 21”;
- 2030 Agenda for Sustainable Development;
- Natura 2000 Action Plan 2021-2027;
- Welfare Development Plan 2016-2023 ;
- Agriculture and Fisheries Development Plan until 2030;
- Fish farming restoration action plan 2017–2019 (with a 2023 perspective);
- Migratory, semi-migratory, and freshwater fish species spawning grounds restoration programme 2017–2023 (with a 2027 perspective);
- European Maritime, Fisheries and Aquaculture Fund’s (EMFAF) operational programme 2021–2027;
- Estonian Multiannual Strategic Plan for Aquaculture 2030
- Transport and Mobility Development Plan 2021-2025 (including primarily the concept of maritime transport policy, an annex to “Transport and Mobility Development Plan 2021-2035“);
- Water management plans 2021-2027 for East-Estonia, West-Estonia and Gauja river basins and programme of measures (draft);
- The National Spatial Plan “Estonia 2030+”;
- The county plan of the maritime area adjacent to Hiiu County;
- The county plan of the maritime area adjacent to Pärnu County;
- Estonian Maritime Spatial Plan.

Based on the results of the analysis, the measures of the programme of measures support the objectives set in other relevant development documents, and no contradictions were identified.

Table 4.1. Relations of Estonian Marine Strategy's programme of measures 2022-2027 to the other most important national and international strategic development documents.

Strategic development document (SDD)	SAD significant impact area/principle/objective (relevant ones provided)	Relevant new measures of the programme of measures	Main relations and compliance
European Union Sustainable Development Strategy	1) Climate change and clean energy – limiting climate change and the resulting costs and negative impact on society and the environment. 2) Sustainable transport – ensuring transport systems that meet the economic, social and environmental needs of society and minimizing their unwanted impact on the economy, society and environment. 3) Sustainable consumption and production – promoting sustainable consumption and production methods. 4) Conservation and management of natural resources – improving the management of natural resources and avoiding their overexploitation, recognizing the value of ecosystem functioning. 5) Public health – promoting good public health on	1) Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects. Construction of the openings of the road dam of Väike Väin (Väike Strait) to improve the water exchange and to open the strait as a fish migration route. 2) Indirectly related: Increasing pollution control capacity through the design and construction of a new pollution control (oil and other hazardous chemicals) buoy and research vessel. Regarding ships, ensuring environmental safety at sea. 3) Reducing fishing efforts to GES level and development and implementation of the corresponding concept. Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational	1) Relations to mitigating possible climate change (the road dam of Väike Väin (Väike Strait) as well as preventing it (EIAs for blue economy projects). 2) The measures are indirectly related to transport and infrastructure. 3) The measures support promoting sustainable production and indirectly also sustainable consumption through promoting environmentally friendly waste management. 4) All measures contribute to a greater or lesser extent to the conservation of natural resources and recognizing the value of ecosystems functioning. 5) The measures indirectly contribute to promoting public health (good status of the marine environment; consumption of sea products) . The measures support and are compliant with the objectives of the development document.

Strategic development document (SDD)	SAD significant impact area/principle/objective (relevant ones provided)	Relevant new measures of the programme of measures	Main relations and compliance
	equal terms and improving protection against health risks.	monitoring of blue economy development projects. Environmentally friendly organization of waste management on coasts and beaches with flood risk. Litter collection campaigns. Planning various additional research. 4) All measures to a greater or lesser extent. 5) Indirectly, all measures that promote reducing litter and hazardous substances reaching the sea.	
European Union Strategy for the Baltic Sea Region	1) Saving the sea – reducing the use and impact of hazardous substances; reducing the discharge of nutrients to the sea to an acceptable level; biota rich in species and having good status; becoming a leader in maritime safety and security in the region; making the region a role model for	1) All measures to a greater or lesser extent. 2) Reducing fishing efforts to GES level and development and implementation of the corresponding concept. Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects.	1) The measures of the programme of measures contribute to achieving the good status of the Baltic Sea. 2) The measures support promoting and preserving sea-related economy of the region. The measures support and are compliant with the objectives of the development document.

Strategic development document (SDD)	SAD significant impact area/principle/objective (relevant ones provided)	Relevant new measures of the programme of measures	Main relations and compliance
	environmentally sustainable shipping. 2) Increasing welfare – education, promoting scientific research and employability; promoting economy; sustainable development of fisheries.	Environmentally friendly organization of waste management on coasts and beaches with flood risk. Litter collection campaigns Management of marine datasets, improvement of data exchange and availability of environmental data, including development of relevant services. Participation in international cooperation in the field of marine environmental protection. Informing and involving interest groups in marine environment protection activities. Enabling marine aquaculture while avoiding the increase in nutrient loads.	
European Union's 2020-2030 Climate and Energy Policy Framework	Set the target of the share of renewable energy sources at least 27%.	Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects. Developing compensatory measures for disturbing or destroying the integrity of the seabed.	The measures support the development of the blue economy (including e.g. offshore wind farms), thereby reducing the risks of possible negative impacts during development activities. The measures support and are compliant with the objectives of the development document.

Strategic development document (SDD)	SAD significant impact area/principle/objective (relevant ones provided)	Relevant new measures of the programme of measures	Main relations and compliance
European Union Biodiversity Strategy for 2030	1) Protection and conservation of nature in the European Union – a coherent network of protected areas; EU Nature Restoration Plan. Legally protecting at least 30% of EU mainland areas and 30% of EU marine areas and integrating ecological corridors into true trans-European nature network. 2) Enabling transformative change – a new governance framework; strengthening the implementation of and ensuring compliance with EU environmental legislation; reliance on an integrated approach involving the society as a whole. 3) EU action for an ambitious global biodiversity agenda – setting higher targets and greater global commitments; using	1) Directly: Improving the effectiveness of the existing network of marine protected areas. Indirectly: several measures related to controlling the spread of alien species (updating regulations), increasing pollution control capacity, promoting waste management, reducing hazardous substances reaching the sea, etc. 2) Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects. Raising awareness on treatment of environmentally hazardous pharmaceuticals. Environmentally friendly organization of waste management on coasts and beaches with flood risk. Implementation of the HELCOM marine noise plan and necessary regulations in Estonia. Management of marine datasets, improvement of data exchange and	1) The measures support the achievement of the goals of preserving biodiversity, and protection and conservation of nature. Planning of additional research is also positive. 2) The measures support the implementation of common environmental approaches in the countries of the Baltic Sea region. In addition to that, during research, additional baseline data will be collected, which would enable better decisions for designing the governance framework and legislation. 3) Most of the measures at least indirectly support the achievement of goals related to biodiversity protection and restoration. The information collected in the course of scientific research and the applied practices are also transferable at least partially at the global level and therefore indirectly contribute to the achievement of this EU goal. The measures support and are compliant with the objectives of the development document.

Strategic development document (SDD)	SAD significant impact area/principle/objective (relevant ones provided)	Relevant new measures of the programme of measures	Main relations and compliance
	external action to further EU objectives.	availability of environmental data, including development of relevant services. Updating regulations. Participation in international cooperation in the field of marine environmental protection. Informing and involving interest groups in marine environment protection activities. 3) All measures to a greater or lesser extent.	
European Green Deal	Transform the EU into a society with resource-efficient and competitive economy, with no net greenhouse gas emissions by 2050 and where economic growth is decoupled from resource use.	Developing compensatory measures for disturbing or destroying the integrity of the seabed. Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects.	The measures support the development of blue economy. The measures support achieving the good status of the marine environment. A marine environment that has good status also contributes to stopping the environmental degradation on a more general level, which is also the main objective of the Green Deal. The measures support and are compliant with the objectives of the development document.
European Union's Farm to Fork Strategy to promote a fair, healthy	Reduce dependence on pesticides and antimicrobials, reduce overfertilization, increase organic	Improving the condition of fish spawning areas and migration routes, stimulating	The measures support the promotion of sustainable fisheries and aquaculture,

Strategic development document (SDD)	SAD significant impact area/principle/objective (relevant ones provided)	Relevant new measures of the programme of measures	Main relations and compliance
and environmentally friendly food system	farming, improve animal welfare and reverse biodiversity loss, ensure sustainable food production.	populations and updating protection measures. Reducing fishing efforts to GES level and development and implementation of the corresponding concept. Developing compensatory measures for disturbing or destroying the integrity of the seabed. Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects. Implementation of the HELCOM marine noise plan and necessary regulations in Estonia. Avoiding the increase in the load of hazardous substances in aquaculture.	which are important components in securing food resources. Indirectly, other measures (e.g. waste management, reduction of hazardous substances, etc.) contribute to the promotion of an environmentally friendly food system through the achievement of good status of the marine environment. The measures support and are compliant with the objectives of the development document.
Building a climate-resilient Europe – a New EU Strategy for Climate Change Adaptation	Make adaptation smarter, faster and more systematic and enhance international measures to adapt to climate change.	Construction of the openings of the road dam of Väike Väin (Väike Strait) to improve the water exchange and to open the strait as a fish migration route. Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects.	The first measure contributes to adaptation to the effects of climate change (e.g. rising water levels) by improving water exchange. The second measure is related to adaptation to climate change, e.g. through the construction of new offshore wind farms.

Strategic development document (SDD)	SAD significant impact area/principle/objective (relevant ones provided)	Relevant new measures of the programme of measures	Main relations and compliance
			Indirectly, the scientific research planned in the programme of measures provides additional background information, which can also be taken into account when designing the activities necessary to adapt to climate change. The measures support and are compliant with the objectives of the development document.
Chemicals strategy for sustainability. Towards creating a non-toxic environment	The strategy seeks to create a non-toxic environment where chemicals are produced and used in a way that maximizes their contribution to society, including achieving the green and digital transitions, while avoiding harming the planet and current and future generations. The aim is to reduce chemical pollution in the natural environment.	Enhancing the management of environmentally hazardous pharmaceutical waste and raising awareness on more environmentally friendly disposal of pharmaceuticals. Environmentally friendly organization of waste management on coasts and beaches with flood risk. Litter collection campaigns. Increasing pollution control capacity through the design and construction of a new pollution control (oil and other hazardous chemicals) buoy and research vessel. Regarding ships, ensuring environmental safety at sea. Avoiding the increase in the load of hazardous substances in aquaculture.	The measures support both directly (e.g. ensuring environmental safety related to ships at sea, etc.) and indirectly (e.g. organizing waste management, etc.) the reduction of chemicals reaching the sea The measures support and are compliant with the objectives of the development document.

Strategic development document (SDD)	SAD significant impact area/principle/objective (relevant ones provided)	Relevant new measures of the programme of measures	Main relations and compliance
HELCOM Baltic Sea Action Plan	The main objectives of HELCOM Baltic Sea Action Plan are: 1) the Baltic Sea would not be affected by eutrophication; 2) the biota of the Baltic Sea would not be affected by hazardous substances; 3) favourable status of marine biota; 4) activities in the Baltic Sea would be carried out in an environmentally friendly manner.	All measures.	All measures support achieving the objectives of Baltic Sea Action Plan. The measures of the programme of measures partially overlap with those in the Baltic Sea Action Plan, but are either applied for Estonia or described in more detail in stages. Research planned within the programme of measures provide important additional information for the further design of the activities necessary to achieve good status of the marine environment. The measures support and are compliant with the objectives of the development document.
HELCOM Baltic Sea Marine Litter Action Plan	The goals are related to the reduction of marine litter through more effective waste management on land (including reducing the use of microplastics and single-use plastic bags) and at sea (including waste management on ships, losses of transported goods, etc.). In addition to that, it is important to prevent the loss of fishing gear and to appropriately handle fishing gear that is out of use.	Litter collection campaigns. Environmentally friendly organization of waste management on coasts and beaches with flood risk. Treatment of precipitation water and wastewater to reduce the amounts of microplastics. Reducing the formation of tire debris	The measures support reducing the generation of marine litter both on land as well as at the sea. The measures also contribute to reducing the amounts of litter, incl microplastics reaching the sea. The measures support and are compliant with the objectives of the development document.

Strategic development document (SDD)	SAD significant impact area/principle/objective (relevant ones provided)	Relevant new measures of the programme of measures	Main relations and compliance
HELCOM Baltic Sea Underwater Noise Action Plan	The aim is to reduce the impact of anthropogenic underwater noise on aquatic biota. Necessary actions include international cooperation, research to reduce the impact of underwater noise (including impulse and continuous noise).	Implementation of the HELCOM marine noise plan and necessary regulations in Estonia. Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects.	The measures support reducing the generation and impact of underwater noise. The objectives of the action plan are also supported by the studies planned within the programme of measures to establish measures to reduce the impact of underwater noise. The measures support and are compliant with the objectives of the development document.
HELCOM Baltic Sea Maritime Spatial Planning Action Plan	The aim is to promote the implementation of common principles in the preparation of maritime spatial plans in the Baltic Sea region through cooperation, and to take into account the approach based on ecosystem services in planning, including for achieving the good status of the marine environment. Maritime spatial plans are also related to promoting the blue economy and adapting to climate change.	Indirectly: Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects. Environmentally friendly organization of waste management on coasts and beaches with flood risk. Management of marine datasets, improvement of data exchange and availability of environmental data, including development of relevant services.	The programme of measures does not directly address maritime spatial planning. At the same time, some measures and studies indirectly support the preparation of the next maritime spatial plan (new background information).
HELCOM Baltic Sea Regional Nutrient Recycling Strategy	The aim is the sustainable use of nutrients in agriculture, optimizing the use of fertilizers and recycling of nutrients and thereby reducing excess nutrients reaching the	Indirectly: Participation in international cooperation in the field of marine environmental protection. Updating regulations.	The goals and activities of the strategy are mainly related to activities taking place on land. The measures of the programme of measures primarily indirectly support the implementation of the strategy.

Strategic development document (SDD)	SAD significant impact area/principle/objective (relevant ones provided)	Relevant new measures of the programme of measures	Main relations and compliance
	Baltic Sea. Application of circular economy principles in the use of nutrients.		The studies planned within the programme of measures (e.g. implementation of regionally coordinated measures to achieve nutrient load reduction goals) also support achieving the strategy's goals.
HELCOM Baltic Sea Research and Development Programme	The aim is to bring together the main needs for scientific research revealed in various fields during the preparation of HELCOM strategies and agreements.	Management of marine datasets, improvement of data exchange and availability of environmental data, including development of relevant services. Participation in international cooperation in the field of marine environmental protection. All planned research.	Measures and planned studies support the achieving the objectives of the Research and Development Programme. Although the planned studies are mainly related to the Estonian maritime area, depending on the nature of the study, they also provide important background information on a wider level.
HELCOM Guidelines for Sea-Based Measures to Manage Internal Nutrient Reserves in the Baltic Sea Region	It provides guidelines for the preparation of activities planned to reduce the internal load of the Baltic Sea, as well as other activities planned for the marine environment. The guidelines are mainly related to environmental impact and risk assessment.	Developing compensatory measures for disturbing or destroying the integrity of the seabed. Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects.	The measures support the guidelines provided in HELCOM Guidelines, including conducting EIA in the case of development projects. In addition to that, the studies planned in the programme of measures provide background information for conducting EIAs.
UNESCO programme for West Estonian Archipelago Biosphere programme area 2014-	The West Estonian archipelago is becoming Estonia's leading region of green economic innovation and pilot projects in the sustainable use	All measures to a greater or lesser extent	The aim of the measures, including research, is to achieve good status of the marine environment, which supports the objectives of the UNESCO programme.

Strategic development document (SDD)	SAD significant impact area/principle/objective (relevant ones provided)	Relevant new measures of the programme of measures	Main relations and compliance
2020 (though its validity period has ended, its objectives will continue to be relevant)	of natural resources of local natural and semi-natural terrestrial and marine communities. Biodiversity is preserved.		The measures support and are compliant with the objectives of the development document.
Estonia 2035+ strategy	Estonia's economy is strong, innovative and responsible. Living environment of Estonia takes into account everyone's needs, is safe and of high quality.	All measures to a greater or lesser extent	One part of a high-quality living environment is a marine environment that has good status. Thus, all planned measures to a greater or lesser extent directly or indirectly support the implementation of the strategy. The promotion of an innovative and responsible economy is supported, for example, by measures related to fisheries and fishing, marine aquaculture, as well as EIAs for blue economy development projects. The measures support and are compliant with the objectives of the development document.
Estonian Marine Strategy	Maintain or achieve good environmental status of maritime area by 2020 at the latest.	All measures	The programme of measures is part of the implementation of the Marine Strategy.
General Principles of Climate Policy until 2050	1) Emissions from the energy economy, including transport, must be decisively and significantly reduced. This means replacing today's non-renewable resource-based and	1) Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects.	1) The measures support, inter alia, the development of offshore wind farms in an environmentally sustainable manner. 2) The measure improves water exchange in Väike Väin (Väike Strait), which supports, inter alia,

Strategic development document (SDD)	SAD significant impact area/principle/objective (relevant ones provided)	Relevant new measures of the programme of measures	Main relations and compliance
	polluting energy production with predominantly local renewable energy production. 2) In order to adapt to the impacts of climate change, ensure the functioning of the economy, infrastructure and energy sector and prevent negative health impacts of any climate events. Also increase the capacity of rescue services and civil emergency preparedness.	Developing compensatory measures for disturbing or destroying the integrity of the seabed. 2) Construction of the openings of the road dam of Väike Väin (Väike Strait) to improve the water exchange and to open the strait as a fish migration route. Management of marine datasets, improvement of data exchange and availability of environmental data, including development of relevant services.	adaptation to climate change (e.g. in case of rising water levels). In addition to that, the studies planned in the programme of measures provide background information for conducting EIAs. The measures support and are compliant with the objectives of the development document.
Estonia's 2030 National Energy and Climate Plan	Introduction of renewable energy, energy security, research, innovation in the field of climate and energy.	Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects. Developing compensatory measures for disturbing or destroying the integrity of the seabed.	The measures support the development of blue economy (including e.g. offshore wind farms), while also reducing the risks of possible negative impacts during development activities. In addition to that, the studies planned in the programme of measures provide background information for conducting EIAs. The measures support and are compliant with the objectives of the development document.

Strategic development document (SDD)	SAD significant impact area/principle/objective (relevant ones provided)	Relevant new measures of the programme of measures	Main relations and compliance
Climate Change Adaptation Development Plan until 2030	1) In a changing climate, the diversity of species, habitats and landscapes, as well as favourable status and integrity of terrestrial and aquatic ecosystems, and providing socio-economically important ecosystem services in sufficient quantity and quality are ensured. 2) The sustainability of the bioeconomy sectors important to Estonia is ensured by climate-conscious agricultural, forest, water, fishing and recreation economy and peat mining. 3) Due to climate change, energy independence, energy security, security of supply and usability of renewable energy resources have not decreased, and the volume of final consumption of primary energy has not increased.	1) Construction of the openings of the road dam of Väike Väin (Väike Strait) to improve the water exchange and to open the strait as a fish migration route All measures related to fish and fishery. Indirectly, all measures to a greater or lesser extent. 2) All measures related to fish and fishery and aquaculture. Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects. Indirectly: Litter collection campaigns. Environmentally friendly organization of waste management on coasts and beaches with flood risk. 3) Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects.	1) The measures support achieving good status of the marine environment, which is an important basis for adapting to climate change. Thus, the measures also support the fulfillment of the objectives of the development plan. 2) The measures support the improvement of food supply in changing climate conditions. Indirectly, the measures contribute to promoting recreation economy. 3) The measures support the development of blue economy (including e.g. offshore wind farms), while also reducing the risks of possible negative impacts during development activities. In addition to that, the studies planned in the programme of measures provide background information for conducting EIAs. The measures support and are compliant with the objectives of the development document.

Strategic development document (SDD)	SAD significant impact area/principle/objective (relevant ones provided)	Relevant new measures of the programme of measures	Main relations and compliance
		Developing compensatory measures for disturbing or destroying the integrity of the seabed.	
Estonian Environmental Strategy 2030	The aim is to determine long-term development directions for maintaining the good status of the natural environment, while considering the relationship between the environment and the economic and social sphere, and their impacts on the surrounding natural environment and on human being.	All measures to a greater or lesser extent.	The measures support achieving good status of the marine environment, which is an important component in ensuring sustainable development. Thus, the measures also support fulfillment of the objectives of the development document. The measures support and are compliant with the objectives of the development document.
Estonian National Strategy on Sustainable Development "Sustainable Estonia 21";	To combine success requirements arising from global competition with the preservation of the principles of sustainable development and traditional values of Estonia.		
2030 Agenda for Sustainable Development	To support sustained, inclusive and sustainable economic growth and to ensure decent work for all. To ensure sustainable consumption and production.		
Natura 2000 Action Plan 2021-2027	Determines actions necessary for achieving and maintaining good status of Natura 2000 sites. In the case of Natura 2000 sites related to the marine environment, the main activities are related to the organization of protection and monitoring of habitat types,	Improving the effectiveness of the existing network of marine protected areas. Implementing technologies to reduce and prevent bycatch in order to protect species in the Baltic Sea.	The measures support maintaining the favourable status of Natura 2000 sites, as the good status of the marine environment is an important foundation for maintaining the favorable status of Natura sites.

Strategic development document (SDD)	SAD significant impact area/principle/objective (relevant ones provided)	Relevant new measures of the programme of measures	Main relations and compliance
	reducing the bycatch of seabirds and seals, reducing the load of nutrients reaching the sea, and increasing the efficiency of pollution removal.	Developing compensatory measures for disturbing or destroying the integrity of the seabed. Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects. Construction of the openings of the road dam of Väike Väin (Väike Strait) to improve the water exchange and to open the strait as a fish migration route. Increasing pollution control capacity through the design and construction of a new pollution control (oil and other hazardous chemicals) buoy and research vessel. Implementation of the HELCOM marine noise plan and necessary regulations in Estonia. Avoiding the increase in the load of hazardous substances in aquaculture. Indirectly, all measures related to fishery and waste management.	The measures support and are compliant with the objectives of the development document.
Welfare Development Plan 2016-2023	High level of employment and a long and high quality working life. Reducing social inequalities and	Reducing fishing efforts to GES level and development and implementation of the corresponding concept.	The measures support preserving fisheries and aquaculture-related business on a long-term scale. Indirectly, the good

Strategic development document (SDD)	SAD significant impact area/principle/objective (relevant ones provided)	Relevant new measures of the programme of measures	Main relations and compliance
	poverty, gender equality and greater social inclusion.	Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects.	status of the marine environment supports the welfare of people in general.
Agriculture and Fisheries Development Plan until 2030	1) Competent scientific support in designing and implementing the common agricultural and fisheries policy. 2) Competent scientific support for the agricultural, food and fisheries sector. 3) Estonian researchers participate in international research cooperation.	1.-3. Improving the condition of fish spawning areas and migration routes, stimulating populations and updating protection measures. Implementing technologies to reduce and prevent bycatch in order to protect species in the Baltic Sea. Reducing fishing efforts to GES level and development and implementation of the corresponding concept. Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects. Participation in international cooperation in the field of marine environmental protection. Management of marine datasets, improvement of data exchange and availability of environmental data,	Measures and various studies support the sustainable and science-based development of fisheries and aquaculture. Indirectly, through achieving good status of the marine environment, all measures support the fulfillment of the goals of the development plan to a greater or lesser extent.

Strategic development document (SDD)	SAD significant impact area/principle/objective (relevant ones provided)	Relevant new measures of the programme of measures	Main relations and compliance
		including development of relevant services. Informing and involving interest groups in marine environment protection activities. Avoiding the increase in the load of hazardous substances in aquaculture.	
Fish farming restoration action plan 2017–2019 (with a 2023 perspective)	Improve the status and increase the abundance of endangered fish species, incl protected fish species by fish farming restoration, also creating wider opportunities for fishing for valuable fish species in Estonia.	Improving the condition of fish spawning areas and migration routes, stimulating populations and updating protection measures. Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects.	Measures and research support the sustainable and science-based development of fish farming reproduction. Indirectly, through achieving good status of the marine environment, all measures support the fulfillment of the goals of the development plan to a greater or lesser extent.
Migratory, semi-migratory, and freshwater fish species spawning grounds restoration programme 2017–2023 (with a 2027 perspective)	Improving the availability of spawning grounds for freshwater, semi-migratory and migratory fish species of Estonian inland waters and brackish waters of coastal area.	Improving the condition of fish spawning areas and migration routes, stimulating populations and updating protection measures.	The measure supports achieving the goals of the programme.
European Maritime, Fisheries and Aquaculture Fund's (EMFAF) operational programme 2021–2027	1) Fostering sustainable fisheries and the restoration and conservation of aquatic biological resources.	1) and 2) All measures and studies to a greater or lesser extent. 3) Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects.	1) and 2) Measures and studies support the sustainable development of fisheries and aquaculture. Indirectly, through achieving good status of the marine environment, all measures

Strategic development document (SDD)	SAD significant impact area/principle/objective (relevant ones provided)	Relevant new measures of the programme of measures	Main relations and compliance
	2) Fostering sustainable aquaculture activities, and processing and marketing of fishery and aquaculture products, thus contributing to food security in the Union. 3) Enabling a sustainable blue economy in coastal, island and inland areas, and fostering the development of fishing and aquaculture communities. 4) Strengthening international ocean governance and enabling seas and oceans to be safe, secure, clean and sustainably managed.	4) All measures and studies to a greater or lesser extent.	support the fulfillment of the objectives of the operational programme to a greater or lesser extent. 3) The measure contributes to fostering blue economy. 4) Measures and studies support achieving good status of the marine environment, which is also important in terms of the wider aquatic environment.
Estonian Multiannual Strategic Plan for Aquaculture 2030	1) The strategic goal for the development of sustainable aquaculture is to increase the capacity of offshore aquaculture to 10,000 tonnes weight gain a year in the future; 2) the cultivation of algae and shellfish would allow removing nutrients from the Baltic Sea and, on the	Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects. Avoiding the increase in the load of hazardous substances in aquaculture. Developing compensatory measures for disturbing or destroying the integrity of the seabed.	The measures support sustainable development of aquaculture. Indirectly, through achieving good status of the marine environment, all measures support the fulfillment of the objectives of the strategic plan to a greater or lesser extent.

Strategic development document (SDD)	SAD significant impact area/principle/objective (relevant ones provided)	Relevant new measures of the programme of measures	Main relations and compliance
	other hand, provide high added value to aquaculture products with high export potential; 3) it is important to consider the environmental status of the Baltic Sea in the development of marine aquaculture; and in maritime spatial planning and based on environmental aspects, we create opportunities for the development of interoperable solutions. Multi-trophic aquaculture, aquaculture in interaction with wind farms or closed nutrient circulation are becoming more important.		
Transport and Mobility Development Plan 2021-2025 (including primarily the concept of maritime transport policy, an annex to "Transport and Mobility Development Plan 2021-2035")	1) To make the maritime transport sector more competitive and greener and connect it with other infrastructure. To develop environmentally friendly facilities and services both in ports and in maritime logistics chains. 2) To preserve maritime cultural heritage.	1) Increasing pollution control capacity through the design and construction of a new pollution control (oil and other hazardous chemicals) buoy and research vessel. Litter collection campaigns. Environmentally friendly organization of waste management on coasts and beaches with flood risk.	1) The measures support developing greener maritime transport sector. 2) The programme of measures does not directly address the issue of preserving maritime cultural heritage. However, indirectly, its measures support preserving and developing the traditional coastal lifestyle.

Strategic development document (SDD)	SAD significant impact area/principle/objective (relevant ones provided)	Relevant new measures of the programme of measures	Main relations and compliance
		Implementation of the HELCOM marine noise plan and necessary regulations in Estonia. Regarding ships, ensuring environmental safety at sea. 2) Indirectly: Improving the condition of fish spawning areas and migration routes, stimulating populations and updating protection measures. Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects. Environmentally friendly organization of waste management on coasts and beaches with flood risk. Litter collection campaigns.	
Water management plans 2021-2027 for East-Estonia, West-Estonia and Gauja river basins (draft)	To provide a thorough overview of the status of Estonian water bodies and plan activities for improving the status of rivers, lakes, coastal waters and the sea. The objectives of water management plans are achieving at	All measures to a greater or lesser extent.	In order to achieve good status of the marine environment, it is important to limit the load originating from land, and this issue is addressed in water management plans and their programme of measures. Water management plans aim to achieve, inter alia, the good status of coastal waters and the sea, which is in

Strategic development document (SDD)	SAD significant impact area/principle/objective (relevant ones provided)	Relevant new measures of the programme of measures	Main relations and compliance
	least good status of surface water and ground water, sustainable use of water and ensuring high quality drinking water.		line with the objective of the Marine Strategy's programme of measures.
Water management plans 2021-2027 for East-Estonia, West-Estonia and Gauja river basins and programme of measures	The programme of measures is an integral part of the water management plans of the river basins, in which the measures for water use and protection are provided in order to achieve the environmental objectives for surface and groundwater. Surface water includes stagnant water bodies as well as watercourses and parts of the coastal sea.	Directly related: measures related to fish spawning areas and migration routes, preventing the spread of alien species (updating regulations), waste management and marine litter. Indirectly: all measures to a greater or lesser extent (the goal is to achieve good environmental status).	Since the majority of the nutrient load comes from agriculture, the programme of measures focuses on agriculture. Addressing the activities related to agriculture is not the objective of the Marine Strategy's programme of measures. However, measures for agricultural activities in the programme of measures of the water management plan support achieving good status of the marine environment. The measures of the programme of measures also support and supplement activities related to fish spawning areas and migration routes, preventing the spread of alien species, waste management and marine litter.
The National Spatial Plan "Estonia 2030+"	Ensure balanced and sustainable development of settlements, high-quality living environment, good and convenient mobility facilities and and the supply of essential networks.	Directly: Developing compensatory measures for disturbing or destroying the integrity of the seabed. Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects.	The measures support the implementation of the National Spatial Plan by providing necessary measures for developing offshore wind farms, as well as for general urban maintenance and encouraging entrepreneurship.

Strategic development document (SDD)	SAD significant impact area/principle/objective (relevant ones provided)	Relevant new measures of the programme of measures	Main relations and compliance
		Litter collection campaigns. Environmentally friendly organization of waste management on coasts and beaches with flood risk. Indirectly measures that are primarily related to fisheries.	
The county plan of the maritime area adjacent to Hiiu County	To ensure meeting the objectives of the spatial development of the maritime area of Hiiu County through an inclusive planning process. Valuing, preserving and sustainably using the resources of Hiiumaa maritime area in the interests of Hiiumaa, which ensures the balanced development of Hiiumaa.	All measures to a greater or lesser extent.	Maritime spatial plan shapes the spatial use of the sea, creating opportunities for, inter alia, the development of business, while also taking into account the traditional ways of using the sea. Achieving good status of the marine environment is important for the sustainable use of the maritime area. Measures provided in the programme of measures support the sustainable use of the maritime area and, thereby, also implementation of the Maritime Spatial Plan.
The county plan of the maritime area adjacent to Pärnu County	Pärnu maritime area is ecologically clean and valuable sea, which is a place for sustainable fishing, tourism and recreation, preserved and valued natural and cultural objects, and functioning harbours and shipping routes.		
Estonian Maritime Spatial Plan	The aim of the maritime spatial plan is to agree on the long-term principles of Estonian maritime area use in order to promote the maritime economy, and contribute to attaining and maintaining a		

Strategic development document (SDD)	SAD significant impact area/principle/objective (relevant ones provided)	Relevant new measures of the programme of measures	Main relations and compliance
	good status of the marine environment.		

5. Assessment of the expected environmental impact accompanying the implementation of the programme of measures (including mitigating measures)

5.1 Analysis of the expected impact accompanying the implementation of the programme of measures

In this chapter, a sectoral analysis of the impact of implementing Estonian Marine Strategy's programme of measures is performed. Impact assessments are conducted for each new measure provided in the programme of measures. The impact has been assessed across different environmental domains and is illustrated by the following colour coding (Table 5.1), which is supplemented by verbal descriptions

Table 5.1. Colour codes characterizing assessments

Green	The measure is accompanied by direct favourable (positive) impact
Blue	The measure is accompanied by indirect favourable (positive) impact
Red	The measure does not contribute to reaching environmental objectives or it may be accompanied by unfavourable (negative) impact
Yellow	The exact direction and nature of the environmental impact cannot be assessed within the degree of accuracy of the programme of measures, or the measure does not have significant impact on the environment.
Orange	Possible accompanying unfavourable impact in a situation where the overall impact of the measure is expected to be favourable

Assessments given to the measures of Estonian Marine Strategy's programme of measures are presented in Table 5.2. Domains of impact assessment presented in the table are based on the SEA programme. Table 5.2 is followed by sectoral summaries of the impact assessment and, where necessary, recommendations/proposals are made regarding measures/issues that should be either additionally considered while continuing the preparation or implementation of the programme of measures, or which have been considered already, but nevertheless need special attention.

Table 5.2. Assessing the measures of Estonian Marine Strategy's programme of measures across different environmental and social domains

Measure with its code (provisional) and the short description of the measure	**Impact on natural environment**				**Impact on social environment**		
	Impact on biodiversity, food webs and benthic communities and communities in water column, and commercial fish and other species (descriptors D1, D3, D4)	Impact regarding alien species (descriptor D2)	Impact on marine habitats (seabed integrity and hydrographic conditions) and other physical indicators of the marine environment (underwater noise), including impact on protected natural objects and the conservation objectives and integrity of Natura 2000 sites (descriptors D6, D7, D11)	Impact on seawater quality, including eutrophication, the content of pollutants in the aquatic environment and the content of pollutants in seafood, the impact of marine litter (descriptors D5, D8, D9 and D10)	Impact on human health, well-being (especially on employment and maritime-related business, and research and development) and property	Impact on maritime cultural heritage and traditional coastal lifestyle	Comment to be further considered or paid significant attention to in implementing the programme of measures
Measure BALEE-M017 - Improving the effectiveness of the existing network of marine protected areas							
Assessing the effectiveness and coherence of the existing network of marine protected areas, and developing measures to improve coherence, developing and implementing a monitoring programme for marine protected areas. Making changes in the network of marine protected areas in order to increase coherence and	The measure contributes to preserving sea-related biodiversity in marine protected areas and to improving the interconnectedness of marine protected areas. The development of monitoring programmes and their implementation provides information on the effectiveness of meeting the conservation objectives of marine protected areas and thus has a favorable impact. In addition to that, monitoring indirectly contributes to the prompt detection of the spread of possible alien species.				Preserving marine biodiversity is also important in relation to human well-being and entrepreneurship, indirectly promoting, for example, the preservation of recreation economy and fishing in the coastal region On the other hand, restrictions on marine protected areas and additional possible restrictions related to ensuring the coherence of protected areas can limit the scope and location of areas		Preserving marine biodiversity is also important in relation to human well-being and entrepreneurship. At the same time, it must be taken into account that there are restrictions on economic activity in marine protected areas, and when assessing the coherence of

Measure with its code (provisional) and the short description of the measure	**Impact on natural environment**				**Impact on social environment**		
	Impact on biodiversity, food webs and benthic communities and communities in water column, and commercial fish and other species (descriptors D1, D3, D4)	Impact regarding alien species (descriptor D2)	Impact on marine habitats (seabed integrity and hydrographic conditions) and other physical indicators of the marine environment (underwater noise), including impact on protected natural objects and the conservation objectives and integrity of Natura 2000 sites (descriptors D6, D7, D11)	Impact on seawater quality, including eutrophication, the content of pollutants in the aquatic environment and the content of pollutants in seafood, the impact of marine litter (descriptors D5, D8, D9 and D10)	Impact on human health, well-being (especially on employment and maritime-related business, and research and development) and property	Impact on maritime cultural heritage and traditional coastal lifestyle	Comment to be further considered or paid significant attention to in implementing the programme of measures
efficiency (changing the boundaries of protected areas, introducing changes to the conservation management plans of protected areas according to the results of the efficiency analysis).					suitable for marine business (tourism, fishing, aquaculture, offshore wind farms, etc). The exact direction and nature of the environmental impact cannot be assessed within the degree of accuracy of the programme of measures. No adverse impact on the conservation of cultural heritage located in the sea can be expected. The preservation of the traditional coastal lifestyle has been discussed above (see fishing, tourism).		protected areas and developing corresponding measures, it is important to consider preserving the possibilities of using the sea related to human activities.
Measure BALEE-M020 - Improving the condition of fish spawning areas and migration routes, stimulating populations							

Measure with its code (provisional) and the short description of the measure	**Impact on natural environment**				**Impact on social environment**		
	Impact on biodiversity, food webs and benthic communities and communities in water column, and commercial fish and other species (descriptors D1, D3, D4)	Impact regarding alien species (descriptor D2)	Impact on marine habitats (seabed integrity and hydrographic conditions) and other physical indicators of the marine environment (underwater noise), including impact on protected natural objects and the conservation objectives and integrity of Natura 2000 sites (descriptors D6, D7, D11)	Impact on seawater quality, including eutrophication, the content of pollutants in the aquatic environment and the content of pollutants in seafood, the impact of marine litter (descriptors D5, D8, D9 and D10)	Impact on human health, well-being (especially on employment and maritime-related business, and research and development) and property	Impact on maritime cultural heritage and traditional coastal lifestyle	Comment to be further considered or paid significant attention to in implementing the programme of measures
and updating protection measures							
As a result of straightening and damming of the rivers, and vegetal invasion in small sea bays and shallow sea areas, the quantity and quality of accessible spawning grounds for many fish populations (e. g. pike, ide, dace, roach, burbot, sea trout, Atlantic salmon, whitefish, eel) have decreased. In order to achieve the biodiversity and distribution of fish in the coastal sea, the status of commercial fish populations and good environmental status of food webs, it is necessary	The opening of spawning grounds and migration routes to spawning grounds has a long-term favourable impact on maintaining the viability of fish populations and thus on biological diversity as a whole. By removing vegetation and sediments, nutrients are removed from the Baltic Sea. In the short term, the activity is accompanied by an adverse impact due to the increase in nutrient concentrations (in addition to suspended solids) in seawater released from the sediment during vegetation and sediment removal. However, this is a local impact, which, considering the general purpose and technical feasibility of the measure (including, for example, limiting the spread of suspended solids carried out of the work zone), is unlikely to have a long-term adverse impact. More detailed impact (preliminary) assessments will be conducted in the appropriate stages of respective projects. The measure has favourable combined impact with restoration of fish migration routes and spawning areas in inland water bodies, which have been discussed, for example, in water management plans.				The measure has a long-term favourble impact on fisheries through improving the viability of commercial fish species populations. Improving the sustainability of fisheries has also favourable impact on preserving cultural heritage (traditional lifestyle).		

Measure with its code (provisional) and the short description of the measure	**Impact on natural environment**				**Impact on social environment**		
	Impact on biodiversity, food webs and benthic communities and communities in water column, and commercial fish and other species (descriptors D1, D3, D4)	Impact regarding alien species (descriptor D2)	Impact on marine habitats (seabed integrity and hydrographic conditions) and other physical indicators of the marine environment (underwater noise), including impact on protected natural objects and the conservation objectives and integrity of Natura 2000 sites (descriptors D6, D7, D11)	Impact on seawater quality, including eutrophication, the content of pollutants in the aquatic environment and the content of pollutants in seafood, the impact of marine litter (descriptors D5, D8, D9 and D10)	Impact on human health, well-being (especially on employment and maritime-related business, and research and development) and property	Impact on maritime cultural heritage and traditional coastal lifestyle	Comment to be further considered or paid significant attention to in implementing the programme of measures
to improve the respective degraded wetlands (e.g. river estuaries, coastal lagoons, shallow sea areas), migration routes (e. g. straits between coastal lagoons and the sea) to ensure migration routes for fish to their spawning grounds, stimulate populations and update protection measures (e. g. updating the regionally coordinated eel management plan) and develop and implement new measures to improve the status of the population (e. g. stocking juvenile fish into the coastal sea, introducing additional							

Measure with its code (provisional) and the short description of the measure	Impact on natural environment				Impact on social environment		
	Impact on biodiversity, food webs and benthic communities and communities in water column, and commercial fish and other species (descriptors D1, D3, D4)	Impact regarding alien species (descriptor D2)	Impact on marine habitats (seabed integrity and hydrographic conditions) and other physical indicators of the marine environment (underwater noise), including impact on protected natural objects and the conservation objectives and integrity of Natura 2000 sites (descriptors D6, D7, D11)	Impact on seawater quality, including eutrophication, the content of pollutants in the aquatic environment and the content of pollutants in seafood, the impact of marine litter (descriptors D5, D8, D9 and D10)	Impact on human health, well-being (especially on employment and maritime-related business, and research and development) and property	Impact on maritime cultural heritage and traditional coastal lifestyle	Comment to be further considered or paid significant attention to in implementing the programme of measures
catch limits or regulating the number of traps used).							
Measure BALEE-M021 - Implementing technologies to reduce and prevent bycatch in order to protect species in the Baltic Sea							
Support testing and adoption of new techniques to reduce bycatch (i. e. catching non-target fish species, birds and mammals). One of the subactivities is to support the introduction of seal deterrents to reduce marine mammal bycatch in commercial fishing gear.	Supporting the use of various techniques to reduce bycatch has a favorable impact on the preservation of biological diversity and, depending on the conservation objective of protected areas (including bird and nature areas), also on achieving favourable status of particular species (e.g. seals) and their conservation objectives. More seal- and bird-proof fishing gear with deterrents would help to reduce the chances of seals or birds being harmed or killed in traps. Therefore, the measure has favourable impact on the abundance of seals and birds. On the other hand, it must be taken into account that depending on the technique used to reduce bycatch, devices operating in water can increase underwater noise. In addition to that, it is important to avoid situations where using a device aimed at a target species may have an adverse impact on other species in the area. Therefore, it is necessary to test the technique and monitor its possible impact before its wider				The impacts are manifested primarily in the fishing sector, being on the one hand related to the reduction of bycatch, but on the other hand to the need to deploy additional technical devices to the fishing gear or fishing area. In general, the impact can be considered rather favourable, as the devices used to reduce bycatch scare piscivorous birds and mammals away from fishing gear in the sea (greater		It is necessary to test the techniques to reduce bycatch and monitor its possible impact before its wider adoption. Before wider adoption of a device, it must be ensured to the maximum extent that the device or its parts do not break down in sea

Measure with its code (provisional) and the short description of the measure	**Impact on natural environment**				**Impact on social environment**		
	Impact on biodiversity, food webs and benthic communities and communities in water column, and commercial fish and other species (descriptors D1, D3, D4)	Impact regarding alien species (descriptor D2)	Impact on marine habitats (seabed integrity and hydrographic conditions) and other physical indicators of the marine environment (underwater noise), including impact on protected natural objects and the conservation objectives and integrity of Natura 2000 sites (descriptors D6, D7, D11)	Impact on seawater quality, including eutrophication, the content of pollutants in the aquatic environment and the content of pollutants in seafood, the impact of marine litter (descriptors D5, D8, D9 and D10)	Impact on human health, well-being (especially on employment and maritime-related business, and research and development) and property	Impact on maritime cultural heritage and traditional coastal lifestyle	Comment to be further considered or paid significant attention to in implementing the programme of measures
Identify problems related to bird bycatch, plan possible voluntary and regulatory measures, especially for important bird areas, to prevent bird bycatch.	adoption. Before wider adoption of a device, it must be ensured to the maximum extent that the device or its parts do not break down in sea conditions and thereby increase the amount of marine litter.				catch; reduced need to repair fishing gear, etc). There is an indirect favourable impact on cultural heritage primarily through supporting the preservation of the traditional coastal lifestyle (fishing).		conditions and thereby increase the amount of marine litter.
Measure BALEE-M026 - Reducing fishing efforts to GES level and development and implementation of the corresponding concept							
The main factor affecting biodiversity and abundance of fish populations, the status of industrial fish stocks and the structure of food webs is fishing. The studies so	Reducing the fishing efforts for fish species important for fisheries to the GES level has a favourable impact not only on particular species (reducing the load resulting from fishing on populations) but also on the biodiversity of the region in general. The activities supported under this measure have an indirect positive impact on protected natural objects and their ecological balance by supporting the preservation of biological diversity in general.				The implementation of the measure and imposing additional restrictions on fishing will have an unfavourable impact on the businesses engaged in fishing. At the same time, it is important that the main goal of the measure is		

Measure with its code (provisional) and the short description of the measure	Impact on natural environment				Impact on social environment		
	Impact on biodiversity, food webs and benthic communities and communities in water column, and commercial fish and other species (descriptors D1, D3, D4)	Impact regarding alien species (descriptor D2)	Impact on marine habitats (seabed integrity and hydrographic conditions) and other physical indicators of the marine environment (underwater noise), including impact on protected natural objects and the conservation objectives and integrity of Natura 2000 sites (descriptors D6, D7, D11)	Impact on seawater quality, including eutrophication, the content of pollutants in the aquatic environment and the content of pollutants in seafood, the impact of marine litter (descriptors D5, D8, D9 and D10)	Impact on human health, well-being (especially on employment and maritime-related business, and research and development) and property	Impact on maritime cultural heritage and traditional coastal lifestyle	Comment to be further considered or paid significant attention to in implementing the programme of measures
far have revealed that the large number of fishing gear potentially in use, the liceneces for which have been issued to fishermen in Estonian maritime areas is one of the main reasons that prevents achieving GES. Thus, it is necessary to reduce the number of fishing gear potentially in use, but at the same time, it is necessary to develop a model of how to implement the change in such a way as to reduce the possible negative socio-economic impact. The concept must propose various solutions to achieve the goal.					the long-term improvement of the reproductive capacity of fish populations and reducing the impact caused by overfishing. Therefore, although the measure may have a short-term unfavourable impact, fishing will not be completely prohibited (based on species-specific GES levels). In the long term, the impact will be favourable, as the status of the fish stocks will presumably improve and it will be possible to continue fishing. The latter is also important regarding the preservation of traditional coastal lifestyle.		

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Measure BALEE-M032 - Developing compensatory measures for disturbing or destroying the integrity of the seabed							
A package of measures will be developed and established to compensate for the disturbance of the seabed and the destruction of habitats during various developments and other activities. One of the goals of the package of measures is to ensure the least possible disturbance of the seabed and restoring it to the original condition after use.	Most of the development activities related to the sea are to a greater or lesser extent also related to the seabed. On the other hand, the seabed and water column above it are important habitats. Although the assessment of the environmental status of the Estonian maritime area (2019) concluded that, considering the physical disturbance and loss of the seabed so far, the conditions of the GES have been met, it can be assumed that in the future the volume of development activities that may affect the seabed (e.g. offshore wind farms, aquaculture) will increase. Therefore, the implementation of the measure is relevant for maintaining GES. When implementing the measure and developing the corresponding package of measures, it is important to consider that sediments containing nutrients are associated with the seabed. By moving sediments during development activities, nutrients bound in the sediments can be released into the water column, which in turn contributes to eutrophication.				The implementation of the measure and the requirements and restrictions imposed as a result of the development of the relevant package of measures may have an unfavourable impact on the development of maritime business. At the same time, it is important that when developing the package of measures, the requirements would be established in a differentiated manner (i.e. with a different degree of strictness) considering the importance of seabed habitats.		When implementing the measure and developing the corresponding package of measures, it is important to take into account the nutrient-rich sediments on the seabed, including taking into account the fact how mobile nutrients may be in the respective sediments.

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The package of measures will be established in a differentiated manner according to the importance of benthic habitats, their nature conservation value, current status and distribution. For this purpose, based on the available information, the situation of benthic habitats will be assessed and a priority list of habitats will be prepared.					There are numerous cultural monuments (shipwrecks) on the seabed, which today are a so-called natural part of the seabed and maritime cultural heritage. As the purpose of the measure is to preserve the good status of seabed habitats, the activity also has an indirect favourable impact on the preservation of cultural monuments located on the seabed.		
Measure BALEE-M035 - Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring							

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	Impact on biodiversity, food webs and benthic communities and communities in water column, and commercial fish and other species (descriptors D1, D3, D4)	Impact regarding alien species (descriptor D2)	Impact on marine habitats (seabed integrity and hydrographic conditions) and other physical indicators of the marine environment (underwater noise), including impact on protected natural objects and the conservation objectives and integrity of Natura 2000 sites (descriptors D6, D7, D11)	Impact on seawater quality, including eutrophication, the content of pollutants in the aquatic environment and the content of pollutants in seafood, the impact of marine litter (descriptors D5, D8, D9 and D10)	Impact on human health, well-being (especially on employment and maritime-related business, and research and development) and property	Impact on maritime cultural heritage and traditional coastal lifestyle	Comment to be further considered or paid significant attention to in implementing the programme of measures
of blue economy development projects							
As for the blue economy development projects, there are no minimum EIA requirements and there is also no standard for monitoring during operation. As these are mostly maritime areas for which the existing information is extremely patchy, as a rule, it is not possible to rely only on the existing information. Within the measure, a guide to the EIA minimum requirements for development projects (description of the necessary information to	The measure has no direct impact. Indirectly, the measure will have a favourable impact on all areas of the natural environment, as minimum requirements will be established for conducting future EIAs related to the sea, and guidelines for monitoring the operation of blue economy projects will be prepared. Both the package of minimum requirements and the guidelines for monitoring contribute to addressing important issues in EIAs and organizing post-implementation monitoring. The results of the monitoring in turn can be used as input data for the next blue economy projects, and in this way, sustainable and environmentally friendly solutions for implementing the projects can be found.				The measure has an indirect favorable impact on human health, well-being and the preservation of cultural heritage, since the minimum requirements of EIAs for blue economy projects also concern the abovementioned areas. In addition to that, monitoring during the operation helps to obtain information about the real impacts of the implementation of blue economy projects and the extent of their impact on a site-specific and general level. Unfavourable impact may occur for developers of blue economy projects, as there will be costs to cover associated with conducting		

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conduct an EIA) and an EIA-EIA ex-post assessment system will be prepared. Guidelines for monitoring the operation of blue economy projects (standard) will be prepared.					both EIAs and subsequent monitoring. On the other hand, these costs are indispensable for the development and implementation of sustainable and environmentally friendly solutions.		
Measure BALEE-M036 - Construction of the openings of the road dam of Väike Väin (Väike Strait) to improve the water exchange and to open the strait as a fish migration route							
As a result of the construction of the road dam of Väike Väin (Väike	Due to closing Väike Väin (Väike Strait) with a road dam, the exchange of water between different parts of the strait has been disurbed, which has caused the water quality to deteriorate, and many fish species (e.g. Baltic herring, whitefish, ide,				The construction of dam openings facilitates the migration of fish, and thus it can be expected that		

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Strait), the exchange of water between different parts of the strait has been disturbed, which has caused the water quality to deteriorate, and many fish species (e.g. Baltic herring, whitefish, ide, perch, pike, etc.) cannot pass through this natural migration route. Therefore, it is necessary to construct the largest possible passageways into the road dam of Väike Väin (Väike Strait) to ensure the free passage of fish between their spawning grounds and feeding areas.	perch, pike, etc.) cannot pass through this natural migration route. This means that there can basically be no natural migration of these fish species between their spawning grounds and feeding areas. This is especially important for species whose respective migrations are relatively short and thus new migration routes around Muhumaa have not been created (e. g. whitefish, pike, perch). At the moment, the only connection between the sides separated by the dam of Väike Väin (Väike Strait) is the culvert under the eastern end of the dam – Tillunire. This does not ensure the free movement of all fish species (e.g. Baltic herring) between their spawning grounds and feeding areas. Therefore, it is necessary to construct the largest possible passageways into the road dam of Väike Väin (Väike Strait) to ensure the free passage of fish between their spawning grounds and feeding areas. The impact associated with the construction of dam openings into the road dam of Väike Väin (Small Strait) was assessed in a study conducted by (2021b) (see more ch 3.2.8). The study concludes that the construction of the openings would increase the water exchange and improve the conditions for the movement of fish, which will be accompanied by a favourable impact on the water quality and biological diversity of the Väike Väin (Väike Strait). The study also assessed the impact of the construction of the dam openings on the Väike Väin (Väike Strait) limited conservation area (also Natura 2000 Väike Väin (Väike Strait) nature area) and found that the construction of dam openings would have an indirect favourable impact on marine habitats and protected species in the area. The area is also part of the Väinameri Sea bird area. In terms of the impact on avifauna, the study has				the status of fish stocks in the region will improve, which in turn will have a favourable impact on fishing-related business. In addition to that, it will likely to be possible to navigate by boat through the openings, which has a favourable impact on, for example, promoting recreational economy. There will be indirect favourable impact on preserving maritime cultural heritage through contributing to preserving fisheries as traditional coastal business.		

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	concluded that the accompanying impact on avifauna would be insignificant. Compared to the land traffic on the dam, the temporary construction noise and also the subsequent additional boat traffic are insignificant.						
Measure BALEE-M039 - Enhancing the management of environmentally hazardous pharmaceutical waste and raising awareness on more environmentally friendly disposal of pharmaceuticals							
The aim of the measure is to improve the efficiency of pharmaceutical waste management and to raise awareness of the possibilities of disposal of pharmaceutical residues in order to reduce the	The measure has a direct positive impact on the improvement of seawater quality, as it reduces the amount of pharmaceutical residues reaching the marine environment and thus also through the food chain into seafood (pharmaceutical residues have adverse impacts on living organisms). There will be indirect favourable impact on marine habitats and protected natural objects through reducing the impact on biota and through supporting the preservation of general biodiversity.				An indirect favourable impact on human health is associated with the improvement of seawater quality and the availability of so-called cleaner food (e.g. fish). No impact on cultural heritage can be predicted.		

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environmental pressure of pharmaceutical residues originating from households.							
Measure BALEE-M040 - Increasing pollution control capacity through the design and construction of a new pollution control (oil and other hazardous chemicals) buoy and research vessel							
Design and construction of a new buoy and research vessel with a capacity to control oil pollution.	The measure has indirect favourable impact on seawater quality, and on biota and habitats as a whole, through enabling faster liquidation of potential marine pollution. A direct favourable impact will come from the appropriate use of the vessel.				Marine pollution, depending on its duration and scope, can disturb and have an adverse impact on business related to the sea and also on the preservation of cultural heritage. Therefore, increasing pollution control		

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					capacity will be accompanied by indirect favourable impact.		
Measure BALEE-M046 – Litter collection campaigns							
The aim of the measure is to prevent litter from reaching the sea and to reduce the waste load in port areas and their vicinity. In port areas and their vicinity the following activities will be conducted: 1) information campaign regarding the waste;	Marine litter is most common in the vicinity of ports in the coastal sea, which is due to the fact that ports and their nearby areas have become places for active vacations, which offer also other activities in addition to going to the sea. Garbage reaches the sea from ships or from the territory of the port or its nearby areas. The measure prevents litter from reaching the sea and also cleans up macro-litter that has accumulated on the seabed. Thus, the measure has direct favourable impact on seawater quality and thereby also indirect favourable impact on marine habitats and biota as a whole.				The implementation of the measure will have an indirect favourable impact first of all on the well-being and health of people visiting ports and coasts. By raising awareness and organizing real litter collection campaigns in the region, it will be possible to contribute to improving people's behaviour (reducing littering in beaches and port areas). An indirect favourable impact on cultural heritage is related to improving cleanliness and		

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2) litter collection campaigns of the land; 3) macro-litter collection campaigns of the seabed.					maintenance of beaches and coasts, which helps to value the cultural heritage related to the sea.		
Measure BALEE-M047 - Environmentally friendly organization of waste management on coasts and beaches with flood risk							
In areas with flood risk, organize waste management in such a way that during floods the collected garbage would not get into the water. Currently litter collection and waste management in flood areas do not take into	The measure prevents litter from reaching the sea. Thus, the measure has direct favourable impact on seawater quality and thereby also indirect favourable impact on marine habitats and biota as a whole.				The implementation of the measure will have an indirect favourable impact first of all on the well-being and health of people visiting coastal areas. An indirect favourable impact on cultural heritage is related to improving cleanliness and maintenance of beaches and		

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account the risk of litter and waste reaching the sea. 1) Guidelines and requirements will be provided to prevent collected litter from reaching the sea during floods. 2) Special closable trash containers. 3) Waste collection sites secured against flooding. Different options will be analyzed and proposed to reduce the spread of garbage from bathing beaches and other beach areas, including the requirement to use closable					coasts, which helps to value the cultural heritage related to the sea.		

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trash cans on public beaches and beach recreation areas (promenades etc). Additions to regulations or rules to reduce the amounts of waste will be proposed and implemented, for example: 1) The ban on the release of large quantities of balloons and lanterns (>50 balloons/lanterns) will be added to the rules of maintenance in local municipalities.							

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The ban on the use of plastic dishes (in addition to single-use plastic dishes) in beach trade will be added to the rules of maintenance in local municipalities situated near the coast.							
Measure BALEE-M051 - Treatment of precipitation water and wastewater to reduce the amounts of microplastics							
Application of technologies in wastewater treatment (including precipitation water) to increase the efficiency of micro-garbage capture, incl:	The measure prevents micro-garbage from reaching the sea. Thus the measure will have direct favourable impact on seawater quality and thereby also indirect favourable impact on marine habitats and biota as a whole. The measure is related to activities on land, which in turn is linked to the measure for fulfilling the marine litter plan in the programme of measures of water management plans.				No direct impact can be predicted. However, there will be increased costs of precipitation and sewage water treatment. Indirectly, there will be a favourable impact through reducing the possibility of micro-		The implementation of the measure requires close cooperation with the implementers of the measures in the programme of

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1) Introducing the best possible technologies; 2) Establishing the goals of applying the technologies (efficiency, setting the obligation, schedule, etc. according to the amount of water to be purified).					trash reaching the sea and from there, e.g. through fish, ending up in human food. The measure will also contribute to promoting research and innovation activities.		measures of the water management plan.
Measure BALEE-M053 – Reducing the formation of tire debris							
Analysis to find the best ways to reduce the amount of tire debris and development and implementation of the	Based on Lips et al (2020), the microplastic pollution load caused by transport (wearing of car tires, road surface and road marking) is considered to be one of the largest sources of microplastics in Europe. Studying this pollution has to take into account a wide range of factors - the spread of microplastics released during				Indirectly, there will be a favourable impact through reducing the possibility of micro-trash reaching the sea and from		The implementation of the measure requires close cooperation/outreach work to raise the

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corresponding regional (HELCOM, EU) recommendation or regulation. Supplementing tire labelling rules with a wear indicator. Promotion of methods to reduce the formation of tire debris, including promoting not using tires with a poor wear coefficient (for example, <300).	transport through wind, precipitation water, river water, soil transport and sewage treatment plants. The measure has indirect favourable impact on improving seawater quality and thereby also biodiversity, incl habitats. The measure has also direct connection with the proposed measure – *Treatment of precipitation water and wastewater to reduce the amounts of microplastics*.				there, e.g. through fish, ending up in human food. The measure will also contribute to promoting research and innovation activities.		awareness of those establishing the legislation regulating the use of tires and tire importers.
Measure BALEE-M055 - Implementation of the HELCOM marine noise plan and necessary regulations in Estonia							
Organize and coordinate the implementation of HELCOM marine noise plan in Estonia, assess the	The significance of marine noise, including underwater noise as a pressure factor, is assumed to increase in the near future, as various development projects related to the sea are planned in addition to ship traffic, e.g. offshore wind farms, etc. Most of the 35 regional measures initially agreed upon in the HELCOM marine noise plan				The measure is primarily aimed at controlling underwater noise and is therefore not directly related to ambient noise that affects human		

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adequacy of the fulfillment of the tasks set for the countries in the marine noise plan, initiate relevant projects, cooperation projects, provide HELCOM with the necessary information about the implementation of the plan. Consider speed limits at sea as one particular topic (analysis and, if necessary, research in cooperation with the other Baltic Sea countries). Development and implementation of appropriate regulation to establish speed limits near sensitive areas or during	are activities for improving knowledge or developing assessment methods. Five direct underwater noise reduction (sub)measures have been proposed regarding impulse sounds, four regarding continuous underwater noise and one regarding other sources of noise (related to seal deterrents). The implementation of the measure, through preparing the corresponding marine noise regulation, contributes to the management of marine noise, which in turn has a favourable impact on preserving biological diversity and communities. The measure has also direct connection with another proposed measure: *Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects*; and with already existing EIA/SEA regulations.				well-being and health. However, restrictions based on regulation (e.g. speed limits in certain places) may have an unfavourable impact on e. g. business related to recreation and tourism. However, there is no reason to assume that this would be a significant unfavourable impact. In the case of possible development activities, it is necessary to take the noise issue into account even now during the corresponding EIA/SEA for them. Therefore, no significant change in the planning of development activities can be predicted compared to the current situation. No impact on preserving cultural heritage can be predicted.		

Measure with its code (provisional) and the short description of the measure	**Impact on natural environment**				**Impact on social environment**		
	Impact on biodiversity, food webs and benthic communities and communities in water column, and commercial fish and other species (descriptors D1, D3, D4)	Impact regarding alien species (descriptor D2)	Impact on marine habitats (seabed integrity and hydrographic conditions) and other physical indicators of the marine environment (underwater noise), including impact on protected natural objects and the conservation objectives and integrity of Natura 2000 sites (descriptors D6, D7, D11)	Impact on seawater quality, including eutrophication, the content of pollutants in the aquatic environment and the content of pollutants in seafood, the impact of marine litter (descriptors D5, D8, D9 and D10)	Impact on human health, well-being (especially on employment and maritime-related business, and research and development) and property	Impact on maritime cultural heritage and traditional coastal lifestyle	Comment to be further considered or paid significant attention to in implementing the programme of measures
sensitive times (including for recreational vessels). Defining sensitive areas in terms of underwater noise and creating corresponding map layers. Development of a proposal to establish a national regulation for the mandatory use of AIS transponders on pleasure craft of the flag state. Preparation of instructional material for organizing shooting exercises and demining (including prior species deterrence).							
Measure BALEE-M056- Management of marine datasets,							

Measure with its code (provisional) and the short description of the measure	Impact on natural environment				Impact on social environment		
	Impact on biodiversity, food webs and benthic communities and communities in water column, and commercial fish and other species (descriptors D1, D3, D4)	Impact regarding alien species (descriptor D2)	Impact on marine habitats (seabed integrity and hydrographic conditions) and other physical indicators of the marine environment (underwater noise), including impact on protected natural objects and the conservation objectives and integrity of Natura 2000 sites (descriptors D6, D7, D11)	Impact on seawater quality, including eutrophication, the content of pollutants in the aquatic environment and the content of pollutants in seafood, the impact of marine litter (descriptors D5, D8, D9 and D10)	Impact on human health, well-being (especially on employment and maritime-related business, and research and development) and property	Impact on maritime cultural heritage and traditional coastal lifestyle	Comment to be further considered or paid significant attention to in implementing the programme of measures
improvement of data exchange and availability of environmental data, including development of relevant services							
Technical measures and research are aimed at improving the of environmental data and anthropogenic pressure factors, creating more adequate information on the environment and its status, ensuring better availability of environmental information and improving the ease of use of the databases.	No direct impact can be predicted. Indirectly, the measure contributes to achieving good status of the marine environment through the communication of more comprehensive environmental information, updating regulations and cooperation between different parties (including international cooperation). High-quality data is a necessary input in making management decisions, as well as in planning the protection of marine biota. Through better collecting of information, knowledge about the impacts is greater. This creates the prerequisites that it is also possible to mitigate the actually accompanying impacts on the natural environment and thus it is a favourable impact on the natural environment. However, this favourable impact is of indirect nature.						
Measure BALEE-M057 - Updating regulations							

Measure with its code (provisional) and the short description of the measure	Impact on natural environment				Impact on social environment		
	Impact on biodiversity, food webs and benthic communities and communities in water column, and commercial fish and other species (descriptors D1, D3, D4)	Impact regarding alien species (descriptor D2)	Impact on marine habitats (seabed integrity and hydrographic conditions) and other physical indicators of the marine environment (underwater noise), including impact on protected natural objects and the conservation objectives and integrity of Natura 2000 sites (descriptors D6, D7, D11)	Impact on seawater quality, including eutrophication, the content of pollutants in the aquatic environment and the content of pollutants in seafood, the impact of marine litter (descriptors D5, D8, D9 and D10)	Impact on human health, well-being (especially on employment and maritime-related business, and research and development) and property	Impact on maritime cultural heritage and traditional coastal lifestyle	Comment to be further considered or paid significant attention to in implementing the programme of measures
All needs to supplement regulations related to the implementation of BSAP will be thoroughly reviewed, changes will be developed and enforced.	No direct impact can be predicted. Indirectly, the measure contributes to achieving good status of the marine environment, as updating regulations and cooperation between different parties (including international cooperation) enable to reduce the pressure on the marine environment. The activities of the measure are also related to managing the spread of alien species, which have favourable impact on limiting the spread of alien species, by reducing the risk of invasion of new alien species and preventing the transmission of alien species.						
Measure BALEE-M058 - Participation in international cooperation in the field of marine environmental protection							
Coordinated participation in international cooperation in the field of marine environmental protection within the framework of HELCOM, IMO, EU, etc. will be ensured.	No direct impact can be predicted. Indirectly, the measure contributes to achieving good status of the marine environment through the communication of more comprehensive environmental information, updating regulations and cooperation between different parties (including international cooperation) and implementing various activities. Through better collecting of information, knowledge of all parties about the impacts related to the marine environment is greater. This creates the prerequisites that it is also possible to mitigate the actually accompanying impacts on the natural environment and thus it is a favourable impact on the natural environment. However, this favourable impact is of indirect nature.						

Measure with its code (provisional) and the short description of the measure	**Impact on natural environment**				**Impact on social environment**		
	Impact on biodiversity, food webs and benthic communities and communities in water column, and commercial fish and other species (descriptors D1, D3, D4)	Impact regarding alien species (descriptor D2)	Impact on marine habitats (seabed integrity and hydrographic conditions) and other physical indicators of the marine environment (underwater noise), including impact on protected natural objects and the conservation objectives and integrity of Natura 2000 sites (descriptors D6, D7, D11)	Impact on seawater quality, including eutrophication, the content of pollutants in the aquatic environment and the content of pollutants in seafood, the impact of marine litter (descriptors D5, D8, D9 and D10)	Impact on human health, well-being (especially on employment and maritime-related business, and research and development) and property	Impact on maritime cultural heritage and traditional coastal lifestyle	Comment to be further considered or paid significant attention to in implementing the programme of measures
Measure BALEE-M059 - Informing and involving interest groups in marine environment protection activities							
Informing and involving inhabitants and target groups in marine environment protection activities. Specific actions will be planned during the work. The initial focus will be on the areas of wastewater/ sewage water, plastic waste, hazardous substances and pharmaceutical residues.	No direct impact can be predicted. Indirectly, the measure contributes to achieving good status of the marine environment through the communication of more comprehensive environmental information and cooperation between different parties (including international cooperation). Through dissemination of knowledge, knowledge of all parties about the impacts related to the marine environment is greater. This creates the prerequisites that it is also possible to mitigate the actually accompanying impacts on the natural environment and thus it is an indirect favourable impact on the natural environment. However, this favourable impact is of very indirect nature and may not manifest itself quickly.						
Measure BALEE-M076 - Changing							

Measure with its code (provisional) and the short description of the measure	Impact on natural environment				Impact on social environment		
	Impact on biodiversity, food webs and benthic communities and communities in water column, and commercial fish and other species (descriptors D1, D3, D4)	Impact regarding alien species (descriptor D2)	Impact on marine habitats (seabed integrity and hydrographic conditions) and other physical indicators of the marine environment (underwater noise), including impact on protected natural objects and the conservation objectives and integrity of Natura 2000 sites (descriptors D6, D7, D11)	Impact on seawater quality, including eutrophication, the content of pollutants in the aquatic environment and the content of pollutants in seafood, the impact of marine litter (descriptors D5, D8, D9 and D10)	Impact on human health, well-being (especially on employment and maritime-related business, and research and development) and property	Impact on maritime cultural heritage and traditional coastal lifestyle	Comment to be further considered or paid significant attention to in implementing the programme of measures
hydromorphological conditions for local environmental improvement							
Removal of hydrological factors, reducing nutrient/organic accumulation and improving conditions, including, if necessary, removal of nutrient-rich sediments or decomposing algae. The local areas are the sea area along Pirita road in Tallinn Bay and Haapsalu Tagalaht bay.	The purpose of the measure is to solve local eutrophication problems (algae washing up and decaying on the beach along Pirita road in Tallinn and excessive nutrients in Haapsalu Tagalaht bay, vegetal invasion). The measure will be primarily accompanied by direct local favourable impacts on seawater quality and the status of the coastal area. Indirectly, favourable impacts will be also manifested on the good status of the marine environment as a whole.				The measure has favourable impact as the quality of seawater and maintenance of coastal area will improve. There will be an impact on coastal inhabitants as well as tourists who are connected to the sea for both daily and recreational purposes. However, the impacts will be local. No significant impact on maritime cultural heritage can be predicted.		
Measure BALEE-M079 - Regarding ships, ensuring environmental safety at sea							

Measure with its code (provisional) and the short description of the measure	**Impact on natural environment**				**Impact on social environment**		
	Impact on biodiversity, food webs and benthic communities and communities in water column, and commercial fish and other species (descriptors D1, D3, D4)	Impact regarding alien species (descriptor D2)	Impact on marine habitats (seabed integrity and hydrographic conditions) and other physical indicators of the marine environment (underwater noise), including impact on protected natural objects and the conservation objectives and integrity of Natura 2000 sites (descriptors D6, D7, D11)	Impact on seawater quality, including eutrophication, the content of pollutants in the aquatic environment and the content of pollutants in seafood, the impact of marine litter (descriptors D5, D8, D9 and D10)	Impact on human health, well-being (especially on employment and maritime-related business, and research and development) and property	Impact on maritime cultural heritage and traditional coastal lifestyle	Comment to be further considered or paid significant attention to in implementing the programme of measures
The aim of the measure is to prevent and reduce the environmental load on the sea caused by discharges from ships. The focus is on the regulation and preparation of guidelines for ship waste disposal and cleaning of the ships at sea.	The implementation of the measure will reduce the risk of marine pollution from ships (including marine litter, hazardous substances, etc.). The measure will be accompanied by a favourable impact on improving seawater quality, which in turn will have a favourable impact on marine habitats and marfine biota as a whole.				The measure has a positive impact, as the quality of seawater improves and the generation of marine litter decreases. There will be an impact on coastal inhabitants as well as tourists who are connected to the sea for both daily and recreational purposes. An indirect favourable impact on maritime cultural heritage is related to the improvement of seawater quality, which contributes to preserving underwater cultural objects and enabling their exploration.		
Measure BALEE-M002-02 – Avoiding the increase in the load of hazardous substances in aquaculture							

Measure with its code (provisional) and the short description of the measure	**Impact on natural environment**				**Impact on social environment**		
	Impact on biodiversity, food webs and benthic communities and communities in water column, and commercial fish and other species (descriptors D1, D3, D4)	Impact regarding alien species (descriptor D2)	Impact on marine habitats (seabed integrity and hydrographic conditions) and other physical indicators of the marine environment (underwater noise), including impact on protected natural objects and the conservation objectives and integrity of Natura 2000 sites (descriptors D6, D7, D11)	Impact on seawater quality, including eutrophication, the content of pollutants in the aquatic environment and the content of pollutants in seafood, the impact of marine litter (descriptors D5, D8, D9 and D10)	Impact on human health, well-being (especially on employment and maritime-related business, and research and development) and property	Impact on maritime cultural heritage and traditional coastal lifestyle	Comment to be further considered or paid significant attention to in implementing the programme of measures
The existing measure „Preparing regional plans for aquaculture to manage potential environmental pressure“ provides for the preparation of regional aquaculture plans based on solutions that are nutrient neutral or remove nutrients from the marine environment. The purpose of supplementing it is to prevent an increase in the load of hazardous substances when marine aquaculture will be enabled. Activities:	It is almost impossible to keep pathogens away from fish kept in fish cages at sea. In Estonia, fish are rarely vaccinated and, for example, rainbow trouts are only vaccinated before they are released into fish cages at sea (Päkk, 2016). Although in order to minimize the risk of disease outbreaks, the main thing is to ensure the correct fulfillment of aquaculture requirements (including the use of infection prevention measures), disease outbreaks cannot be completely ruled out, and it may be necessary to use e.g. medicines (e.g. through feed). The need to use chemicals and medicines depends on the aquaculture technology, the specifics of the location, and other circumstances. The implementation of the measure helps to identify the environmental risks and threats to seawater quality and thus biological diversity arising from the use of chemicals and medicines in marine aquaculture. Thereby it indirectly contributes to reaching the good environmental status of the sea. In addition to this measure, broader studies are also planned to promote aquaculture – *Studies for developing sustainable aquaculture in the Estonian maritime area*.				The measure has an indirect favourable impact on aquaculture entrepreneurs, contributing to their awareness of the problem and a more precise identification of possible risks and threats. This measure contributes to promoting research and innovation activities. No impact on cultural heritage can be predicted.		

Measure with its code (provisional) and the short description of the measure	**Impact on natural environment**				**Impact on social environment**		
	Impact on biodiversity, food webs and benthic communities and communities in water column, and commercial fish and other species (descriptors D1, D3, D4)	Impact regarding alien species (descriptor D2)	Impact on marine habitats (seabed integrity and hydrographic conditions) and other physical indicators of the marine environment (underwater noise), including impact on protected natural objects and the conservation objectives and integrity of Natura 2000 sites (descriptors D6, D7, D11)	Impact on seawater quality, including eutrophication, the content of pollutants in the aquatic environment and the content of pollutants in seafood, the impact of marine litter (descriptors D5, D8, D9 and D10)	Impact on human health, well-being (especially on employment and maritime-related business, and research and development) and property	Impact on maritime cultural heritage and traditional coastal lifestyle	Comment to be further considered or paid significant attention to in implementing the programme of measures
1) Regional studies on the possible environmental impact of hazardous substances from aquaculture. Both traditional hazardous substances and substances related to fish farms and fish feed (including medicines) are considered hazardous substances; 2) Conducting a risk assessment of hazardous substances from aquaculture; 3) Considering the possible environmental impact of pollutants in preparing regional aquaculture plans.							

5.2 Impact analysis sectoral overviews and proposals

5.2.1 Impact on biodiversity, food webs and benthic communities and communities in water column, and commercial fish and other species (descriptors D1, D3, D4 and D6)

According to what was stated in chapter 2.1.5, regarding **biodiversity (descriptor D1)**, the good environmental status has not been achieved, because mammals as well as fish and pelagic habitats have unfavourable status. Marine **food web (descriptor D4)** has not good environmental status either because none of the GES assessment criteria has been achieved. According to the current Estonian Marine Strategy's programme of measures, the most important anthropogenic pressure factors are related to eutrophication, the spread and impact of hazardous substances, fishing, physical disturbance of the marine environment and the spread of alien species. In addition to the above, based on the context of biological diversity and the food web, the Baltic Sea Action Plan (updated October 2021) also mentions bycatch, disturbance of species, targeted fishing (death or injury of birds and mammals), physical disturbance and loss of the seabed, marine litter and anthtropogenic noise as pressure factors. According to the future forecast of various pressure factors, most of the pressure factors will be increasing in the future. In order to control the deterioration of the status, measures should be developed to reduce the impact of various pressure factors.

Regarding biological diversity and marine food web, several measures have been developed in the programme of mesures, which are based on reducing the impact of the previously mentioned pressure factors. These measures will have either direct favourable impact (e. g. *Improving the effectiveness of the existing network of marine protected areas; Improving the condition of fish spawning areas and migration routes, stimulating populations and updating protection measures; Implementing technologies to reduce and prevent bycatch in order to protect species in the Baltic Sea*) or indirect favourable impact (e. g. *Increasing pollution control capacity through the design and construction of a new pollution control (oil and other hazardous chemicals) buoy and research vessel; Treatment of precipitation water and wastewater to reduce the amounts of microplastics).*

Besides that, it is positive that the programme of measures plans to conduct a number of studies that will help fill in the gaps in existing knowledge, and the results of which can be taken into account when updating the programme of measures and preparing new measures.

As an additional measure, the following measure is planned in the programme of measures: *Implementing technologies to reduce and prevent bycatch in order to protect species in the Baltic Sea*. Table 5.3 provides an overview of the total extrapolated number of birds and mammals accidentally caught in fish traps in Estonian maritime area in 2021.

Table 5.3. Total (on the basis of yield data for all the nets and traps used in fishing) extrapolated number of birds and mammals accidentally caught in fish traps in Estonian maritime area in 2021 (individual±SD (standard deviation). For the sake of readability of the table, the cells are left empty if the respective species are absent in the maritime area (i.e. number of individuals=0). Source: Saks et al, 2022.

Species	Individuals (+-SD)			
	The Gulf of Riga	**The open part of the Baltic Sea**	**The Gulf of Finland**	**Väinameri Sea**
otter			10 (±332)	
grey seal	60 (±145)	24 (±81)	13 (±246)	13 (±43)
ringed seal	20 (±212)			
seal*			3 (±329)	4 (±92)
mute swan	25 (±257)		10 (±332)	23 (±173)
tufted duck	25 (±257)			139 (±173)
greater scaup		24 (±168)		
common eider		119 (±117)		
long-tailed duck	51 (±257)		40 (±192)	
common scoter		143 (±168)		
common goldeneye	25 (±257)	24 (±168)	40 (±227)	4 (±92)
red-breasted merganser				21 (±92)
mergansers*			20 (±332)	
black-throated diver			20 (±332)	
divers*			10 (±332)	
great crested grebe	10 (±212)		2 (±329)	46 (±173)
cormorant	75 (±395)	34 (±103)	39 (±516)	138 (±29)
common coot				139 (±173)

* individuals whose exact species could not be identified

While implementing the measure it must be taken into account that depending on the technique used to reduce bycatch, devices operating in water can increase underwater noise. In addition to that, it is important to avoid situations where using a device aimed at a target species may have an adverse impact on other species in the area. Therefore, it is necessary to test the technique and monitor its possible impact before its wider adoption. Before wider adoption of a device, it must be ensured to the maximum extent that the device or its parts do not break down in sea conditions and thereby increase the amount of marine litter.

Using seal deterrents is considered to be one of the activities to reduce bycatch. Studies have shown that the effect of visual deterrents and deterrents that produce a weaker disturbing sound remains low and seals get used to them quickly (University of Tartu, Estonian Marine Institute, 2014). Effective results in keeping seals away from traps have been obtained by using AHD (*Acoustic Harrassment Devices*) (University of Tartu, Estonian Marine Institute, 2014;

Vetemaa et al 2021; Lehtonen et al, 2022). Such devices add to the fear also the physical discomfort of high sound pressure. Based on Vetemaa et al (2021), there is no solid evidence, but it is likely that at a distance of less than 30 m, such deterrents create an unbearable sound for the seals and they tend to move away (the exception may be, for example, old individuals with poor hearing). In the same study conducted in Estonia, fishermen reported that the catch was not damaged by seals up to 200 m from the deterrent, but seal damage was present at a distance of more than 300 m (Vetemaa et al, 2021). Regarding the impact of using acoustic seal deterrents on fish, the study of Estonian Marine Institute (2014) states that no fish living in the Baltic Sea can hear higher sounds than about 5000 Hz, and therefore the deterrents (the frequency of their generated sound is higher than 10000 Hz) are completely inaudible to fish and do not affect the yield of a trap in any way. On the other hand, seal deterrents have been used minimally so far, and it is not known what their long-term and cumulative impacts could be if their use expands. Lehtonen et al (2022) point out as one of the risks, for example, the development of hearing damage of seals in case of long-term use of deterrents. However, fishing gear with seal deterrents helps to reduce the chances of seals being harmed or killed in fish traps. Therefore, the use of AHD (*Acoustic Harrassment Devices*) helps to reduce bycatch, thereby helping to reduce the death of seals on the one hand, and on the other hand to reduce damage caused by the seals to fishermen. <u>At the same time, their use must be avoided in and near habitats important to seals (e.g. protected and limited conservation areas, permanent habitats).</u>

Regarding the reduction of bird bycatch, Saks et al (2022) points out the following: *While fish traps, which primarily endanger mammals, are placed in a relatively limited area for fishing during the season, birds are mostly endangered by much more „mobile" net fishing. Thus, it has been found (e.g. BirdLife 2021) that in the case of birds it is probably necessary to reduce the abundance of birds in net fishing areas in order to reduce their bycatch. However, research so far has shown that scaring birds away from their favourable feeding areas can be very difficult (see, for example, Russell et al, 2012; Remm 2019, BirdLife 2021). Many measures have been proposed (e. g. Russell et al, 2012; BirdLife 2021, Rouxel et al, 2021), but mostly these are methods that require the introduction of various infrastructure elements. The aforementioned makes the corresponding measures relatively expensive, which in turn can significantly affect the profitability of fishing. Therefore, it would be appropriate to test the effectiveness of the respective measures in Estonian sea areas before their wider adoption.*

Descriptors D1 and D4 are also directly related to descriptor **D3 the status of commercial fish species**. According to the chapter 2.2.6, of the commercial fish species (Baltic herring, sprat, flounder, perch, pikeperch, salmon), the good status was achieved only regarding fishing mortality of Baltic spring spawning herring in the open sea and the ratio of the biomass of commercial flounder fishing to the biomass of monitoring fishing. According to the other descriptors, the good status has not been achieved yet. Based on Saks (2022), the main pressure factors on fish are related to fishing and the status of their spawning grounds, and in the case of migratory fish (Atlantic sturgeon, salmon, sea trout, river lamprey) migration barriers on several larger rivers (e.g. Narva, Kunda, Jägala) are still a problem as well. Of those pressure factors, no significant increase is expected regarding fishing and migration barriers on rivers, but the pressure due to physical disturbance and loss of the seabed may increase in relation to development activities in sea areas and coastal areas, e.g. wind energy developments or infrastructure projects. It is also likely that due to investments in the development of the blue economy, the development of aquaculture in the coastal areas of Estonia will increase. The latter, in turn, can increase the level of anthropogenic pressure on natural populations. Furthermore, the addition of alien species to the Estonian coastal sea is unlikely to stop in the coming decades. Therefore, it is likely that the pressure on local fish populations will increase due to this pressure factor as well.

Considering, among other things, the pressure factors and their future forecasts, and the existing measures, it was found during the preparation of the programme of measures, that the existing measures are insufficient and it is necessary to establish additional measures. The proposed measures will have both direct favourable impacts (*Improving the condition of fish spawning areas and migration routes, stimulating populations and updating protection measures; Reducing fishing efforts to GES level and development and implementation of the corresponding concept; Construction of the openings of the road dam of Väike Väin (Väike Strait) to improve the water exchange and to open the strait as a fish migration route; Litter collection campaigns*) as well as indirect favourable impacts (*Developing compensatory measures for disturbing or destroying the integrity of the seabed; Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects*). However, it should be taken into account that the implementation and results of most measures are rather manifested on a long-term scale. In addition to that, it is important and has a positive impact that the the programme of measures also plans relevant studies that provide additional information about the field.

Restoring spawning grounds and reopening passages for fish to their spawning grounds in clogged river mouths contributes to the preservation of species diversity and the faster reproduction of commercially important fish stocks. Restoring spawning grounds and ensuring access to spawning grounds is one of the most effective long-term solutions for the natural, high-quality reproduction of fish.

Regarding the measure *Reducing fishing efforts to GES level and development and implementation of the corresponding concept* the following can be pointed out:

The situation of populations of target species without quota inhabiting Estonian coastal sea is mostly poor due to excessive fishing pressure. The quantitative indicators of the EU Marine Strategy Framework Directive (MSRD) characterizing the fishing pressure show it as well, according to these the situation in the Gulf of Finland and in Pärnu Bay is very bad, elsewhere just bad. Therefore, it is necessary to reduce fishing efforts at least temporarily. When adjusting the fishing opportunities to achieve the GES, it must be taken into account that the fish populations have been brought to a bad status by the traps that have been used in fishing, too. It is not possible to reduce the fishing efforts and improve the status of fish populations if we only cut down traps that are finally not used in fishing at all or are used only in very few years, when, due to some strong fish generations, fishing becomes temporarily profitable, in order to quickly overexploit fish stocks again. Therefore, when reducing the number of traps, the limit should be based on the maximum number of traps that were in use at the same time (Eschbaum et al, 2020).

Establishing necessary restrictions on fishing proposed either by fisheries protection or research institutions to ensure sustainable exploitation of fishery resources if fishery resources are endangered is regulated by § 11 of Fishing Act (henceforth referred as FA), and establishing fishing opportunities and allowable catches based on the status of fishery and aquatic plants resources and international agreements is regulated by § 45 and § 46 and § 47 of FA. According to the FA § 50 section 1: „Where the fishing opportunities of waters do not allow applications for fishing authorisations to be fully satisfied, fishing opportunities shall be allocated among the applicants who have legally acquired the fishing opportunities of these waters during the previous three years.“ In that case according to FA § 51 section 1: „Upon allocation of the fishing opportunities … the quotient of the sum of the fishing opportunities legally acquired by an applicant during the previous three years and the sum of all the fishing opportunities legally acquired by the applicants for the same fishing opportunities during the previous three years shall be taken into account“. In other words, the Agriculture and Food Board calculates the applicant's share from the total amount of fishing opportunities legally acquired by all applicants during the previous three years (henceforth *the share of historical fishing rights*), which shows the ratio of fishing opportunities legally acquired by the applicant during the previous three years to the fishing opportunities legally acquired by all applicants for the same fishing opportunity in the previous three years. This method of allocating fishing opportunities in a situation where applications exceed fishing opportunities is in FA briefly defined as historical fishing rights. Fishing opportunities that are allocated among the applicants according to FA § 50-51, will be according to FA § 45 established by the Government of the Republic „for fishing on the basis of a fisherman's fishing authorisation by counties and at sea by waters, inland water bodies and permanently inhabited small islands based on the status of fish and aquatic plant resources“. FA thus provides a methodology for allocating restricted commercial fishing opportunities in a situation where applications exceed fishing opportunities established by the regulation of the Government of the Republic or EU.

Therefore, it is necessary that the establishment of fishing opportunities and allowable catches would be in line with the quantities necessary to achieve the GES level, and then the fishing opportunities and allowable catches will be also distributed among fishermen based on the total fishing opportunities and alllowable catches.

To sum up, the planned measures related to this field take into account the pressure factors and their potential future prospects. A large part of the measures are the so-called preventive measures which are based on the expected intensification of the use of the sea in the near future (various development projects related to the sea). On the other hand, there are also measures that help to create a balance between the preservation of marine biodiversity and the use of marine resources (fishing). When implementing the measures, their impact will be manifested primarily on a long-term scale, and their implementation is necessary to achieve good environmental status of the sea. Although the planned measures are directly related to specific descriptors of GES, in many cases the measures complement each other and have a favourable impact in other areas as well, i.e. the implementation of the measures will have a favourable cumulative impact. Several studies are planned within the programme of measures, which help to supplement field-specific knowledge and the results of which can be applied in further updates of the programme of measures and preparing new measures.

5.2.2 Impact related to alien species (descriptor D2)

According to chapter 2.2.5, two new alien species (*Laonome sp* and *Rangia cuneata*) have been registered in the Estonian maritime area during the last years, which were probably brought here by human activities, therefore, regarding the indicator *the number of new alien species introduced into nature through human activities in the period under assessment (6 years)*, good environmental status has not been achieved. Also, good environmental status has not been achieved regarding the indicators *the proportion of alien species in benthic macroinvertebrate community* and *the level of biological pollution*, but good environmental status has been achieved regarding the indicator *the proportion of alien species in pelagic zooplankton community*. Based on Põldma (2022), shipping is the most important way of transmitting alien species in the Baltic Sea (including Estonian maritime area), and potentially the most important mode of spread is alien species spreading through ships' ballast water tanks (both water and sediments). The impact of the pressure factor is predicted to remain the same by 2030. Since alien species spread mainly through the ballast water of ships, it is important that all the Baltic Sea countries ratify and implement the IMO Ballast Water Convention to mitigate the risk of alien species spreading from neighboring areas (previous measure in the programme of measures: *ratification of the International Ballast Water Management Convention (BWMC), facilitation of its implementation through participation in the planned regional information system and its implementation*). In Estonia, the convention entered into force in 2018. Other pressure factors to be pointed out are the spread of invasive alien species through the overgrowth of ship hulls, as well as the possible facilitation of the spread of invasive alien species due to climate change and human activity (e.g. increased shipping, aquaculture).

Therefore, in addition to the existing measures (including the implementation of BWMC, monitoring alien species, raising awareness of alien species), it is necessary to implement activities to reduce the spread of alien species that spread through the overgrowth of ship hulls. These activities are included in the following planned measures – *Updating regulations* and *Participation in international cooperation in the field of marine environmental protection*. The implementation of activities planned to reduce the spread of alien species spreading through the overgrowth of ship hulls will have a favourable impact on the control of the spread of alien species, that impact will be enhanced by the combined impact with other implemented measures. The implementation of common regulations to reduce the overgrowth on ship hulls reduces the risks of using substances dangerous to the marine environment (e.g. the previous „mistake" with the use of TBT). Also the measure *Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects* will contribute to controlling the spread of alien species by enabling comprehensive addressing of the impacts of planned activities in the maritime area and subsequent monitoring during operations (monitoring also increases the opportunities to identify possible alien species). Controlling the spread of alien species will indirecty contribute to preserving biodiversity of the region.

In addition to the measures, it is positive that the programme of measures provides for studies that contribute to a more effective assessment of the risk and extent of the spread of possible alien species and, based on this, if necessary, to prompt quick response to take further action.

5.2.3 Impact on marine habitats (seabed integrity and hydrographic conditions) and other physical indicators of the marine environment (underwater noise), including impact on protected natural objects and the conservation objectives and integrity of Natura 2000 sites (descriptors D6, D7, D11)

The impact on Natura 2000 sites will be addressed in a separate chapter 5.2.7.

In the case of descriptor D6 – seabed integrity – the conservation status of the habitat types of Annex I of the Habitats Directive in the Estonian coastal sea and the extent of the destroyed or physically disturbed area of these habitats have been assessed so far. Based on Martin (2022), the structure and functions of the habitat types were assessed as being in a favourable status in 2019, and the extents of physical disturbance, physical loss and hydrographic changes of all habitat types of Annex I of the Habitats Directive were within the limits of good environmental status. According to Martin (2022), pressure factors caused by various human activities primarily affect the integrity of the seabed. The integrity of the seabed is directly impacted by dredging and dumping, the construction of permanent engineering facilities in the sea, seabed mining, the construction of shore fortifications and under certain conditions also, for example, shipping (both the construction and maintenance of waterways, erosion caused by ship traffic), small boat traffic (especially in shallow areas), fishing (both trawling and placing and removing various traps from the seabed), military activities and also various forms of aquaculture. Most pressure factors will remain at the same level in the future. However, the pressure factors related to development activities in the sea (wind farms, aquaculture, etc.) may increase. Large-scale transport infrastructure projects such as constructing fixed link of Suur Väin (Suur strait) or the construction of Tallinn-Helsinki tunnel can also be mentioned as separate pressure factors in the future. The intensification of small boat traffic in islands region can be predicted as well – this is facilitated by both the development of tourism and the improvement of the standard of living of the Estonian population.

Ensuring the protection of the integrity of the seabed is based on the goals and measures provided in various development documents, legal acts and other relevant documents. Based on Martin (2022), the need for new measures to preserve the integrity of the seabed is primarily related to intensifying pressure factors, but also, for example, to climate change. The level of good environmental status achieved so far in assessing the integrity of the seabed for the different assessed habitat types rather indicates the low intensity of pressure factors rather than the effectiveness of the measures taken so far. With the intensification of pressure factors, there is a very high risk that without additional measures, maintaining GES may prove to be problematic in the future. It is important that the new measures would take into account developments in the intensification of pressure factors as well as international commitments to preserve seabed habitats and biological diversity, and also take into account processes related to climate change.

Measures that are planned for preserving the integrity of the seabed are related to the following measures: *Improving the effectiveness of the existing network of marine protected areas, Developing compensatory measures for disturbing or destroying the integrity of the seabed, Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects*. The implementation of the measures will have a favourable impact on preserving the status and integrity of the seabed as a habitat, and this in a situation where the intensification of maritime area management can be predicted. Depending on the protected natural objects related to the sea, seabed habitats are also mentioned in the conservation objectives of the respective objects, and the measures have favourable impact on achieving these conservation objectives (see also ch 5.2.7 Natura preliminary assessment). In addition to that, it is a positive fact that additional studies are also planned within the programme of measures. On the other hand, it is important that benthic communities and species form part of the marine ecosystem, being also affected by other pressure factors, e.g. eutrophication, fishing, alien species, hazardous substances, etc, so it is appropriate to consider the information pointed out in the other chapters of impact analysis as well. Here can be pointed out that regarding the measure *Developing compensatory measures for disturbing or destroying the integrity of the seabed*, that when implementing the measure and developing the corresponding package of measures, it is important to consider that nutrient-rich sediments are associated with the seabed. By moving sediments during various development activities, nutrients bound in the sediments can be released into the water column, which in turn contributes to eutrophication. The release of nutrients from sediments depends on the nature of the sediments. In part, nutrients (primarily phosphorus) are bound differently in the sediments. Some forms of phosphorus are easily released from the sediment and available to plants and phytoplankton. Some of these forms are inert and do not participate in the phosphorus cycle of the water body, but are stored in the sediment. In general, forms of phosphorus bound to iron compounds and organic matter are considered labile, i.e., easily released forms of phosphorus. Phosphorus bound to aluminum compounds may be potentially releasable under suitable environmental conditions, but is considered a more resistant fraction than the form of phosphorus bound to iron compounds. Residual P and phosphorus forms bound to calcium compounds are considered relatively inert and are not thought to participate in phosphorus cycle of a water body. Therefore, when implementing the measure *Developing compensatory measures for disturbing or destroying the integrity of the seabed*, the mobility of nutrients bound to sediments must be taken into account, and this aspect should also be considered when developing compensatory measures. Depending on the location, the sediments may also contain residues of the organotin compound – tributyltin. Moving sediments with high TBT content can lead to secondary pollution.

According to chapter 2.2.7, **hydrographic changes (descriptor D7)** is not a significant threat to Estonian marine environment. The sea area with the largest area, where long-term changes in hydrographic conditions occur, is Väike Väin (Väike Strait) – related to the construction of the strait dam (Lips, 2022). Based on Lips (2022), pressure factors are associated with hydrographic changes, which can cause long-term changes in the wave and current regime (including affecting water retention time, water mixing and water level) and physical disturbance and loss of the seabed (the seabed and coastal bathymetry, geomorphology and substrate are changed). Such human activities or uses of the sea are the existing or to be built transport infrastructure, producing renewable energy and its infrastructure, coastal defence and flood protection, offshore facilities, changing the morphology of the seabed, including dredging and dumping, mining of mineral resources, pipelines and water abstraction. For the most part, the impacts on hydrographic changes associated with the mentioned activities/uses are local (Lips, 2022). The exception is larger mining and water abstraction activities, the impact of which must be assessed more precisely during the EIAs of the respective projects.

Implementing the new measures in the programme of measures that are related to hydrographic changes have ether direct (e. g. *Construction of the openings of the road dam of Väike Väin (Väike Strait) to improve the water exchange and to open the strait as a fish migration route)* or indirect (*Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects*) favourable impact. Issues (including the impact) related to Väike Väin (Väike Strait) were addressed in chapter 2.2.8.

Regarding underwater noise (descriptor D11), there are currently no regionally agreed threshold values for good environmental status. Therefore, in assessing the environmental status of the Estonian maritime area (2019), no assessment was given regarding the achievement of the GES. At the same time, due to the intensification of the use of the sea area, an increase in underwater noise can be expected in the coming years. The main pressure factors of underwater noise are related to the increase in ship traffic, as well as various development activities (offshore wind farms, aquaculture; including possible preliminary studies) and national defence activities.

In the report of the strategic environmental impact assessment of Estonian Maritime Spatial Plan (Private company Hendrikson & Ko, 2021), the issues regarding underwater noise are also discussed in relation to offshore wind farms. The report states that *the impact of construction noise accompanying the construction, operation and dismantling phase of offshore wind farms is the most extensive, but in the case of offshore wind farms planned for Estonia, it is not so acute due to the planned use of gravity foundations, which do not require drilling into the* *seabed or ramming the tower into the seabed. The operating noise of wind turbines is more or less continuous, but (depending on the strength of the wind) it is still relatively quiet compared to, for example, ship noise. In general, scientists are currently of the opinion that the noise of wind turbines can disturb the fish only in the immediate vicinity of wind turbines, and it has no significant impact. Depending on fish species and sound volume, the fish will certainly hear the operating noise of wind turbines from different distances. According to the current knowledge, of the fish species in the Baltic Sea, sprat and especially Baltic herring are probably the most susceptible to the potential negative impacts of offshore wind farms*. It also states that *there are still no studies proving that spawning aggregations of Baltic herring are in any way disturbed by the noise from offshore wind farms (no special studies have been conducted yet)*.

Thus, knowledge about the impact of underwater noise on fish is still modest. Although the previous example addressed the impact of noise from offshore wind farms on fish, there is modest knowledge about the impact of noise from other uses of the sea area on the biota as well.

Since underwater noise requires a comprehensive approach and affects the Baltic Sea more broadly, a corresponding action plan has been prepared by HELCOM to reduce underwater noise (RAP Noise). The action plan includes both regional and national measures related to the assessment, reduction and monitoring of underwater impulse noise and continuous noise (including low frequency).

Based on the comprehensive approach of HELCOM marine noise plan to the issues of underwater noise and its relevance in Estonian conditions, a new measure is designed in the programme of measures *Implementation of the HELCOM marine noise plan and necessary regulations in Estonia*. Implementing the measure will have favourable impact on controlling the underwater noise. In assessing the impact of underwater noise, it is important to have up-to-date and adequate knowledge based on relevant studies. Although improving knowledge is also part of HELCOM marine noise plan, priority studies are also planned within the programme of measures, which are necessary considering the intensification of sea use in the coming years.

In addition to the specific measure related to the management of marine noise, noise issues are an important component in implementing, for example, the measure *Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects*. It is also important that when implementing the measure *Implementing technologies to reduce and prevent bycatch in order to protect species in the Baltic Sea*, it must be taken into account that depending on the technique used to reduce bycatch, devices operating in water can increase underwater noise. In addition to that, it is important to avoid situations where using a device aimed at a target species may have an adverse impact on other species in the area. Therefore, it is necessary to test the technique and monitor its possible impact before its wider adoption (see also ch 5.2.1 – the part regarding deterrents).

To sum up, regarding the descriptors of GES discussed in this chapter, good environmental status has either been achieved or has not yet been assessed (e.g. underwater noise). However, due to the intensification of the use of the sea area, an increase in pressure factors can be expected in the coming years. Thus, the measures provided in the programme of measures are primarily preventive, helping to reduce the adverse impacts caused by the increase in pressure factors. Although the proposed measures are directly related to particular desciptors of GES, the marine environment is a complete ecosystem, therefore, to a lesser or greater extent, the other proposed measures also have impact on the areas discussed in this chapter. Several studies are planned within the programme of measures, which help to supplement field-specific knowledge and the results of which can be applied in further updates of the programme of measures and preparing new measures.

5.2.4 Impact on seawater quality, including eutrophication, the content of pollutants in the aquatic environment and the content of pollutants in seafood, the impact of marine litter (descriptors D5, D8, D9 and D10)

The consequence of directing excessive nitrogen and phosphorus caused by human activities into the Baltic Sea is the excessive unlimited growth of algae and the production of organic matter (algae mass) exceeding the sea's self-purification capacity, which results in accelerated eutrophication of the Baltic Sea. Excessive primary production significantly changes the conditions of the sea as a living environment: the transparency of the water decreases, temperature-induced stratification of the water column intensifies, organic sediments accumulate, the oxygen found in deep water near seabed is used up during the decomposition processes of algae remains, toxic intermediate products (hydrogen sulphide, ammonia) are released during the incomplete decomposition of organic matter due to the lack of oxygen. As the silting of the seabed occurs and there will be a lack of oxygen, suitable habitats for benthic biota will disappear. All this results in species impoverishment of marine biota, reduction or destruction of more valuable commercial fish populations, and a general decline in seawater quality. Excess organic matter can also directly disturb people's activities in the areas directly bordering the sea, even by the fact that the sea containing excessively decomposing organic matter stinks.

Based on chapter 2.2.1, taking into account both the concentration of nutrients, the direct and indirect impact indicators of plant nutrients, the water bodies and offshore basins of the Estonian maritime area have poor (6 water bodies), bad (8 water bodies) or very bad (7 water bodies) status according to the overall assessment of the impact of nutrients. According to Lips&Stoicescu (2022), the overall assessment of the status of the Estonian maritime area regarding **eutrophication (descriptor D5)** gives the result for the entire maritime area that good environmental status has not been achieved. The difference between good environmental status and the actual status is the biggest in the northern basin of the open part of the Baltic Sea (the ratio of eutrophication is greater than 2) and of coastal water bodies in Pärnu Bay and Väinameri Sea (together with Haapsalu Bay). The main reason for the poor results of these assessment units is the assessment results based on indicators of direct impacts of either nutrients (primarily phosphorus) or eutrophication (chlorophyll). As the assessment units of the open sea have mostly worse status than coastal water bodies, international cooperation within the framework of HELCOM is important to improve the status of the Estonian maritime area, i.e. reducing the load of nutrients to the entire Baltic Sea.

Estonian Environment Agency (2020) prepared an overview of land-based pollution loads during the last 10 years (2009-2018). In order to assess the fulfillment of HELCOMs pollution load reduction goals, the pollution load reduction goals have been compared with the average values of the periods 2009-2014 and 2015-2017. The 2009-2014 data were taken as the reference period for HELCOMs assessments. On the basis of the reference period, HELCOM has calculated the volumes of reduction of the reference level necessary to achieve the goals.

Table 5.4 shows the average loads of the period 2015-2017 and the load values of the reference period.

Table 5.4. Load reduction goals and the load values of the reference period (Estonian Environment Agency, 2020)

Sub-basin	Goal, t/yr	Reference level (2009-2014), t/yr	The need to reduce the reference level, t/yr	2015-2017 average, t/yr
Total nitrogen				
BAP	1413	1749	336	1836
GUF	11265	13896	2631	12838
GUR	13029	13389	360	15678
EE	26168	26441	3389	30813
Total phosphorus				
BAP	8	25	17	22
GUF	236	400	164	304
GUR	239	274	35	259
EE	483	698	215	585

According to the data given in table 5.4, it is necessary to reduce the pollution load from Estonia into the Baltic Sea by 3389 t/yr in terms of total nitrogen and 215 t/yr in terms of total phosphorus.

Based on Lips&Stoicescu (2022), the main anthropogenic pressure factor regarding eutrophication is the load of nutrients from land, either through water (including rivers and direct discharges into the sea) or air, as well as maritime activities (shipping, aquaculture). The load of nutrients to the Estonian maritime area, which comes from neighboring areas (other Baltic Sea regions) or bottom sediments, i.e. the internal nutrient load, must also be taken into account. In terms of land-based nutrient load, an increase in the load mainly due to climate change-related floods and rainwater overflows, the load originating from agriculture and the load originating from the development of aquaculture is expected. Water Management Plan 2015-2021 and programme of measures of the draft Water Management Plan 2022-2027 include measures to reduce point load and diffuse load, most of them are related to the limitation and reduction of nutrient load resulting from floods and rainwater overflows due to climate change, and from agriculture. Therefore, the Marine Strategy's programme of measures does not separately address reducing the impacts of diffuse pollution of the aquatic environment.

The NEC Directive, which is part of the European Clean Air Package, establishes obligations for each EU member state to reduce emissions of air pollutants by 2030 compared to the 2005 level. Estonia is required by the NEC Directive to reduce NOx emissions into the atmosphere by 30% and NH3 emissions by 1% by 2030 compared to 2005. To meet these requirements, corresponding measures are prepared in the *National Programme for Reducing Emissions of Certain Air Pollutants for 2020-2030* (Ministry of the Environment, 2019b). Therefore, it can be assumed that in the future the pressure from the air on the marine environment will rather decrease.

In the future, an increase in the volume of marine aquaculture and the resulting nutrient load can be predicted. In marine aquaculture farms, the density of organisms is almost always higher than in the natural environment, and this concentration of biomass also increases the concentration of metabolic residues in the farming area. In order for organisms to grow optimally, excess metabolic residues must be removed and a constant supply of basic resources (oxygen, nutrients) must be ensured. This applies both to fish farms and, for example, shellfish and algae farms. Only a part of the metabolic residues is related to substances containing nitrogen and phosphorus (Kotta et al, 2019).

The impacts of fish farming can be broadly divided into two (Kotta et al, 2019): local and large-scale processes, dealing with which also requires different strategies. Local impacts are related to undesirable phenomena due to increased nutrient concentrations. For example:

- Increase in the content of organic matter in the seabed below the fish cages, development of oxygen deficiency, destruction of biota, etc.
- Increase in the amount of nutrients in the water, proliferation of pelagic microalgae, changes in macroalgae and large invertebrate communities and mass development of opportunistic species in the immediate vicinity of fish cages.

Large-scale processes include the nutrient balance of sea basins, which on the one hand depends on the total nutrient load of the Baltic Sea and on the other hand climatic factors. The latter determine the movement of nutrients between marine sediments and the water column.

Measures that directly affect the availability of nutrients in the water column are suitable for mitigating local impacts. These can be, for example, algae and shellfish farms in the immediate vicinity of fish cages, technological methods that prevent leaching of nutrients from fish cages (for example, the collection of feed residues and faeces in the cage, or in its immediate vicinity), as well as chemical binding of nutrient load resulting from fish farming or also improving the dilution (Kotta et al, 2019). The probability of occurrence of negative (local) impact on environment is especially great in sea areas with limited water exchange (location near the coast hidden from wind, narrow and deep gulfs, large shallow areas). Ensuring local water exchange is meant by improving the dilution.

Here alternative solutions for balancing nutrient balance in a basin can be used as well as compensatory measures or measures neutralizing the impact. For example, more efficient nutrient removal options can be developed for other sources of nutrient loads entering the same basin; or one might contribute to more efficient treatment of urban and industrial effluents, reducing agricultural loads resulting from land use; or to the other nutrient removal options such as additional fishing (e. g. fishing for alien species) or picking coastal debris.

While fish farms in natural water bodies generally increase the nutrient load on the environment, the cultivation of seaweed and shellfish as a part of the aquaculture that removes nutrients from the marine environment is considered by many EU directives to be the flagship of environmentally sustainable economy (Kotta et al, 2020). Shellfish grow considerably larger in ocean water than in the Baltic Sea. Productivity (total biomass) of shellfish farms is high at sea areas with low salinity as well. This kind of smaller shellfish can be used as either fish feed, animal feed or bird feed, or if previously processed, for human consumption as well. Based on the average growth rate of shellfish, it is possible already today to remove an estimated 35 tons of nitrogen and 2,7 tons of phosphorus from 1 km^2 of sea area in the coastal area of West Estonia in a year. The shellfish growth cycle in a shellfish farm in our coastal sea is estimated to be 2 years, so one harvest removes 70 tonnes of nitrogen and 5,4 tons of phosphorus from the sea (Kotta et al, 2020).

For an illustration may be added that based on the data by Kotta et al (2019), for balancing excess nitrogen load reaching the Baltic Sea from the mainland of Estonia only with shellfish farms, there should be additional shellfish farms in an area of ~97 km^2, and for balancing excess phosphorus load in an area of ~80 km^2. As for comparison, the area of Estonian territorial sea is altogether 25 200 km^2. However, it is not realistic to establish one or also many large shellfish farms on such a scale, as negative environmental impacts cannot be ruled out in the case of very large shellfish farms (area > 1 km^2) (see below).

In addition to removing the nutrients, such kind of shellfish farm significantly increases water transparency within a radius of about 1 km^2 and reduces the risk of local algal blooms due to fish farming. Therefore, it would be reasonable to place shellfish farms in the immediate vicinity of coastal fish farms, as such co-use can compensate for the flow of nutrients released from fish farms into the sea and keep the water in the immediate vicinity of a fish farm transparent. However, in case of offshore fish farming, it is not important that the compensatory measures would be located in exactly the same area, as the local environmental impacts of fish farms are often insignificant in the context of intensive open sea water movement (Kotta et al, 2019).

In case of the fish and shellfish farming scenario used in the study by Kotta et al (2022) (195 t fish weight gain), it is necessary to cultivate shellfish in a total area of 2,9 hectares (0,029 km^2) in order to fully compensate for the environmental impact of bioavailable nutrients released from fish farming into water column and sediments (if we take into account only the amount of nutrients removed from the marine environment by harvesting, i. e. with shellfish, the shellfish should be cultivated in an area of 4,5 hectares (0,045 km^2)).

However, in case of very large shellfish farms (with an area > 1 km^2) negative environmental impacts cannot be ruled out. In Estonia, there is a perspective for cultivating blue mussels in marine aquaculture. By filtering water mussels feed on plankton and by doing this they also bind nitrogen that has accumulated into it.

In a shellfish farm, much of the plankton is filtered out of the water column. Only ~ 25% of nutrients are bound in mussel. About 30% go to sediments from faeces and about 45% is released back into the water column in dissolved form. At the same time, the balance of nitrogen and phosphorus in the water column changes as well. This in turn can change the species composition of plankton. In areas with low water exchange, this could theoretically lead to unwanted local algal blooms (Hedberg et al, 2018).

Smaller algae and shellfish farms each with an area of some hectares scattered within a larger area should be preferred. Smaller farms have higher productivity per unit area, smaller farms are able to remove significantly more nutrients from the marine environment with the same amount of investment than individual large farms, and their potential negative impact on environment is significantly smaller (University of Tartu, Estonian Marine Institute, 2019a).

As for algae cultivation, the report by Kotta et al (2019) is based on a solution that Furcellaria is grown in the sea. Farming Furcellaria means establishing algae groves anchored into the sea, and maintaining and harvesting them. Assuming that the natural density of algae population is used in such groves (950 g algae by fresh weight per one square metre), this kind of algae farm

would hypothetically produce in case of 135% annual weight gain 1296 t algal mass per one square kilometre and would remove 4,3 t of nitrogen and 2,2 t of phosphorus from the marine environment. Therefore, in order to balance nitrogen load only with Furcellaria farming also the excess nitrogen load reaching the Baltic Sea from Estonian mainland, one should additionally grow Furcellaria in an area of ~788 km^2, and in order to balance the excess phosphorus load reaching the Baltic Sea from Estonian mainland, one should additionally grow Furcellaria in an area of ~98 km^2.
Removal of other biomass is also one way to remove nutrients from the aquatic environment.

Commercially used species of algae in Estonian coastal sea is Furcellaria. It is collected at beaches in the form of coastal debris and trawled from the sea in Väinameri region. According to the statistics, a total of 653,9 t of algae by fresh weight has been caught from a square No 272 in two years (2014-2015). The nitrogen and phosphorus contents of Furcellaria are 2% and 1% by dry weight, respectively, but these values may vary significantly depending on the season and growing conditions. The average ratio of fresh weight of Furcellaria to dry weight of Furcellaria is 6. Based on the abovementioned data, an estimated 1 t of nitrogen and 0,5 t of phosphorus in a year are removed by catching Furcellaria from the sea in Väinameri region (Kotta et al, 2019).

Picking coastal debris is currently an underused opportunity to remove excess nutrients from coastal sea. Of coastal debris, only Furcellaria is collected at present. Bladderwrack forms a very large part of the biomass of phytobenthos in Estonian coastal sea. A large part of this production is eaten by herbivores or it decomposes on the spot, but an estimated 10-20% of it may reach the beach as coastal debris. This kind of amount of algal debris contains 280 t of nitrogen and 70 t of phosphorus, and 48% of such reserves are located on the southern coast of Saaremaa and 34% in the West Estonian archipelago (Kotta et al, 2019).

It is recommended to exploit commercial fish stocks only up to such a limit that would ensure catch yields at least as high as they were for the following years. In case of many species, this limit may as well have been exceeded and fishing should be restricted in order to restore fish stocks. However, there are also very few fish species whose catches could be increased. Examples of such species are alien species, for which there is no major interest in fishing so far and which, as competitors, threaten our native and more valuable fish species. So if a suitable selective fishing method exists, catches of gibel karp and round goby could be increased. Compensating for fish farm pollution by catching round goby from fish farm's impact area is a prospective approach, since besides removing biogens the abundance of an invasive alien species will be reduced who endanger native species and commercial fish stock. Concerning this approach it is important to observe that the caught fish would be from fish farm's area, i. e. fish caught from other regions would not be used to compensate for negative environmental status of fish farms (Kotta et al, 2019).

Therefore, to sum it up, in order to slow down eutrophication in the Baltic Sea through developing aquaculture, developing combined aquaculture (fish and mussels or algae) would be the most appropriate way to do that, or developing only shellfish and algae farms if it proves economically viable. Smaller algae and shellfish farms each with and area of some hectares scattered within a larger area are suitable, and marine areas with low water exchange (e. g. enclosed and shallow bays) should be avoided when setting up shellfish farms. The removal of nutrients from the sea can also be increased by e. g. collecting coastal debris and catching alien species (e.g. gibel karp, round goby).

According to Lips&Stoicescu (2022), the main environmental goal regarding eutrophication is to reduce the load of nitrogen and phosphorus coming from Estonia to the extent specified in the objectives of the Baltic Sea Action Plan. On the basis of current knowledge, it is not possible to achieve this goal with the existing measures, i.e. measures that have been implemented and measures that are currently being implemented. Within the framework of HELCOM cooperation, the adequacy of the existing measures has been assessed based on the feedback of experts from different countries and it has been found that the measures implemented in the countries are not sufficient to bring the phosphorus load to the permitted level for any of the Baltic Sea basins surrounding Estonia (HELCOM ACTION, 2020). Even if the load reduction goals could be achieved, the natural characteristics of the Baltic Sea environment must be taken into account as well. It is estimated that it will take 30-40 years to achieve good environmental status after reducing the load according to the goal set by the Baltic Sea Action Plan (HELCOM ACTION, 2021). Therefore, good environmental status cannot be achieved by 2030. More detailed analyses are necessary to implement additional measures. Regional coordination of measures is important here, because as the latest assessments of the status of the Estonian maritime area have shown, the status of assessment units in the open sea is often worse than in coastal water bodies.

Nevertheless, it is important to reduce the load of nutrients added to the marine environment. Since a large part of the nutrient load comes from land, it is important to implement the measures specified in the water management plans, i.e. the main measures for achieving it are provided in the water management plans.

Implementing the measures of the programme of measures will have either direct (e. g. measure: *Changing hydromorphological conditions for local environmental improvement*) or indirect (e. g. *the measure related to EIA for blue economy projects, but also measures promoting the involmement of interest groups*) favourable impact. Implementing them together with the measures of the water management plan will have in turn favourable cumulative impact. In addition, the author of the SEA proposes to consider increasing the catch of alien species (e.g. gibel karp, round goby) and also collecting coastal debris (e.g. bladderwrack) in order to remove nutrients from the marine environment. The possibilities and profitability of the further use of caught alien species or collected algae (e.g. using bladderwrack as fertilizer; using them in the cosmetic or food industry, etc.) must be determined with a relevant study.

The following measure *Developing compensatory measures for disturbing or destroying the integrity of the seabed* is planned within the programme of measures. Here it is important to point out that when implementing the measure and developing the corresponding package of measures, it is important to take into account that there are sediments associated with the seabed that contain nutrients. By moving sediments during development activities, nutrients can be released into the water column, which in turn contributes to eutrophication. One has to take into account how mobile the nutrients in the respective sediments can be.

To sum it up, it is necessary to significantly reduce the amount of nutrients reaching the sea as a result of economic activities. Otherwise, the goal of achieving good status of the seawater will not be achievable. Corresponding measures are planned in water management plans for the new period. Therefore, it can be assumed that the new measures of the Marine Strategy's programme of measures and the measures of the water management plan will have a long-term combined favourable impact on the aquatic environment.

The analysis prepared by Laht et al (2022) provides a comprehensive overview of **hazardous substances in the marine environment (descriptors D8, D9**), recent monitoring results and assessments, measures that will be implemented and measures being implemented (see also ch 2.2.2).

To summarize it, based on Laht et al (2022) it can be stated that according to the results of the assessment of hazardous substances in the Baltic Sea and Estonia, the most problematic hazardous substances in the marine environment are mercury (Hg), cadmium (Cd), lead (Pb), tributyl tin (TBT), polybrominated diphenyl ethers (PBDE)), diclofenac and cesium-137 (Cs-137). Based on the Estonian results, regional attention should also be paid to the contents of nickel (Ni), anthracene and Di(2-ethylhexyl) phthalate (DEHP) in the environment. In addition to that, regarding food safety (D) dioxins and dioxin-like PCBs proved to be problematic.

According to Laht et al (2022): *achieving the environmental goals largely depends on the effectiveness of the implementation of the measures being implemented and the measures planned within the programmes of measures of the Water Management Plans for the period 2022-2027, and on fulfilling the goals of the Estonian National Renewable Energy and Internal Security Development Plan. Since there are no quantitative assessments of the effectiveness of the activities, it is not possible to assess the extent to which various pressure factors are reduced when the measures are implemented and whether it is possible to achieve the GES with the help of the measures being implemented and the new measures, but through regional cooperation, the ability to ensure a quantitative assessment of the effectiveness must be developed. On the other hand, the rates of reducing the pressures necessary to achieve GES are of low reliability and therefore there is considerable uncertainty between the relationship between reduction of pressures and achievement of GES. In addition to that, within the framework of the HELCOM ACTION project, the time delay between the elimination of the pressure (assuming that all measures are effectively implemented) and the achievement of GES has been assessed. The averaged results of the expert assessments showed that the time delay in reaching the GES is 38 years for mercury, 14 years for TBT, 17 years for PFOS and 5 years for diclofenac. Taking into account how much it is estimated to be possible to reduce pollutant loads by fully implementing the existing measures and the schedule for the implementation of the new measures, according to which the measures should be implemented by 2027, and the time delays in achieving the GES, it can be stated that the achievement of the GES by 2030 for most hazardous substances that currently do not have good status is not very likely*.

Despite the fact that it is likely that good environmental status will not be achieved by 2030 for most hazardous substances that currently do not have good status, it is still important to continue to reduce the release of hazardous substances into the marine environment. In addition to the measures that are already being implemented (including measures planned in other strategic development documents), the programme of measures proposes measures aimed at influencing consumer behavior, increasing the capacity of marine pollution control, ensuring environmental safety related to ships, and preventing the increase of pollutant loads associated with development works at sea and intensifying economic activity. In addition to that, the following measure in the current programme of measures „preventing an increase in the load of hazardous substances in aquaculture" has been supplemented, so that the measure focuses not only on nutrients but also on reducing pollutant loads. The planned measures to promote international cooperation in research and development, and several studies related to hazardous substances, which will help to fill the current knowledge gaps are also important. The implementation of the planned measures is accompanied by a long-term cumulative favourable impact on achieving good status of the marine environment.

According to chapter 2.2.3, regarding **marine litter (descriptor D10)** good environmental status of the marine environment has not been achieved. According to Laas&Lips (2022), the areas of human activity that are the main sources of marine litter in Estonia tend to grow/intensify during the following period until 2030. Within the framework of the HELCOM ACTION project, three areas of human activity, which are the main sources of macro-litter, were analyzed: fishing, tourism and shipping. It was assumed that this pressure regarding macro-litter reaching the sea via rivers (from household, industry, waste management, etc.) will not change significantly by 2030. In the most likely scenario, by 2030, fishing will remain at the same level, tourism will increase by 30% and shipping by 20% (HELCOM ACTION, 2021 ref Laas&Lips (2022)).

Preparing the new measures of the programme of measures has mainly focused on these areas in which the increase in pressure can be predicted. So the measures regarding shipping (e. g. *Regarding ships, ensuring environmental safety at sea*), tourism and ports (e. g. *Litter collection campaigns; Environmentally friendly organization of waste management on coasts and beaches with flood risk*), but also reducing the amounts of litter reaching the sea with precipitation water and effluent (e. g. *Treatment of precipitation water and wastewater to reduce the amounts of microplastics*) have been developed. A negative environmental problem accompanying fishing, which has also an indirect impact on fish stocks, is lost fishing gear, or the so-called ghost nets, in which fish can get stuck and thus die even several years after the net was initially placed for fishing. Therefore, macro-litter collection campaigns from the seabed have positive impact on fish and on biodiversity in general.

The implementation of the measures will have both direct and indirect favourable impacts, which cumulate in interaction with the measures provided in other development documents (e.g. the programme of measures of water management plans). In addition to that, measures that contribute to promoting cooperation and the improvement of knowledge will have positive impact. The latter plays an important role in the planned studies as well.

As for marine litter, it is important to point out regarding the following measure planned within the programme of measures *Implementing technologies to reduce and prevent bycatch in order to protect species in the Baltic Sea* <u>that while implementing the measure, it is necessary to test the techniques to reduce bycatch and monitor its possible impact before its wider adoption. Before wider adoption of a device, it must be ensured to the maximum extent that the device or its parts do not break down in sea conditions and thereby increase the amount of marine litter</u>.

To sum it up, based on the descriptors of good environmental status discussed in this chapter, the good environmental status of the marine area has not been achieved, and an increase in the pressure factors affecting the status is expected. The new measures developed in the programme of measures contribute to moving towards good environmental status, also the measures stipulated in the other relevant development documents contribute additionally to that purpose. Also important and having positive impact are the measures provided in the programme of measures which promote international cooperation and highlight the need for relevant studies to fill the existing knowledge gaps. Despite the above, it must be taken into account that implementing measures and reducing loads have long-term impact (i.e. with a time delay) on achieving good environmental status. Therefore, it is likely that by 2030, good environmental status will not be achieved in terms of all descriptors. However, this does not diminish the need to implement measures to move towards good environmental status.

5.2.5 Impact on human health, well-being (especially on employment and maritime-related business, and research and development) and property

Human well-being and health and social needs are affected by a number of factors, from environmental pollution and noise to the general cleanliness of the marine environment and ensuring recreation opportunities. But also opportunities to engage in business and earn a decent income.
It is important to be aware of the fact that the marine environment not only provides people with food, the opportunity to move and foster the blue economy, but also direct contact between a human being and the marine environment. Research (Fleming et al, 2019) has shown that such kind of contact can contribute to improving mental as well as physical health and well-being. For example, access to the sea, especially in urban environments, increases the possibility that people spend more time in the fresh air and also move more (water sports, walking on the shore, etc). Based on the context of human well-being and health, coastal environment is a so-called blue gym (Depledge & Bird, 2009). Studies have also shown that having a sea view from home reduces the risk of general and/or mental health problems. Here it is important to point out that people benefit more from a cleaner and higher quality environment for their mental health (Fleming et al, 2019). Therefore, achieving good status of the marine environment is also important for human health and well-being.

Since all the measures planned in the programme of measures are aimed at achieving good environmental status of the sea, all measures have, to a lesser or greater extent, directly or indirectly, favourable impact on human well-being (including social needs) and health. However, the programme of measures will also provide the so-called restrictive measures that have impact on well-being in a broader sense (related to business and fishing). For example, the measure *Reducing fishing efforts to GES level and development and implementation of the corresponding concept.* The implementation of the measure and imposing additional fishing restrictions will have an adverse impact on the enterprises engaged in fishing. On the other hand, it is important that the main goal of the measure is the long-term improvement of the reproductive capacity of fish populations and reducing the impacts caused by overfishing. Therefore, although the measure may have an adverse impact in the short term, fishing will not be completely prohibited (based on species-specific GES levels). Its lon-term impact will be favourable, as the status of the fish stocks will presumably improve and it will be possible to continue fishing.

The following measure planned within the programme of measures – *Improving the effectiveness of the existing network of marine protected areas* – is important regarding the preservation of marine biodiversity. Preserving biological diversity is also important in relation to human well-being and entrepreneurship, indirectly promoting, for example, preserving coastal recreation economy and fisheries. On the other hand, restrictions on marine protected areas and additional possible restrictions related to ensuring the coherence of protected areas can limit the scope and location of areas suitable for marine business (tourism, fishing, aquaculture, offshore wind farms, etc.). Besides that, various ways of using the maritime area may have the so-called competition with each other. This is an issue of co-use of the maritime area which have been addressed, among other things, in the SEA report for Estonian Maritime Spatial Plan (Private company Hendrikson & Ko, 2021) as follows: *The sea area encourages various co-uses of the maritime area, while the co-use also brings about certain risks to the property: on the one hand, co-use consolidates the activities planned in the maritime area, which on the one hand increases security, but on the other hand, the scope and/or cumulation of the impact may increase during consolidation (e.g. ship entanglement in shellfish lines or* *fish cages in the areas of wind farms, where in adverse conditions, an uncontrolled vessel may collide with wind turbines). The method of mitigating the impact is to develop a set of rules, customs and practices for the co-use and to assess the risk of co-use. In the light of what is planned in the Maritime Spatial Plan, in which new areas of use arise in the maritime area, it is necessary to supplement national risk analyses and, if necessary, maritime rescue strategies*. The Maritime Spatial Plan provides general guidelines for encouraging co-use based on the European Commission project (2018) *Ocean Multi-Use Action Plan*. According to the guidelines, for example, the co-use of environment protection, fisheries and tourism is encouraged. Based on what is stated above, while implementing the measure *Improving the effectiveness of the existing network of marine protected areas* – it is important to take into account the enabling of other uses of the maritime are as well, and probably it is possible to find opportunities for the co-use of the maritime area in such a way that the coherence of the network of marine protected areas and the ways of sea use related to humans will be preserved.

When implementing the measure *Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects* it is possible to assess the impacts on human well-being and health and property when planning various blue economy projects. In addition to that, operational monitoring provides information that can be used, for example, in EIAs of similar blue economy development projects. Therefore, implementing the measure will have favourable impact regarding human health and well-being and property.

During public display of the SEA programme, a question was raised regarding the impact of low-frequency noise, including infrasound, emanating from the offshore wind farms being built on human health. The impact of renewable energetics in the maritime area have been discussed in preparing the Estonian Maritime Spatial Plan, and the impacts will be assessed in detail during environmental impact assessments of specific wind farm development projects (also the following measure in the programme of measures addresses this issue *Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects*). Based on the literature, the following facts can be pointed out.

Low-frequency sound (20-200 Hz) and infrasound (0-20 Hz) play an important role in the noise of wind turbines. The human ear typically hears sound frequencies between 20 Hz and 20 kHz. Sounds with a frequency below 20 Hz are called infrasound. Sound waves with a frequency between 20-200 Hz are considered low-frequency noise. In the frequency spectrum of the sound of the wind turbine, the highest sound power levels occur at low frequencies (0-200 Hz), i.e. the lower the frequency, the higher the sound power level (Katinas et al, 2016). The same trend is generally also observed in the noise levels measured further from the wind turbines, i.e. in the lower part of the frequency spectrum, the measured noise levels are higher. Low-frequency noise spreads farther and fades away in air (noise level decreases) worse than noise at higher frequencies. It has been found that the measured infrasound level in outdoor conditions and indoors does not differ significantly (Jakobsen, 2005), i. e. the construction of the building does not significantly reduce the level of infrasound reaching the room from outside. It has also been found that human being is able to hear infrasound as well if the sound pressure level (noise level) is high enough (Moller & Pedersen, 2010; Victorian Government Department of Health, 2013). Figure 5.1 describes the dependence of human hearing threshold on sound frequency and sound pressure level. Studies have shown that low-frequency sound and infrasound do not have impact on humans at a distance of about 1 km from a wind turbine or more, and the infrasound level at such a distance is comparable to the natural infrasound level (NYSERDA, 2013).

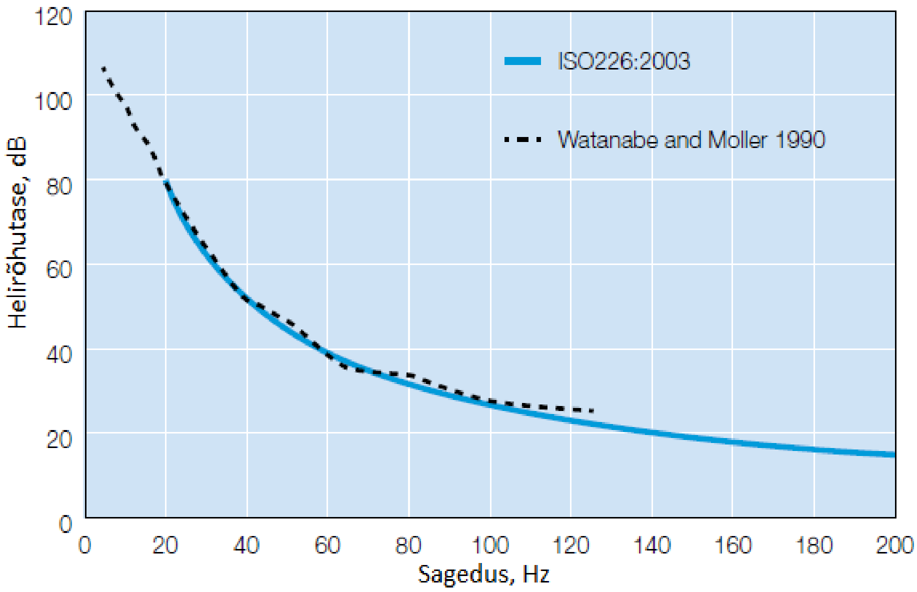

Figure 5.1. Human hearing threshold within the range of low-frequency sounds and infrasound. Source: Victorian Government Department of Health, 2013. *Helirõhutase* – sound pressure level; *Sagedus* – frequency.

An infrasound perception experiment conducted in Finland (Maijala et al, 2020) did not show that people would have sensitivity to infrasound, nor did people who were opposed to wind energy. Physiological measurements showed no effect of infrasound on heart rate, heart rate variability and changes in skin electrical conductivity for either wind power opponents or supporters. No confirmation was found for that even if people themselves do not perceive infrasound, it would affect their body's reactions in any way. Subjects of the experiment did not respond differently to recordings containing infrasound or to recordings without it. In the group of opponents of wind energy, 6 out of 11 reported the so-called wind turbine induced symptoms, and 2 out of 15 of those who did not oppose wind energy. At the same time, of the 8 people who reported any symptoms (19 different symptoms), only 5 symptoms were reported if they were actually presented with the infrasound recordings measured in the wind farm. At the same time, the manifestation of symptoms in the group opposed to wind energy increased as the test day progressed. In other words, they were more stressed because of the long testing, although at the same time these symptoms were not related to being in the actual infrasound environment since they were not exposed to infrasound. Since testing with human subjects did not establish that it was the infrasound that caused the symptoms, it was concluded that for those who already had the mindset to have symptoms (i. e. wind energy opponents), other factors, including their mindset, were causing the symptoms because compared to the control group (those not opposed to wind energy) they did not actually perceive infrasound differently in any way (Maijala et al, 2020).

In Estonia, low-frequency noise in residential premises is regulated by Regulation No. 42 (4.03.2002) of the Minister of Social Affairs *Standard Levels of Noise in Residential and Recreation Areas, Residential and Public Buildings, and Methods of Measuring Noise Level*. Here noise standards are presented across the sound frequency spectrum. Within the framework of this SEA, the results of wind turbine noise (including low-frequency and infrasound) studies conducted in Finland (Maijala et al, 2020) and in the USA (Channel Islands Acoustics, Hessler Associates Inc, Rand Acoustics, Schomer and Associates Inc, 2012) were compared with the low-frequency noise standards valid in Estonia. In the study conducted in Finland, noise measurements were made within 308 days in residential buildings about 1,5 km away from wind turbines (3-3,3 MW, 137-143 m high). In the study conducted in USA, noise measurements were made in residential buildings (and also directly next to them) about 335 m, 1066 m and 2133 m away from wind turbines (2,5 MW, 150 m high). In both studies under consideration, people did not live in these buildings during the measurement period. By juxtaposing the results of the mentioned study with the low-frequency noise standards for indoor areas valid in Estonia (Figure 5.2), it can be pointed out that the norm values were not exceeded at any of the mentioned distances. In addition to the norms, Figure 5.2 also shows the human hearing threshold across different frequencies. Compared to the hearing threshold, it turned out that the noise emanating from a wind turbine with a frequency of 100 Hz and higher can be heard even at a distance of 1,5-2 km, while the infrasound caused by wind turbines (below 20 Hz) cannot be heard even at a distance of 335 m from the wind turbine.

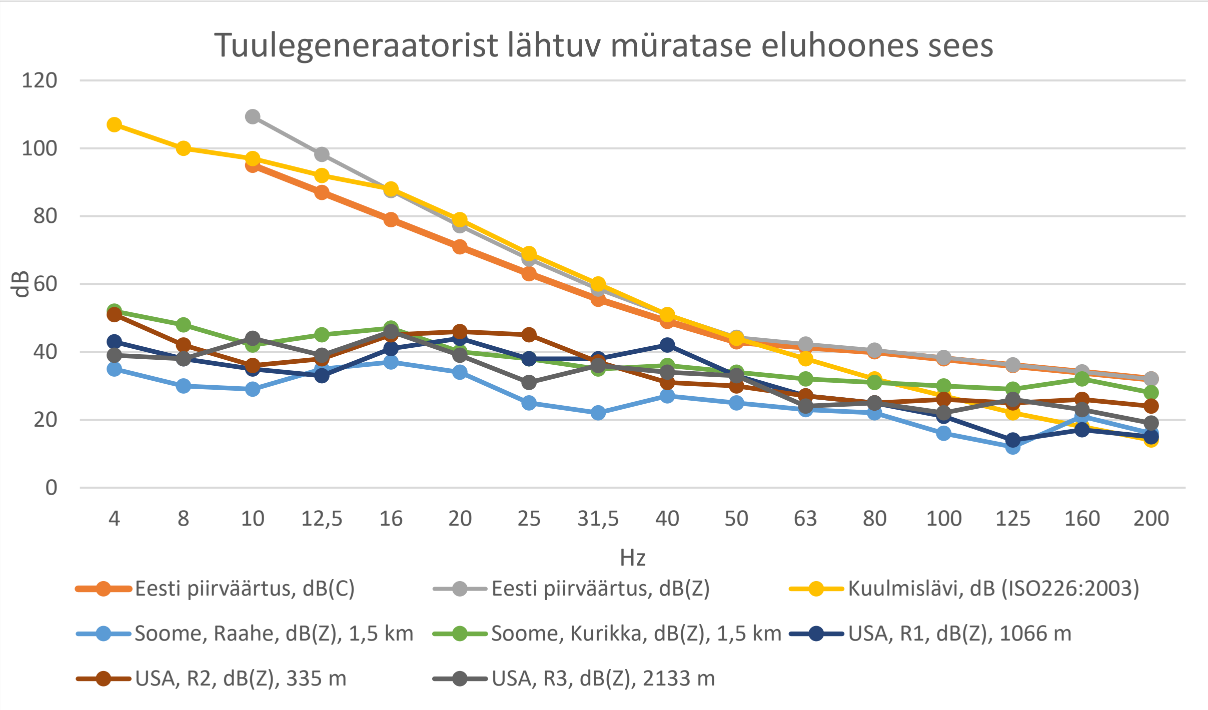

Figure 5.2. The results of noise measurements of wind turbines conducted in Finland (Maijala et al, 2020) and in the USA (Channel Islands Acoustics, Hessler Associates Inc, Rand Acoustics, Schomer and Associates Inc, 2012) in comparison with the low-frequency noise standards for indoor areas valid in Estonia, and the human hearing threshold.
***Tuulegeneraatorist lähtuv müratase eluhoones sees* – Noise emanating from a wind turbine inside a residential building**. *Eesti piirväärtus* – the limit value in Estonia. *Soome* – Finland. *Kuulmislävi* – hearing threshold.

It has been found (Schäffer et al, 2019) that the visibility of a wind turbine in the landscape significantly affects the level of disturbance to people. If a person has a positive attitude towards wind turbines, his/her noise tolerance is higher. Also in the case of low-frequency noise and infrasound from wind turbines, it has been observed in studies (e.g. Onakpoya et al, 2015; Freiberg et al, 2019; Maijala et al, 2020) that people's inclination toward wind turbines determines to a significant extent the disturbance of noise perceived by these people. Thus, people with a negative attitude towards wind turbines perceive wind turbine noise as more disturbing than people who does not have negative attitude towards wind turbines.

Although, according to the current knowledge, the noise standards are not exceeded at a distance of 1 km, the noise emanating from a wind turbine, especially the low-frequency noise, can be heard even at a further distance than 1 km, especially at night and under stable atmospheric conditions. Audible low-frequency noise can cause disturbance, especially to people who have a negative attitude towards the construction of wind turbines. On the other hand, the low-frequency noise heard at a further distance than 1 km is strongly related to the low-frequency noise of the local environment (e.g. the wind around the house), and the noise actually emanating from the wind turbine may not be distinct from the other noises (it is possible to check with modeling). In offshore wind farms, the wind turbines would be located much further than 1 km from residential buildings. Thus, it is unlikely that the low-frequency noise from the wind turbines would cause significant disturbance to the people. More detailed assessments will be conducted within the framework of the EIA of the respective projects.

There are measures planned within the programme of measures that are related to promoting cooperation (including International cooperation) in maritime activities and the involvement of interest groups. In addition to that, several studies are planned. The cooperation as well as conducting studies will have favourable impact on promoting research and innovation activities.

To sum it up, the measures of the programme of measures are aimed at achieving good status of the marine environment, but in the long term both local people living by the sea as well as those involved in maritime business will benefit from the improvement of the status of the sea. Thus, there will be long-term favourable impact on human well-being (also in a broader sense, e. g. on business) and on health. In the short term, the implementation of some measures will be accompanied by an unfavourable impact through imposing restrictions (e.g. reducing fishing efforts). On the other hand, planning and implementing new blue economy development projects helps to mitigate the impact.

5.2.6 Impact on maritime cultural heritage and traditional coastal lifestyle

Cultural heritage constitutes a limited, irreversible and irreplaceable community which, if destroyed, either intentionally, accidentally or due to „excessive interest", may be lost forever (BalticRIM project, 2017-2020). Cultural heritage related to the sea can be broadly divided into two: material and spiritual. Material maritime cultural heritage consists of various things ranging from netting needles to watercraft of all sizes, as well as buildings and structures related to the sea, such as lighthouses, sea forts and historic harbours. The Baltic Sea is also extremely rich in underwater cultural heritage and reportedly hides up to 10,000 shipwrecks and an even larger number of other historical artifacts. The spiritual heritage of maritime culture comes from people who value the coastal area as their living environment and for whom the sea is connected with their work, food and recreation at the same time. Maritime culture can be defined as the collection of maritime knowledge, skills and experiences of a nation or a region (https://meremuuseum.ee/merekultuur/kultuur-ja-parand/, 13.06.2022). The coastal living environment is characterized by a beautiful natural environment, traditional coastal villages with an interesting history and cultural heritage (including historic harbours, boat harbours, boathouses, etc.) and experienced fishermen who are the bearers of coastal fishing traditions. Important changes have taken place in the way of life in coastal villages during the last century precisely for historical reasons. For most of the coastal fishermen, fishing has become an additional source of income in addition to other work due to the short fishing season.

BalticRIM project (2017-2020) points out threats to the underwater cultural heritage, e. g.:

- ship traffic in shallow water;
- looting of underwater cultural heritage (e. g. shipwrecks);
- possible damages to shipwrecks related to bottom trawls of fishing vessels ;
- development activities at sea that affect the seabed (e. g. wind turbines, cables, including activities related to their installation, e. g. anchoring, etc).

In addition to the above, the lack of resources for the inventory of culturally valuable objects and implementing activities necessary for their preservation can also be pointed out as a problem.

On the other hand, underwater wrecks can be a potential source of pollution to the marine environment. This is especially true of wrecks from World War II, which are on the verge of disintegration and can leak dangerous chemicals (oil, petroleum) into the surrounding environment (Pärn, 2018). There are also many wrecks containing munitions in the Baltic Sea. In addition to that, there are the so-called ghost nets on the wrecks, which have remained attached to the shipwrecks from trawl fishing and continue to function as uncontrolled fishing gear.

The risk assessment of shipwrecks is a costly and time-consuming process. It is known that studies are planned to be conducted in the coming years to assess the potential risks of shipwrecks located in the Estonian maritime area. This is a *Preliminary study on the state of shipwrecks in the Baltic Sea*, the purpose of which is to examine up to ten potentially polluting shipwrecks in the Baltic Sea and map their environmental hazards. Within the measure of Marine Strategy’s programme of measures *Participation in international cooperation in the field of marine environmental protection*, conducting a comprehensive risk assessment of wrecks and dangerous sunken objects has also been considered as one of its activities.

Despite the risk of pollution, wrecks can also be a habitat for various species, depending on their location. Wreck creates a completely new environment in the area, the colonization of which by species depends on the conditions of the location in which the wreck is situated. Since shipwrecks are multi-layered and complex in structure, they generally provide habitats for both vertebrates and invertebrates. For example, a wreck on the bottom sediment is a favorable habitat for invertebrates and algal species that prefer a harder seabed (Pärn, 2018).

Sea areas are sometimes included among the valuable landscapes in the county plans. These are areas where nature conservation values are intertwined with historical and cultural values (e. g. the valuable landscapes of marine park Kihnu (Kihnu Väina Merepark), Lahemaa, Neugrund Shallow). The action plan for the implementation of the Estonian Maritime Spatial Plan stipulates the need to define valuable underwater landscapes and prepare a corresponding guide for the year 2027 in order to promote marine use that better takes into account local values.

In implementing the following measure of Marine Strategy’s programme of measures – *Developing compensatory measures for disturbing or destroying the integrity of the seabed* – a package of measures will be developed and established to compensate for the disturbance of the seabed and the destruction of the habitat during various developments and other activities.

One of the purposes of the package of measures is to ensure the least possible disturbance of the seabed and restoration of the previous situation after use. In addition to nature conservation values, the seabed is also directly related to cultural heritage, including wrecks, which can be habitats as well. Therefore, when implementing the measure, it is important to take into account the existence and preservation of underwater cultural heritage (currently known wrecks are recorded in the wreck register).

Within the programme of measures, a measure is planned for the implementation of development activities in the maritime area – *Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects.* Implementing the measure has a favourable impact on preserving maritime cultural heritage as well, as the impact on cultural heritage is also assessed during the respective EIAs, depending on the sensitivity of the area. In addition to that, depending on the volume and nature of the development activities, studies on seabed will be conducted in the maritime area, which may provide new information about the wrecks on the seabed.

Implementing the measure *Increasing pollution control capacity through the design and construction of a new pollution control (oil and other hazardous chemicals) buoy and research vessel* will have indirect favourable impact as well. More precisely, by using a pollution control vessel, it is also possible to reduce the risk of potential pollution from wrecks.

Long-term favourable impact will be accompanied on preserving traditional coastal lifestyle, the impact is related to improved seawater quality, improved viability of populations of commercial fish species, and improved maintenance of cleanliness at beaches and coastal areas. There can be short-term unfavourable impacts related to, for example, to the need to reduce fishing efforts (see more ch 5.2.5).

To sum it up, implementing the measures of the programme of measures can be expected to have a favourable long-term impact on preserving maritime cultural heritage. The implementation of the measures will have a favourable combined impact with the implementation of other strategic development documents (e. g. county plans; Estonian Maritime Spatial Plan). In addition to that, the planned studies help to obtain new and up-to-date information about the existence and condition (including risks) of objects related to the seabed (including wrecks).

5.2.7 Impact on conservation objectives and integrity of Natura 2000 sites

5.2.7.1 General information

Natura 2000 is a pan-European network of protected areas aimed at ensuring the protection of rare or endangered bird, animal and plant species and their habitats. The sites (protected nature areas and bird areas) within the Natura 2000 network area are designated on the basis of the directives of the Council of Europe: 92/43/EEC (Habitat Directive) and 79/409/EEC (Bird Directive).

In case of protected areas, which are also part of the pan-European network of protected areas Natura 2000, any adverse impacts on the conservation objectives and integrity of the network must be avoided in planning of an activity.

The assessment of the impacts of the programme of measures on the international Natura 2000 network is conducted in accordance with Article 6 (3) and (4) of the Habitats Directive and § 45 of EIA&EMSA. In preparing Natura assessment documentation, the following instructional materials have been relied on:

- Assessment of Plans and Projects in Relation with Natura 2000 Sites. Methodological Guidance on the Provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC. European Commission, 2021
- „Guidelines for Conducting a Natura Assessment in the Implementation of Article 6 (3) of the Habitats Directive in Estonia" (Estonian Association of Impact Assessment, 2019)

5.2.7.2 Information on the planned activities

The Marine Strategy applies to the entire Estonian maritime area and its objectives are as follows (Regulation No 46 of the Minister of Environment, 25.09.2020):

• to protect and preserve the marine environment, prevent deterioration of its status or, where possible, restore marine ecosystems in areas where they have been damaged;
• to prevent and reduce discharges into the marine environment in order to gradually reduce its pollution and ensure that discharges neither significantly impact nor threaten marine biodiversity, marine ecosystems, human health or legitimate uses of the sea.

Information about the measures planned within Estonian Marine Strategy's programme of measures is presented in the table 5.2 (ch 5.1).

5.2.7.3 Description of the Natura sites within the impact area of the planned activities

Due to the orientation of Marine Strategy's programme of measures, possible impacts on Natura 2000 areas are primarily related to the Natura 2000 areas located at the sea and the coast, i. e. protected nature areas and bird areas. Aquatic habitats will be the most affected, the possible impact on coastal habitats is related to possible measures, the related activities of which take place at least partially on land (on the coast).

According to the Natura 2000 Action Plan 2021-2027, marine habitats include underwater sandy shoals (1110), estuaries (1130), foreshores (1140), coastal lagoons (1150), wide shallow bays (1160), reefs (1170). The most widespread habitat type in Estonian marine waters is sandy shoal. At the same time, more than half of the Estonian maritime area is not yet covered by data from the inventory of habitat types. On the other hand, the most valuable habitats known so far are included in Natura sites. The status of marine habitats (1110, 1130, 1140, 1150, 1160, 1170) has been assessed as favourable. The abundance of most bird species nesting on small islands and islets, especially fish-eating species, has increased. The decline of abundance of bird species feeding on benthic biota has slowed down and their abundance has stabilized at low levels. However, the abundance of many species is still declining (velvet scoter *Melanitta fusca*, common eider *Somateria mollissima*, goosander *Mergus merganser*). Benthos-feeding bird species have still bad overall status. Ringed seal *Phoca hispida botnica* has very bad status, grey seal *Halichoerus grypus* has favourable status.

Coastal habitats include beach ridges (1210), shingle beaches (1220), sea cliffs (1230), salt marshes (1310), small islands and islets (1620), coastal meadows (1630), sandy beaches (1640), pre-dunes (2110), white dunes (2120), gray dunes (2130), brown dunes with crowberries (2140), forested dunes (2180), interdunal wetlands (2190) and limestone outcrops (8210). The status of most of the coastal habitats has been assessed as favourable, except coastal meadows and forested dunes, the status of which has been assessed as inadequate. The status of brown dunes with crowberries has been assessed as inadequate as well (Ministry of the Environment, 2019c).

The habitat type rivers and brooks (3260) is also directly related to the sea, its status has been assessed as inadequate (Ministry of the Environment, 2019c).

5.2.7.4 Relation of the planned activities to nature conservation management

Marine Strategy's programme of measures is neither directly related to nor necessary for nature conservation management of Natura 2000 sites. However, in Natura 2000 Action Plan 2021-2027 some measures have been proposed, for example, for achieving the conservation objectives of marine and freshwater habitat types, to which the measures of Marine Strategy's programme of measures correspond to and support the implementation of those measures in Natura 2000 Action Plan (table 5.5).

Table 5.5. Measures planned in Natura 2000 Action Plan 2021-2027 and corresponding measures/studies in Marine Strategy's programme of measures.

Measure in Natura 2000 Action Plan 2021-2027	**corresponding measure/study in Marine Strategy's programme of measures**
Analysis of the coherence and functioning of protected areas (including in the maritime area), if necessary, establishing new protected areas.	Measure: Improving the effectiveness of the existing network of marine protected areas. In addition to that, also studies supporting implementation of the measure.
Assessing the effectiveness of eradication of alien species, early detection of new alien species and rapid response to it.	Indirectly measure: Updating regulations (addresses also activities to control the spread of alien species). In addition to that, also the planned studies related to alien species.
Studies on marine biodiversity (including studies on grey seals' habitats using telemetry; studies on migratory birds and bats).	Studies planned within the programme of measures, for example: • Assessing the impact of measures that contribute to the protection of species by means of risk and status assessments; • Preparing maps of sensitive areas for birds to inform the public ; • Inventory of HELCOM Red List species and habitats.
Developing methods for assessing and mapping of cultural ecosystem services, including, for example, a study on the potential of nature tourism.	Indirectly measure: Litter collection campaigns. Studies, for example: • Defining ecosystem services in the Estonian maritime area; • Introduction of ecosystem-based accounting in sustainable management of the marine environment.
Developing measures to reduce the bycatch of seals and birds.	Measure:

Partially compensated preventive investments (e.g. seal- and bird-proof fishing gear).	Implementing technologies to reduce and prevent bycatch in order to protect species in the Baltic Sea.
Improving the status (quality, structure and functioning) of marine habitats by restoring habitats for marine key species (e. g. *Zostera L*, *Fucus vesiculosus*, *Furcellaria lumbricalis*).	Measure: Developing compensatory measures for disturbing or destroying the integrity of the seabed. Studies, for example: Launching a systematic seabed inventory programme.
Cultivation of algae and shellfish in aquaculture in affected protected areas (potential problem areas in Pärnu Bay, Haapsalu Bay and Tallinn Bay) to reduce the pressure of eutrophication.	Indirectly measure: Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects.
Reducing the impact of marine pollution.	Measures: Enhancing the management of environmentally hazardous pharmaceutical waste and raising awareness on more environmentally friendly disposal of pharmaceuticals. Increasing pollution control capacity through the design and construction of a new pollution control (oil and other hazardous chemicals) buoy and research vessel. Regarding ships, ensuring environmental safety at sea. Studies, for example: Conducting a national risk analysis of marine pollution of hazardous substances for oil and HNS substances, and analysis of the impact of threats and risks arising from marine pollution on species and marine habitats.
Opening migratory passages for fish, restoring spawning grounds.	Measures: Improving the condition of fish spawning areas and migration routes, stimulating populations and updating protection measures. Construction of the openings of the road dam of Väike Väin (Väike Strait) to improve the water exchange and to open the strait as a fish migration route.

5.2.7.5 Predicting the impact of planned activities on Natura 2000 sites

Strategic document – Marine Strategy's programme of measures – which is the basis of this assessment, is of a general nature that does not allow to conduct Natura 2000 assessment in accordance with its methodology. Directions of the activities planned within the programme of measures will be specified with lower level zoning plans or projects in the future. Presumably, at these stages more specific activities (e. g. construction volume, technologies used) will be known and it would allow more accurate prediction of impacts and Natura 2000 assessment.

However, according to what has been said in ch 5.2.7.4, some measures in Marine Strategy's programme of measures will either directly or indirectly support the nature conservation management of Natura 2000 network marine and freshwater habitat sites and species related to them, and contribute to improving the status of these habitats.

The main pressure factors and threats to marine habitats and species are related to eutrophication, physical alteration and disturbance of habitats (including dredging, dumping, mining, construction activities), marine pollution, bycatch and invasive species. The main pressure and risk factors for coastal habitats are related to active recreational activities on the coast, as well as natural processes. The main pressure and risk factors for the habitat type directly related to the sea – rivers and brooks – are pollution, changes in the water regime and invasive alien species (Natura 2000 Action Plan 2021-2027).

The main pressure factors for ichthyofauna are fishing mortality, loss of habitats and spawning grounds or deterioration of their status, and hydrometeorological conditions. One important risk factor for migratory fish species is constructing river dams, which prevent fish from moving to their spawning grounds and cause the quality of watercourses to deteriorate. The main pressure factors for avifauna are eutrophication, by-catch and oil pollution. Birds are at particular risk of getting caught into fishing gear during migratory or wintering periods when they congregate in large flocks and stay in areas where fishermen are also active. Eutrophication is also an important pressure factor for aquatic birds to which they may respond. For example, eutrophication can cause quite opposite changes in functional groups of birds – an increase in the concentration of dissolved inorganic nitrogen (DIN) causes an increase in the abundance of ducks feeding on molluscs, while the abundance of herbivorous birds decreases (Alkranel OÜ & TTÜ MSI, 2016). The main pressure factor for ringed seals is related to changes in the ice cover in the Baltic Sea due to climate change.

The purpose of implementing the measures of Marine Strategy's programme of measures is to achieve the good status of the marine environment. Therefore, the implementation of all measures can generally be expected to have a direct or indirect favourable impact on preserving marine habitat types and the species associated with them. However, while implementing the measures one must consider that implementing any planned activity must not damage the natural values of Natura 2000 site. It is possible to avoid the possible occurrence of negative impact and to reduce it by appropriate preparation of projects that would take environmental aspects into consideration as well.

The most likely risk of adverse impacts occurring is the construction of various buildings or facilities in Natura 2000 sites or in the immediate vicinity of these sites. It is important that these activities would not cause either direct or indirect long-term changes in habitats included into conservation objectives of Natura 2000. When designing facilities or buildings to be built in aquatic environment, solutions must be found and technologies and other measures must be implemented that do not pose a threat to aquatic habitat types and therefore have no impact on the species specified in the conservation objectives of Natura 2000 sites. Occurring or not occurring of potential adverse impacts is dependent on particular location and development activities and it is not predictable within the degree of accuracy of the programme of measures. However, the adverse impacts of such kind of development activities are generally avoidable or they can be mitigated through planning of development activities that take into account the conservation objectives of Natura 2000, the implementation of which is supported, for example, by the following measures in the programme of measures: *Developing compensatory* *measures for disturbing or destroying the integrity of the seabed* and *Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects*.

In the Estonian Maritime Spatial Plan (2022), more extensive exclusion zones have been established for areas suitable for the development of wind energy and for fish farming, i. e. these activities are prohibited and excluded in the areas of protected natural objects, including the Natura 2000 network. This avoidance principle and requirement would minimize the expected potential adverse impacts on sites of natural value, including the sites of Natura 2000 network and achieving their conservation objectives.

The Estonian Maritime Spatial Plan does not exclude shellfish and algae cultivation on protected natural objects (including the sites of Natura 2000 network). In developing marine aquaculture, engaging into shellfish and algae farming in parallel with fish farming has positive impact, since it has the potential to reduce eutrophication in the marine environment (shellfish and algae farming enable nutrients to be removed from the marine environment) and this, in turn, is expected to have indirect favourable impact on all marine Natura 2000 sites and species related to them. The issue has been addressed in more detail in chapter 5.2.4.

Therefore, at the stage of Marine Strategy's programme of measures, no adverse impacts on achieving the conservation objectives of the Natura 2000 network sites are expected to occur during the implementation of the programme of measures. However, when planning the activities necessary to implement the measures, it must be taken into account that implementing any planned activity must not damage the natural values of a Natura 2000 site. The adverse impacts of potential development activities are generally avoidable or they can be mitigated through planning of development activities that take into account the conservation objectives of Natura 2000. Existing environmental legislation and minimization of adverse impacts must be taken into account when planning particular activities.

5.2.7.6 The results of Natura 2000 preliminary assessment and conclusion

Based on the assessment of the information with the degree of accuracy of the programme of measures, it can be assumed that implementing the programme of measures would not lead to unfavourable impact on the integrity and conservation objectives of Natura 2000 network site(s). Rather, since the main goal of the programme of measures is to achieve the good status of the marine environment, implementing the measures will have direct or indirect favourable impact on the Natura 2000 network sites, if the recommendations mentioned above are considered as well.

Therefore, within the degree of accuracy of this strategic document it is not reasonable to proceed with the stages of appropriate Natura 2000 assessment and start making more detailed assessments.

When implementing the programme of measures, if implementation mechanisms and the spatial scope and time of particular activities are already known to a certain extent, an (strategic) environmental impact assessment must be conducted (including Natura 2000 assessment), if necessary. When already planning the activities, potential adverse impacts on the environment are to be considered and their occurrence to be minimized, and the impact of each accompanying activity on affected species/habitat types of Habitats Directive and Bird

Directive is to be assessed. The assessment is also necessary if implementing the measures requires applying for some kind of activity licences.

5.2.8 Impact on adapting to climate change

Climate Change Adaptation Development Plan until 2030 states that *To reduce the dependency of marine environment on weather conditions and to minimise the increase of the environmental impact due to climate change, the good status of the marine environment needs to be achieved first. In relation to the environmental changes caused by climate change and to the mitigation thereof, both regulative measures as well as plans and additional studies need to be prepared in order to achieve the good status of the marine environment*. The goal of Marine Strategy's programme of measures is to achieve the good status of the marine environment. Therefore, all its measures contribute more or less, directly or indirectly to adapting to climate change.

Based on the HELCOM Climate Change Fact Sheets (HELCOM, 2021) prepared on the basis of scientific literature, it can be expected that the water temperature of the Baltic Sea's surface layer will increase (depending on the scenario) by the end of the century between 1.1°C and 3.2°C compared to the average of 1976-2005. The maximum extent of ice cover (6400-10900 km^2 per decade) and the number of ice days are predicted to decrease. There is no consensus on the future trends of salinity in the Baltic Sea, but the stratification of the water column will most likely strengthen due to the increase in temperature. With the predicted increase in precipitation in the catchment area of the northern part of the Baltic Sea, river flows will also increase. The water level is expected to rise, as in the entire world ocean, but in the northern part of the Baltic Sea it is slightly compensated by the continued land rising. (HELCOM, 2021)

Climate Change Adaptation Development Plan points out that the changed climatic conditions of the Baltic Sea affect all living organisms and the relations between them. Regime shifts in biota make the marine environment unstable and more susceptible to pressure factors. When sea water temperature increases in the Baltic Sea, it creates better survival conditions for alien species who may completely reorganise the functioning of the local ecosystem. Nõges (2012) also point out that the biota of the Baltic Sea is extremely sensitive to pressure factors, as a large number of species are not originally brackish water species, but come from either the ocean or fresh water. Therefore, they live in the Baltic Sea at the limit of their physiological tolerance to salinity. There are also many cryophilic species, whose thermal tolerance is tested by the rise in temperature. In a situation where the salinity drops and the temperature rises simultaneously, the environmental suitability of species of marine origin decreases and freshwater species finds themselves in an advantageous situation. This situation can also encourage the spread of non-indigenous species (invasive alien species). To control the „introduction" of alien species, there are the following measures in the programme of measures: *Updating regulations* and *Participation in international cooperation in the field of marine environmental protection*, the activities of which also provide for control of the spread of alien species. In addition to that, research is planned on identifying the environmental impact of alien species and creating an early detection system for alien species.

Climate change is also a factor worsening the reproductive potential of fish. Warming increases the decomposition of organic matter and reduces the amount of oxygen in the aquatic environment, which in turn has negative impact on local biota. For example, most coastal fish of commercial interest (pike, perches and carps) breed in the spring. Whereas in the past Estonian spring has been characterized by seasonal floods due to melting of snow that has accumulated in winter, which creates conditions suitable for fish to reproduce (flooded meadows, oxbows that have connection with the main river), then, with climate change, there are more and more periods in winter when the temperature is above zero and when the snow that has accumulated in the meantime melts. As a result, the duration and extent of spring seasonal floods have declined significantly, with its peak shifting to a time when solar radiation is not yet sufficient for the massive growth of zooplankton needed to establish the necessary food basis for juvenile fish.

As a result of climate change, traditional ice fishing is also in danger. Therefore, measures that support the restoration of spawning grounds and the opening of migration routes play an important role in adapting to climate change. The relevant measures in the programme of measures are, for example: *Improving the condition of fish spawning areas and migration routes, stimulating populations and updating protection measures; Reducing fishing efforts to GES level and development and implementation of the corresponding concept; Construction of the openings of the road dam of Väike Väin (Väike Strait) to improve the water exchange and to open the strait as a fish migration route.*

Seabed habitats and species related to them are also affected by the climate change. In addition to that, seabed can be affected by planned blue economy projects. Thus, there may be cumulative impacts on seabed habitats and species. In order to minimize the impacts and maintain the good status of the seabed habitats, the following measures are planned within the programme of measures: *Developing compensatory measures for disturbing or destroying the integrity of the seabed; Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects.*

The impacts of climate change on the marine environment are manifested at different levels and are themselves in turn influenced by many factors. Also, knowledge regarding the extent, direction, significance and other aspects of possible impacts is still incomplete. Knowledge can be supplemented by monitoring, which provides data on changes, but long-term observational data is necessary to increase reliability. In addition to that, international cooperation is important here. The programme of measures includes a study to find out the more precise impacts of climate change: *Assessment of the potential impacts of climate change and planning corresponding countermeasures*. In addition to that, promoting international cooperation is planned as one of the measures in conducting scientific research.

In terms of land-based nutrient load, an increase in the load mainly due to climate change-related floods and rainwater overflows, the load originating from agriculture and the load originating from the development of aquaculture is expected. Water Management Plan 2015-2021 and programme of measures of the draft Water Management Plan 2022-2027 include measures to reduce point load and diffuse load, most of them are related to the limitation and reduction of nutrient load resulting from floods and rainwater overflows due to climate change, and from agriculture. Thus, the measures provided in Water Management Plan contribute also to reaching the good status of the marine environment.

Regarding monitoring climate change, the Water Management Plan 2022-2027 (draft) proposes to map potential climate change hotspots, i. e. to map water bodies/habitat types more sensitive to climate change, which should be monitored in the future. Mapping potential climate change hotspots in Estonia and explaining their inclusion in the monitoring network provides an opportunity to consciously direct research monitoring for early detection of the impact of climate change. At the same time, the list of the most endangered habitat types of the Habitats Directive includes two habitat types of the Baltic Sea – reefs and sandy shoals – and of coastal habitats coastal lagoons, estuaries, wide shallow bays, and sandy and muddy foreshores. The programme of measures includes a study planned as seabed monitoring *Launching a systematic seabed inventory programme*, within the framework of which a long-term plan for seabed inventories will be developed (geological studies + inventory of benthic biota and habitats). This study contributes to the organization of long-term monitoring, including the impact of climate change.

Climate change occurs on a long-term scale. The same is true for the implementation of the planned measures, i. e. their impact will be manifested on a long-term scale. It is important that while developing the measures of the programme of measures, potential occurrence of climate change is taken into account, and the measures can be adapted if necessary based on the results of the planned studies and monitoring.

5.2.9 Cumulative impacts

The purpose of establishing measures in the programme of measures is to achieve the good status of the marine environment. Therefore, on a general level, the implementation of the measures will have a favourable cumulative impact on the natural environment. However, the impact of the implementation of the measures is manifested primarily on a long-term scale.

Across the components of the ecosystem, several measures have been planned to improve or preserve the status of species related to the sea. For example, measures *Improving the condition of fish spawning areas and migration routes, stimulating populations and updating protection measures* and *Construction of the openings of the road dam of Väike Väin (Väike Strait) to improve the water exchange and to open the strait as a fish migration route*; in conjunction with the measure *Reducing fishing efforts to GES level and development and implementation of the corresponding concept* will have long-term favourable impact on preserving the viability of fish populations. Also, for example, measures designed to protect the seabed as a habitat will have a long-term favourable impact on preserving habitat types and species related to them. The planning of monitoring is also important here (the study planned within the programme of measures *Launching a systematic seabed inventory programme*), which will help to identify changes in the seabed and the long-term cumulative impacts of possible development activities and climate change.

Cumulative favourable impacts can also be expected regarding the reduction of marine litter. Several measures are either directly or indirectly designed to reduce the risk of litter, including microplastics, reaching the sea.

Since a large part of the nutrient load comes from land, it is important to implement the measures specified in the Water Management Plan, which in turn, together with the measures of the programme of measures, will have a favourable cumulative impact on the status of the marine environment.

Unfavourable (negative) long-term cumulative impact on the natural environment cannot be expected due to the implementation of the measures. However, regarding, for example, the measure *Implementing technologies to reduce and prevent bycatch in order to protect species in the Baltic Sea*, before applying the corresponding technologies (e.g. seal deterrents), their potential side effects on non-target species must be determined.

Since it is necessary to reduce the anthropogenic pressure in order to achieve the good status of the marine environment, some of the measures in the programme of measures will have an unfavourable impact on the social environment. For example, the measure *Reducing fishing efforts to GES level and development and implementation of the corresponding concept* in conjunction with the measure *Improving the effectiveness of the existing network of marine protected areas* may reduce the extent of areas suitable for fishing and the catch volumes. This in turn will have cumulative unfavourable impact on people engaged in fisheries. Fisheries is also a part of maritime cultural heritage. On the other hand, the measure related to the reduction of fishing effort is necessary primarily for the restoration/preservation of fish stocks on a long-term scale, and the unfavourable impact accompanying with the measure is short-term.

Favourable cumulative impacts on the social environment will accompany the implementation of several measures aimed at increasing the level of maintenance (reducing littering). Increasing the level of maintenance in turn will encourage promoting recreational economy and tourism. The implementation of all measures will have a favourable cumulative impact on human well-being and health in general, as their goal is to achieve the good status of the marine environment.

Favourable cumulative impact on underwater cultural heritage will be expected while implementing the following measures: *Developing compensatory measures for disturbing or destroying the integrity of the seabed;* and *Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects*. These measures enable identifyingunderwater cultural heritage and taking into account already known underwater cultural heritage and, if necessary, to establish requirements for the preservation of cultural heritage.

5.2.10 Cross-border impact

On the basis of the circumstances known during the preparation of the SEA programme, it was assumed that the implementation of the new measures of the Estonian Maritime Strategy's programme of measures 2022-2027 may have a cross-border impact, therefore, in cooperation with the Ministry of the Environment, opinions on the SEA programme were asked from neighboring countries with common maritime border – Latvia, Sweden, Finland and Russia. The rest of the countries of the Baltic Sea region were also informed about initiating the preparation of the Estonian Marine Strategy's programme of measures and the strategic environmental impact assessment.

The measures of Marine Strategy's programme of measures are aimed at achieving the good status of the marine environment. Although the measures are aimed at improving the status of Estonian maritime area, due to the marine ecosystem as a whole, favourable impacts will also occur beyond the Estonian maritime area. For example, improving the condition of fish spawning areas and migration routes will contribute to the favourable status of respective species as a whole. Also, reducing the load of nutrients and litter coming from Estonian mainland will have a favourable impact on the Baltic Sea as a whole. In order to achieve the good status of the Baltic Sea as a whole, international cooperation is important, the promotion of which is also one of the measures planned within the programme of measures.

Therefore, no significant adverse impact on the environment outside Estonia is expected to occur when implementing the new measures proposed in the programme of measures, and no significant impact on the environment of another country is expected to occur within the meaning of EIA&EMSA § 46 (Strategic environmental assessment in transboundary context) and Article 7 (transboundary consultations) of Directive 2001/42/EC of the European Parliament and of the Council.

6. Description of monitoring and ex-post assessment

Environmental monitoring is the continuous monitoring of the status of the environment and the factors affecting it, which includes environmental observations and analyses, and the processing of observational data. In the case of strategic documents of higher level, it is also potentially possible to monitor the achievement of the set objectives. Given the nature of the SEA object, two types of monitoring can be addressed in this case: environmental monitoring and monitoring the effectiveness of development documents.

According to EIA&EMSA § 40 (13) SEA report must include a description of the measures proposed for the monitoring of significant environmental impact resulting from the implementation of the strategic planning document and of the measurable indicators. The purpose of the monitoring measures is to identify at an early stage whether significant environmental impact arises from the implementation of the strategic planning document and to take measures that prevent and mitigate adverse environmental impact (EIA&EMSA § 42 (10)).

The programme of measures does not plan measures the implementation of which is expected to have a significant unfavourable impact. Therefore, the SEA expert group does not provide for additional monitoring measures to assess and minimize the negative environmental impact.

The implementation of the Marine Strategy takes place in six-year cycles, where one cycle consists of three main stages: 1. stage – assessing the status of the maritime area and setting targets, 2. stage – development and implementation of marine monitoring programme and 3. stage – preparation and implementation of marine programme of measures. Each of the aforementioned stages of the Marine Strategy is updated every six years. Therefore, the effectiveness of the programme of measures is monitored through the implementation of the monitoring programme and the next assessment of the status of the marine environment.

The purpose of the marine monitoring programme is to collect data for the periodic assessment of the environmental status of the Estonian maritime area and to monitor the achievement or non-achievement of environmental targets and to assess the effectiveness of the Marine strateg’s programme of measures. Marine Strategy’s marine monitoring and data collection programme 2021-2026 is therefore sufficient to monitor the Marine Strategy.

7. An overview of SEA process and difficulties encountered

Minister of the Environment approved with the Directive No 1-1/21/390 (15.09.2021) preparing „Estonian Marine Strategy’s Programme of Measures“, and initiation of strategic environmental impact (SEA) for it (Annex 1). Strategic environmental impact assessment for Estonian Marine Strategy’s Programme of Measures 2022-2027 has been initiated based on § 33 section 1 point 1 and § 35 section 2 of Environmental Impact Assessment and Environmental Management System Act, without justifying the need for it since the programme of measures includes the fields of fisheries, waste management and water management.

The Ministry of the Environment sent the SEA programme (Annex 2 of the SEA report) to the institutions and persons listed in Table 8.1 to ask for their opinion on the Strategic Environmental Impact Assessment Programme. Opinions given on the SEA programme and considering these opinions are described in Annex 2 of the SEA programme. Due to the potential cross-border impact Ministry of the Environment asked for opinions on the SEA programme from neighboring countries with common maritime border – Latvia, Sweden, Finland and Russia. The rest of the countries of the Baltic Sea region were also informed about initiating the preparation of the Estonian Marine Strategy's programme of measures and the strategic environmental impact assessment. Based on the opinions received on the SEA programme from foreign countries, the following countries expressed their wish to be involved into the further processes of the programme of measures and the SEA for it: Latvia (opinion registered in document management system of the Ministry of the Environment, No 16-3/22/619-19), Finland (opinion registered in document management system of the Ministry of the Environment, No 16-3/22/619-20) and Sweden (opinion registered in document management system of the Ministry of the Environment, No 16-3/22/619-22). Poland (opinion registered in document management system of the Ministry of the Environment, No 16-3/22/619-10) and Denmark (opinion registered in document management system of the Ministry of the Environment, No 16-3/22/619-21) are not involved into the further processes.

The public display of the draft of the SEA programme took place on 04.05-18.05.2022 and the public consultation on 26.05.2022 at 14:00 online in the MS Teams environment. The Ministry of the Environment informed all relevant institutions and interested persons about the public display. The public display and public consultation were also announced in Official Announcements (www.ametlikudteadaanded.ee) and in nationwide newspapers. Opinions delivered during the period of public display of the SEA programme and considering these opinions, and minutes of the public consultation are presented in annexes to the SEA programme (Annex 2 of the SEA report).

The SEA programme was declared compliant with the letter No 16-3/22/619-30 (19.07.2022) from the Ministry of the Environment KSH programm (Annex 3).

There were no significant difficulties in conducting the SEA.

8. Summary of SEA results

The object of the strategic environmental impact assessment was Estonian Marine Strategy's programme of measures 2022-2027**.** The Marine Strategy applies to the entire Estonian maritime area and its objectives are as follows (Regulation No 46 of the Minister of Environment, 25.09.2020):

- to protect and preserve the marine environment, prevent deterioration of its status or, where possible, restore marine ecosystems in areas where they have been damaged;
- to prevent and reduce discharges into the marine environment in order to gradually reduce its pollution and ensure that discharges neither significantly impact nor threaten marine biodiversity, marine ecosystems, human health or legitimate uses of the sea.

Preparing the programme of measures and its strategic environmental impact assessment was initiated by the Directive No 1-1/21/390 (15.09.2021) of the Minister of Environment (Annex

1). The purpose of the programme of measures is to update Estonian Marine Strategy's programme of measures approved by the Government of the Republic in 2017, in order to ensure the fulfilment of the established environmental targets and thereby achieve or maintain the good environmental status (GES) of the Estonian maritime area. The new measures planned within the programme of measures are described in chapters 1 and 5.1 of the SEA report.

The basis of the SEA report is the SEA programme that was declared compliant with the letter No 16-3/22/619-30 (19.07.2022) from the Ministry of the Environment (Annex 3).

8.1 A brief overview of the impacted environment and pressure factors

Natural environment
The maritime area under jurisdiction of the Republic of Estonia is altogether 36 622 km^2, of which 14 487 km^2 is coastal sea, about 10 714 km^2 is territorial sea and 11 421 km^2 falls within the economic zone. Estonian maritime area is situated in the northeastern part of the Baltic Sea and consists of parts of many major basins in the Baltic Sea, that are quite different in terms of natural conditions: the Gulf of Finland, open part of the West Estonian islands and the Gulf of Riga, (incl Väinameri, which is situated in the West Estonian archipelago). Coastal sea is divided into 16 coastal water bodies. All coastal water bodies in Estonia have bad status.

Estonian maritime area is quite shallow – about a third of maritime area is deeper than 60 metres. Depth of the water in Estonian maritime area range from 0 to 180 metres. Detailed knowledge of the seabed comes only from those points where measurements and analyses have been conducted, but marine benthal deposit have not been systematically mapped in Estonia and, therefore, Estonian seabed can be described using modelled data. According to the modelling results by the University of Tartu, Estonian Marine Institute, Estonian maritime area has to the greatest extent muddy sediments. Sand and mixed sediment (mixture of hard and soft substrate) is also common. To a lesser extent, there are areas with stony or rocky surface.

The inflow of salt water into the Baltic Sea takes place through the Danish straits, but at the same time fresh water is also added to the sea from rivers. Due to its lower density, less salty water remains into surface layer and flows out of the sea in surface layer as well. But the saltier water from the North Sea sinks into the deep layers of the sea, as a result of which the water column of the Baltic Sea is also vertically stratified. In the case of a continuously stratified water column, the transport of nutrients and oxygen between the near-bottom water layer and surface layers is hindered.

During the last 100 years, the annual maximum ice cover in the Baltic Sea has decreased by 20%, while the duration of the ice cover has also decreased. Ice cover in Estonian maritime area occurs every year at least in Pärnu Bay and in Väinameri Sea, being the parts of the Estonian coastal sea with the longest duration of ice cover. During tough winters, the whole Estonian maritime area is covered with ice.

Compared to other aquatic ecosystems, there are relatively few animal and plant species living in the Baltic Sea. The biodiversity of the Baltic Sea consists of a unique mixture of marine and freshwater species adapted to brackish water conditions and a few true brackish water species. In the northern and eastern part of the Baltic Sea, where salinity is low, fewer marine species can spread, and marine habitats, especially in estuaries and coastal waters, are dominated by freshwater species.

Ichthyofauna of the Estonian maritime area is quite diverse, but under strong human impact. Pelagic communities of the Baltic Sea are dominated by Baltic herring and sprat. The most typical species in benthic communities of the Baltic Sea is flounder and typical representatives of coastal waters are bullheads (e. g. four-horned sculpin, shorthorn sculpin and sea scorpion). Of the commercial fish (Baltic herring, sprat, flounder, perch, pikeperch, salmon), the good status was achieved only regarding fishing mortality of Baltic spring spawning herring in the open sea and the ratio of the biomass of commercial flounder fishing to the biomass of monitoring fishing. As for the rest of the indicators, the good environmental status has not been achieved.

The following mammals are living in the Baltic Sea: ringed seal, harbour seal and grey seal, and harbour porpoise. Harbour seal gets into Estonian waters rather accidentally. During the 20th century, the abundance of harbour porpoise has decreased catastrophically and this species practically does not get into Estonian waters anymore. Regarding the abundance of grey seals, good environmental status has been achieved, but the abundance of ringed seals does not meet the criteria for good environmental status. The spread of ringed seals in the Estonian part of the Gulf of Finland has significantly decreased over the past 50 years as a result of the lack of ice conditions necessary for the species and direct human activity, which is why the spread of ringed seals has retreated eastward to the waters of Russia.

The importance of the Estonian coastal sea for aquatic birds is primarily due to its geographical location, as it lies directly on one of the important branches of the Eastern Atlantic migration route. From the point of view of Estonian avifauna and their protection, migratory birds that stop at sea during their migration are one of the most important groups, with endangered bird species of Estonia, Europe and of the world making stops at the sea.

In the conditions of the Baltic Sea, the Estonian maritime area is very diverse in terms of habitats. Of 25 marine benthic habitats according to EBHAB (*Eastern Baltic marine benthic habitats*) classification, 18 are represented in the Baltic Sea. There are also 6 habitat types listed in Annex 1 of the European Union Habitats Directive in Estonian maritime area — reefs, sandy shoals, shallow inlets, estuaries, coastal lagoons and large bays.

According to the marine environment status assessment in 2018, birds and benthic habitats in Estonian maritime area have good status, but mammals, fish and pelagic habitats have bad status. Regarding biodiversity, one has to admit that good environmental status has not been achieved, as both mammals as well as fish and pelagic habitats have unfavourable status. Also, food webs does not have good environmental status, because none of the assessment criteria achieved GES. Only the status of benthic habitats corresponds to the good environmental status.

The protected area in Estonia is 23% of the total area (land and water areas together), including 27% of the territorial sea being under protection and 18,7% of the maritime area including the economic zone is protected. As of 2017, the Estonian Natura 2000 network consists of 66 bird areas and 542 nature areas, with a total area of 14,863 km^2. A little less than half of the Natura sites are located in the sea, and 17% of Estonia’s terrestrial area is covered by Natura 2000 sites.

There are nine mineral deposits in Estonian maritime area: Haapsalu, Käina, Kõpu, Hiiumadala, Nasva, Naissaare, Kuradimuna, Ihasalu and Letipea. Only two of these mineral deposits, the Haapsalu and Käina mineral deposits, have sea mud as their main mineral resource, while the rest have sand.

Pressure factors

Over the past twenty years the release of nutrients into the water has decreased in almost all parts of the Baltic Sea, while nitrogen release has decreased by 12% and phosphorus release by 26%. The reduction has been achieved primarily by measures imposed on point sources of pollution (e. g. sewage treatment plants, industrial plants) and by limiting the spread of nitrogen through the air, especially in the context of reducing emissions from the energy and transport sectors. However, during the same period, no significant reduction in emissions from diffuse sources has been observed, and nutrients from these sources account for almost 35% of pollution entering the sea via rivers. Despite overall progress regarding nitrogen emissions, emissions still need to be reduced, especially in shipping. Ammonia emissions have remained at their previous levels and have recently even slightly increased, indicating the need for more effective emission reduction measures in the agricultural sector. Due to human-induced excess nutrients entering the Baltic Sea in the past, a significant amount of phosphorus has accumulated in the bottom sediments. In case of lack of oxygen or low oxygen level, phosphate is released from the sediments, which increases the total load of nutrients to the marine ecosystem and further contributes to the continuation of the vicious cycle of eutrophication in the Baltic Sea. According to the status assessment of Estonian maritime area conducted in 2018, regarding eutrophication the good environmental status has not been achieved.

Pollutants, including hazardous substances reduce the quality of water in the Baltic Sea and can cause enormous damage to the functioning of the sea. In addition to reducing water quality, pollution can also have impact on living organisms or biological processes. More and more connections are being established between different disease outbreaks and pollutants that affect individual aquatic individuals or even populations. Pollution caused by pharmaceutical residues, together with the resulting potential threats to ecosystems and people, is an increasing problem, with pharmaceutical residues reaching the environment during the production, consumption and disposal of pharmaceuticals. In assessing the environmental status of Estonian maritime area in 2018, based on many indicators regarding hazardous substances, marine environment had bad status, i. e. the good environmental status had not been reached. However, it should be mentioned that the reliability of the assessments is low due to the small number of analyzed samples or the lack of regular monitoring.

The main possible sources of marine litter, especially microplastics getting into the marine environment in the coastal area of Estonia are cosmetics and hygiene products, plastic industries, synthetic textiles, transport, construction, artificial turf fields, fishing, maritime activities and maritime tourism, and industries. But their main distribution routes are via sewage treatment plants (wastewater and sewage sludge), precipitation water and snow removal from settlements, atmospheric deposition, rivers, ports and beaches. In assessing environmental status of the Estonian maritime area in 2018, the composition, amount and spatial distribution of macro-litter (larger than 5 mm) and micro-litter (smaller than 5 mm) were assessed. As for macro-litter, good environmental status has not been achieved regarding litter found on the coastline. The assessment regarding macro-litter on the seabed shows a good status for all natural parts of the sea and for 2/3 of the areas affected by human activities, so the status assessment regarding macro-litter on the seabed is good. In terms of the composition, amount and spatial distribution of macro-litter, the overall status assessment for the Gulf of Finland is bad and for the Gulf of Riga and for the open part of the Baltic Sea poor, which is why a good environmental status has not been achieved as a whole. In 2018, micro-litter was assessed only in the surface layer of the sea, as it was not possible to give an assessment of the bottom sediments due to the lack of data. The assessment showed a good environmental status for all studied parts of the sea, which is why in terms of the composition, quantity and spatial distribution of micro-litter, the good environmental status of the sea was considered achieved. However, based on Laas&Lips (2022), later studies have shown that although mostly the amounts of micro-litter are decreasing, an increase in the amounts of micro-plastics has also been found. For example, compared to the first measurements (2016-2017), larger amounts of microplastics have been found in individual stations of all basins, which, based on the monitoring data of 2018, resulted in the conclusion that in the Northern basin of the open part of the Baltic Sea, good environmental status has not been achieved.

Anthropogenic underwater noise can increase natural noise levels to polluting levels. Anthropogenic continuous noise can come from car traffic on bridges, wind turbines located in water, shipping, etc. Continuous noise can prevent communication between animals and the signals necessary for orientation. Impulse noise can be caused by underwater blasting and similar short-term noise-generating activities. Such noise can scare animals away from places that are important to them (e. g. feeding, nesting and spawning areas). The assessment of the environmental status of the Estonian maritime area in 2018 assessed the spatial extent, duration and level of impulse sound and continuous low-frequency sound. Anthropogenic continuous and impulse sound in the Estonian maritime area has been mapped, but there are no agreed assessment methodologies yet. Based on the insufficiency of existing assessments of how continuous or impulse noise impact marine biota, it is not possible to assess whether a good environmental status has been achieved in terms of impulse sound or not.

Alien species reach the Baltic Sea as a result of human activities, especially in ballast water by fishing and maritime transport. Over time, alien species adapt to new environmental conditions and may begin to spread very widely, becoming invasive and also affecting the food chain. There may also be a risk of affecting biological diversity and ecosystems. It follows from the status assessment (2018) regarding alien species that two new alien species (*Laonome sp* and *Rangia cuneata*) have been registered in the Estonian maritime area during the last years, which were probably brought here by human activities.

Large areas of the Baltic Sea are involved in fishing and it has direct impact on the species caught as well as the species and habitats to be protected. In assessing the environmental status of the Estonian maritime area in 2018, assessments of good environmental status were given based on the catch or mortality/injury of natural species as a result of commercial fishing. Of the fish assessed (Baltic herring, sprat, flounder, perch, pikeperch, salmon), the good status was achieved only regarding fishing mortality of Baltic spring spawning herring in the open sea and the ratio of the biomass of commercial flounder fishing to the biomass of monitoring fishing. As for the rest of the indicators, the good environmental status has not been achieved. There is no assessment of the impact of recreational fishing, but its impact is probably smaller than that of commercial fishing. In assessing environmental status, the mortality rate of seabirds and seals due to accidental bycatch was assessed as well, but the available data is not sufficiently reliable, therefore, data on avifauna cannot be used for a species-specific assessment of the mortality rate due to bycatch. However, there is reason to assume that it is an important pressure factor for several species. According to official statistics, bycatch of seals is minimal. Due to insufficient data, it is not possible to unequivocally decide whether bycatch is a significant pressure factor for seabirds or seals, but it can be assumed that this is the case.

Seabed is an important factor for biological diversity of marine biota and for the resources necessary for life. As a result of human activity, the structure there may be changed, such activities include underwater mining, certain fishing methods, pollution, introduction of alien species, sinking of dangerous objects into the sea etc.

In 2018, the assessment of the environmental status of the Estonian maritime area was based on the spatial distribution and area of direct physical loss and disturbance of the seabed and changes in hydrographic conditions. According to the indicators assessed the good environmental status of the seabed has been achieved.

Väike Väin (Väike Strait) is a shallow sea area between Saaremaa and Muhu islands, and it has also been designated as a Väike Väin limited-conservation area to protect various habitats, plant and bird species. Väike Väin belongs also to the Natura 2000 network (Väike Väin nature area, the Väinameri Sea bird area). Väike Väin is a habitat for many species of fish, seals and birds, with many aquatic birds using the shallow strait, nearby coastal meadows and islets as stopover sites and for searching food during migration. The dam of Väike Väin was completed in 1896. The hydrodynamic regime of the strait was significantly changed by the construction of the dam. With the construction of the dam, the sea area was closed to the currents and exchange of substances passing through the strait, and the waves were reduced, which is why the accumulation of sediments, including the accumulation of organic sediment, has occurred near the dam. Water and sediments near the dam have high concentrations of total nitrogen, probably due to the presence of the dam. The dam is also a migration barrier to fish. The impact of land transport can be seen in the content of hazardous substances in the sediments near the dam, but their concentrations are mostly below the target and limit values.

The main factor affecting Estonia's climate is the geographical position of the country, including its bordering with the Baltic Sea, which warms the coastal region and islands in winter and cools it in spring. According to the future climate scenarios of Estonia prepared by the Estonian Environment Agency (2015), the surface temperature of the Baltic Sea will increase by 2,9°C for the years 2071–2100 compared to the period 1961–1990, while the warming will be most noticeable in the Gulf of Finland. In addition to water level of the world ocean, the water level of the Baltic Sea is affected by rising of the land after the ice age, changes in wind speed and direction, seawater salinity and temperature, with the biggest changes in the water level being in the Gulf of Finland and the Gulf of Riga (6-8 cm). The impact of climate change is already visible in the Baltic Sea: the water temperature is rising, ice conditions are worsening and the annual average amount of precipitation in the northern part of the Baltic Sea is increasing. All these changes affect the sea, its ecosystems and ecosystem services, including human activities (e. g. fishing). Among other things, several species of wintering birds remain more to the north for winter, and the number of fish in the sea that prefer warmer water has also increased.

Socio-economic environment

Maritime transport throughout the European Union has a large proportion and importance for the functioning of the economy: 77% of European international trade and 35% of EU internal trade takes place by sea. The length of the public shipping lanes of the Estonian coastal sea is 527 km, and in addition to them, 165 km of access roads to the coastal sea and inland waters. According to the State Port Register, there are 230 ports in Estonia, most of them are located in the coastal sea, and shallow water, moving sediments and changing weather conditions create their own specific characteristics and technical requirements for each port.

Estonian fishermen catch most of their catches from the Baltic Sea, while coastal fishing takes place in the sea within 12 nautical miles or up to the 20-metre isobath. Economically the most important species of coastal and trawl fishing are sprat, Baltic herring, perch, pikeperch, smelt, flounder, garfish, roach, gibel karp and vimba bream.

In 2020, 48 operating companies were registered as aquaculture producers. Half of them were engaged in fish farming and the other half in crayfish farming. In Estonia, mostly rainbow trout is grown for human consumption. Due to the small size of the Estonian market, there is no commercial fish farming for producing fish roe. But the majority of Estonian fish farming production comes from freshwater farms. In Estonia, the cultivation of mussels and algae has also been assessed as promising.

Sustainable blue economy allows society to benefit from the seas and coastal areas while allowing the marine environment to recover. Therefore, human activities must be managed in such a way as to ensure the health and economic viability of water bodies. In the European Union, contributions are made to the growth of the blue economy through various marine resources, offshore wind farms, activities in the port, maritime transport and maritime tourism. In Estonia, a blue economy and water resources research group has been established at Tallinn University of Technology, the purpose of which is to carry out development activities related to production technologies and valorization of raw materials of coastal areas and aquatic environment.

A large part of the maritime cultural heritage is made up of underwater monuments. According to the National Registry of Cultural Monuments, there are a total of 106 underwater monuments in the Estonian maritime area. Shipwrecks form the largest part of underwater monuments, the majority of which are protected as archaeological monuments. In addition to the wrecks of watercraft, ports and boat harbour sites have been preserved in the sea. In addition to material (including underwater) cultural heritage, an important part is also the spiritual cultural heritage related to the sea, including the traditional coastal lifestyle, etc.

Research and educational institutions have supporting role in maritime affairs, as these institutions provide companies and institutions belonging to the maritime sector with competent personnel and contribute to finding and implementing innovative solutions for the companies. Major university-affiliated marine research institutions are dedicated to research and analysis of the status of the marine environment and teaching maritime education to new generations. Estonia participates in maritime international cooperation. In addition to that, continuing education also plays an important role in Estonian maritime education. Continuous monitoring of the environmental status of the Estonian maritime area and the factors affecting it is conducted within the framework of marine monitoring sub-programme of the national environmental monitoring programme.

8.2 Key findings of the impact assessment and proposals

According to EIA&EMSA § 31[1] the purpose of the strategic environmental impact assessment is to take into account environmental considerations in the preparation and establishment of strategic planning documents, to ensure a high level of environmental protection and to promote sustainable development. Basically, during the SEA, the significant impact, both unfavourable (negative) and favourable (positive), direct and indirect impact likely to accompany the implementation of the strategic planning document was assessed. Cumulability of impacts and cross-border impact were also assessed. Two main methodical approaches have been used in conducting SEA: compliance analysis (relations to other strategic documents, ch 4) and analysis of externalities (sectoral impact assessment, ch 5). The analysis of externalities was conducted across both natural as well as socio-economic environment domains. The descriptors necessary for achieving good environmental status of the maritime area were addressed as domains of impact of the natural environment in SEA. Based on the EU Marine Strategy Framework Directive (2008/56/EC), 11 qualitative descriptors are taken into account when determining good environmental status: biological diversity (D1), alien species (D2), commercial fish and other species (D3), food web (D4), eutrophication (D5), seabed integrity (D6), hydrographic conditions (D7), pollutant content (D8), pollutants in seafood (D9), marine litter (D10) and energy, including underwater noise (D11). The domains of the socio-economic environment were considered to be human health and well-being (including employment and maritime-related business, research and development activities, property), as well as maritime cultural heritage and the traditional coastal lifestyle.

8.2.1. Compliance analysis

During the compliance analysis, the relations of the programme of measures to other strategic documents were analyzed. Compliance analysis represents the assessment of the measures set in the programme of measures, to what extent the programme of measures is in accordance and comply with relevant objectives set in other strategic documents. In the course of the compliance analysis, it was analysed whether the developed goals and measures contribute or do not contribute to the achievement of various international, European Union and Estonian national political environmental goals.

Based on the results of the analysis, the new measures of the programme of measures support fulfilling the goals set in other relevant development documents, and no contradictions were identified.

8.2.2. Brief summary of the impact analysis accompanying the implementation of the programme of measures, and proposals (<u>underlined</u>)

The results of the impact assessment on the natural environment:

Impact on biodiversity, food webs and benthic communities and communities in water column, and commercial fish and other species (descriptors D1, D3, D4 and D6)
The planned measures related to this domain take into account the pressure factors and their potential future prospects. A large part of the measures are the so-called preventive measures which are based on the expected intensification of the use of the sea in the near future (various development projects related to the sea). On the other hand, there are also measures that help to create a balance between the preservation of marine biodiversity and the use of marine resources (fishing). When implementing the measures, their impact will be manifested primarily on a long-term scale, and their implementation is necessary to achieve good environmental status of the sea. Although the planned measures are directly related to specific descriptors of GES, in many cases the measures complement each other and have a favourable impact in other domains as well, i.e. the implementation of the measures will have a favourable cumulative impact. Several studies are planned within the programme of measures, which help to supplement field-specific knowledge and the results of which can be applied in further updates of the programme of measures and preparing new measures.

***Proposals*:**

- As an additional measure, there is the following measure planned within the programme of measures *Implementing technologies to reduce and prevent bycatch in order to* *protect species in the Baltic Sea*. While implementing the measure it must be taken into account that depending on the technique used to reduce bycatch, devices operating in water can increase underwater noise. In addition to that, it is important to avoid situations where using a device aimed at a target species may have an adverse impact on other species in the area. Therefore, it is necessary to test the technique and monitor its possible impact before its wider adoption. In the wider adoption of a device, it must be ensured to the maximum extent that the device or its parts do not break down in sea conditions and thereby increase the amount of marine litter.

- Using AHD (*Acoustic Harrassment Devices*) as seal deterrents helps to reduce bycatch, thereby helping to reduce the death of seals on the one hand, and on the other hand to reduce damage caused by the seals to fishermen. However, their use must be avoided in and near habitats important to seals (e.g. protected and limited conservation areas, permanent habitats).

Impact related to alien species (descriptor D2)

In addition to the existing measures (including the implementation of BWMC, monitoring alien species, raising awareness of alien species), it is necessary to implement activities to reduce the spread of alien species that spread through the overgrowth of ship hulls. These activities are included in the following planned measures – *Updating regulations* and *Participation in international cooperation in the field of marine environmental protection*. The implementation of activities planned to reduce the spread of alien species spreading through the overgrowth of ship hulls will have a favourable impact on the control of the spread of alien species, that impact will be enhanced by the combined impact with other implemented measures. The implementation of common regulations to reduce the overgrowth on ship hulls reduces the risks of using substances dangerous to the marine environment (e.g. the previous „mistake“ with the use of TBT). Also the measure *Preparing and implementing minimum requirements for EIA (environmental impact assessment) and operational monitoring of blue economy development projects* will contribute to controlling the spread of alien species by enabling comprehensive addressing of the impacts of planned activities in the maritime area and subsequent monitoring during operations (monitoring also increases the opportunities to identify possible alien species). Controlling the spread of alien species will indirecty contribute to preserving biodiversity of the region.

In addition to the measures, it is positive that the programme of measures provides for studies that contribute to a more effective assessment of the risk and extent of the spread of possible alien species and, based on this, if necessary, to prompt quick response to take further action.

Impact on marine habitats (seabed integrity and hydrographic conditions) and other physical indicators of the marine environment (underwater noise), including impact on protected natural objects and conservation objectives and integrity of Natura 2000 sites (descriptors D6, D7, D11)

Regarding the descriptors of GES for this domain, good environmental status has either been achieved or has not yet been assessed (e.g. underwater noise). However, due to the intensification of the use of the sea area, an increase in pressure factors can be expected in the coming years. Thus, the measures provided in the programme of measures are primarily preventive, helping to reduce the adverse impacts caused by the increase in pressure factors. Although the proposed measures are directly related to particular desciptors of GES, the marine environment is a complete ecosystem, therefore, to a lesser or greater extent, the other proposed measures also have impact on the areas discussed in this chapter. Several studies are planned within the programme of measures, which help to supplement field-specific knowledge and the results of which can be applied in further updates of the programme of measures and preparing new measures.

The results of Natura 2000 preliminary assessment will be presented below in a separate sub-section.

Proposals:

- Benthic communities and species form part of the marine ecosystem, being also affected by other pressure factors, e. g. eutrophication, fishing, alien species, hazardous substances, etc, so it is appropriate to consider the information pointed out in the other chapters of impact analysis as well. Here can be pointed out that regarding the measure *Developing compensatory measures for disturbing or destroying the integrity of the seabed*, that when implementing the measure and developing the corresponding package of measures, it is important to consider that nutrient-rich sediments are associated with the seabed. By moving sediments during various development activities, nutrients bound in the sediments can be released into the water column, which in turn contributes to eutrophication. The release of nutrients from sediments depends on the nature of the sediments. Some forms of phosphorus are easily released from the sediment and available to plants and phytoplankton. Some of these forms are inert and do not participate in the phosphorus cycle of the water body, but are stored in the sediment. Therefore, when implementing the measure *Developing compensatory measures for disturbing or destroying the integrity of the seabed*, the mobility of nutrients bound to sediments must be taken into account, and this aspect should also be considered when developing compensatory measures. Depending on the location, the sediments may also contain residues of the organotin compound – tributyltin. Moving sediments with high TBT content can lead to secondary pollution.
- In the context of underwater noise, the above proposals regarding *Impact on biodiversity, food webs and benthic communities and communities in water column, and commercial fish and other species (descriptors D1, D3, D4 and D6)* are relevant here as well.

Impact on seawater quality, including eutrophication, impact on the content of pollutants in the aquatic environment and the content of pollutants in seafood, the impact of marine litter (descriptors D5, D8, D9 and D10)

Based on the descriptors of good environmental status of this domain, the good environmental status of the marine area has not been achieved, and an increase in the pressure factors affecting the status is expected. Therefore, it is necessary to significantly reduce the amount of nutrients reaching the sea as a result of economic activities. Otherwise, the goal of achieving good status of the seawater will not be achievable. Corresponding measures are planned in water management plans for the new period and Marine Strategy's programme of measures does not separately address reducing the impacts of diffuse pollution of the aquatic environment. However, the new measures developed in the programme of measures contribute to moving towards good environmental status. Therefore, it can be assumed that the new measures of the Marine Strategy's programme of measures and the measures of the Water Management Plan will have a long-term combined favourable impact on the aquatic environment. Also important and having positive impact are the measures provided in the programme of measures which promote international cooperation and highlight the need for relevant studies to fill the existing knowledge gaps. Despite the above, it must be taken into account that implementing measures and reducing loads have long-term impact (i.e. with a time delay) on achieving good environmental status. Therefore, it is likely that by 2030, good environmental status will not be achieved in terms of all descriptors. However, this does not diminish the need to implement measures to move towards good environmental status.

Proposals:

- In order to slow down eutrophication in the Baltic Sea through developing aquaculture, developing combined aquaculture (fish and mussels or algae) would be the most appropriate way to do that, or developing only shellfish and algae farms if it proves economically viable. Smaller algae and shellfish farms each with and area of some hectares scattered within a larger area are suitable, and marine areas with low water exchange (e. g. enclosed and shallow bays) should be avoided when setting up shellfish farms.
- Increasing the catch of alien species (e.g. gibel karp, round goby) and also collecting coastal debris (e.g. bladderwrack) may contribute to removing nutrients from the marine environment. The possibilities and profitability of the further use of caught alien species or collected algae (e.g. using bladderwrack as fertilizer; using them in the cosmetic or food industry, etc.) must be determined with a relevant study.
- Regarding the measure *Developing compensatory measures for disturbing or destroying the integrity of the seabed planned within the programme of measures*, it is important to point out that when implementing the measure and developing the corresponding package of measures, it is important to consider that sediments containing nutrients are associated with the seabed. By moving sediments during various development activities, nutrients bound in the sediments can be released into the water column, which in turn contributes to eutrophication. The release of nutrients from sediments depends on the nature of the sediments. Some forms of phosphorus are easily released from the sediment and available to plants and phytoplankton. Some of these forms are inert and do not participate in the phosphorus cycle of the water body, but are stored in the sediment. Therefore, when implementing the measure *Developing compensatory measures for disturbing or destroying the integrity of the seabed*, the mobility of nutrients bound to sediments must be taken into account, and this aspect should also be considered when developing compensatory measures.
- As for marine litter, it is important to point out regarding the following measure planned within the programme of measures *Implementing technologies to reduce and prevent bycatch in order to protect species in the Baltic Sea* that while implementing the measure, it is necessary to test the techniques to reduce bycatch and monitor its possible impact before its wider adoption. Before wider adoption of a device, it must be ensured to the maximum extent that the device or its parts do not break down in sea conditions and thereby increase the amount of marine litter.

Impact on the conservation objectives and integrity of Natura 2000 network sites

The assessment of the impacts of the programme of measures on the international Natura 2000 network sites was conducted in accordance with Article 6 (3) and (4) of the Habitats Directive and § 45 of EIA&EMSA.

Based on the assessment of the information with the degree of accuracy of the programme of measures, it can be assumed that implementing the programme of measures would not lead to unfavourable impact on the integrity and conservation objectives of Natura 2000 network site(s). Rather, since the main goal of the programme of measures is to achieve the good status of the marine environment, implementing the measures will have direct or indirect favourable impact on the Natura 2000 network sites. However, when planning the activities necessary to implement the measures, it must be taken into account that implementing any planned activity must not damage the natural values of a Natura 2000 site. The adverse impacts of potential development activities are generally avoidable or they can be mitigated through planning of development activities that take into account the conservation objectives of Natura 2000.

Therefore, within the degree of accuracy of this strategic document it is not reasonable to proceed with the stages of appropriate Natura 2000 assessment and start making more detailed assessments.

When implementing the programme of measures, if implementation mechanisms and the spatial scope and time of particular activities are already known to a certain extent, an (strategic) environmental impact assessment must be conducted (including Natura 2000 assessment), if necessary. When already planning the activities, potential adverse impacts on the environment are to be considered and their occurrence to be minimized, and the impact of each accompanying activity on affected species/habitat types of Habitats Directive and Bird Directive is to be assessed. The assessment is also necessary if implementing the measures requires applying for some kind of activity licences.

Results of the impact assessment on the socio-economic environment:

Impact on human health, well-being (primarily on employment and maritime-related business, and on research and development activities) and on property
Human well-being and health and social needs are affected by a number of factors, from environmental pollution and noise to the general cleanliness of the marine environment and ensuring recreation opportunities. But also opportunities to engage in business and earn a decent income.

Although the measures of the programme of measures are aimed at achieving good status of the marine environment, but in the long term both local people living by the sea as well as those involved in maritime business will benefit from the improvement of the status of the sea. Thus, there will be long-term favourable impact on human well-being (also in a broader sense, e. g. on business) and on health. In the short term, the implementation of some measures will be accompanied by an unfavourable impact through imposing restrictions (e.g. reducing fishing efforts). On the other hand, planning and implementing new blue economy development projects helps to mitigate the impact.

Proposal:

- The measure planned within the programme of measures *Improving the effectiveness of the existing network of marine protected areas* is important for preserving biodiversity. On the other hand, while implementing this measure it is important to take into account the enabling of other uses of the maritime are as well, and probably it is possible to find opportunities for the co-use of the maritime area in such a way that the coherence of the network of marine protected areas and the ways of sea use related to humans will be preserved.

Impact on maritime cultural heritage and traditional coastal lifestyle
Cultural heritage related to the sea can be broadly divided into two: material and spiritual. Material maritime cultural heritage consists of various things ranging from netting needles to watercraft of all sizes, as well as buildings and structures related to the sea, such as lighthouses, sea forts and historic harbours. The Baltic Sea is also extremely rich in underwater cultural heritage and reportedly hides up to 10,000 shipwrecks and an even larger number of other

historical artifacts. The spiritual heritage of maritime culture comes from people who value the coastal area as their living environment and for whom the sea is connected with their work, food and recreation at the same time. The coastal living environment is characterized by a beautiful natural environment, traditional coastal villages with an interesting history and cultural heritage (including historic harbours, boat harbours, boathouses, etc.) and experienced fishermen who are the bearers of coastal fishing traditions. Important changes have taken place in the way of life in coastal villages during the last century precisely for historical reasons. For most of the coastal fishermen, fishing has become an additional source of income in addition to other work due to the short fishing season.

Implementing the measures of the programme of measures can be expected to have a favourable long-term impact on preserving maritime cultural heritage. The implementation of the measures will have a favourable combined impact with the implementation of other strategic development documents (e. g. county plans; Estonian Maritime Spatial Plan). In addition to that, the planned studies help to obtain new and up-to-date information about the existence and condition (including risks) of objects related to the seabed (including wrecks).

Proposal:

- In implementing the following measure of Marine Strategy's programme of measures – *Developing compensatory measures for disturbing or destroying the integrity of the seabed* – a package of measures will be developed and established to compensate for the disturbance of the seabed and the destruction of the habitat during various developments and other activities. One of the purposes of the package of measures is to ensure the least possible disturbance of the seabed and restoration of the previous situation after use. In addition to nature conservation values, the seabed is also directly related to cultural heritage, including wrecks, which can be habitats as well. Therefore, when implementing the measure, it is important to take into account the existence and preservation of underwater cultural heritage (currently known wrecks are recorded in the wreck register).

Impact on adapting to climate change

Climate Change Adaptation Development Plan until 2030 states that *To reduce the dependency of marine environment on weather conditions and to minimise the increase of the environmental impact due to climate change, the good status of the marine environment needs to be achieved first. In relation to the environmental changes caused by climate change and to the mitigation thereof, both regulative measures as well as plans and additional studies need to be prepared in order to achieve the good status of the marine environment*. The goal of Marine Strategy's programme of measures is to achieve the good status of the marine environment. Therefore, all its measures contribute more or less, directly or indirectly to adapting to climate change.

Climate change occurs on a long-term scale. The same is true for the implementation of the planned measures, i. e. their impact will be manifested on a long-term scale. It is important that while developing the measures of the programme of measures, potential occurrence of climate change is taken into account, and the measures can be adapted if necessary based on the results of the planned studies and monitoring.

Cumulative impacts

The purpose of establishing measures in the programme of measures is to achieve the good status of the marine environment. Therefore, on a general level, the implementation of the measures will have a favourable cumulative impact on the natural environment. However, the impact of the implementation of the measures is manifested primarily on a long-term scale.

The implementation of the measures is expected to have favourable cumulative impact mainly on preserving the viability of the fish populations, preserving the seabed as a habitat and the species related to it, and regarding the reduction of marine litter and the increase in the level of maintenance. In addition to that, these measures enable identifying underwater cultural heritage and taking into account already known underwater cultural heritage and, if necessary, to establish requirements for the preservation of cultural heritage.

Since a large part of the nutrient load comes from land, it is important to implement the measures specified in the Water Management Plan, which in turn, together with the measures of the programme of measures, will have a favourable cumulative impact on the status of the marine environment.

Cross-border impact

On the basis of the circumstances known during the preparation of the SEA programme, it was assumed that the implementation of the new measures of the Estonian Maritime Strategy's programme of measures 2022-2027 may have a cross-border impact, therefore, in cooperation with the Ministry of the Environment, opinions on the SEA programme were asked from neighboring countries with common maritime border – Latvia, Sweden, Finland and Russia. The rest of the countries of the Baltic Sea region were also informed about initiating the preparation of the Estonian Marine Strategy's programme of measures and the strategic environmental impact assessment.

The measures of Marine Strategy's programme of measures are aimed at achieving the good status of the marine environment. Although the measures are aimed at improving the status of Estonian maritime area, due to the marine ecosystem as a whole, favourable impacts will also occur beyond the Estonian maritime area. For example, improving the condition of fish spawning areas and migration routes will contribute to the favourable status of respective species as a whole. Also, reducing the load of nutrients and litter coming from Estonian mainland will have a favourable impact on the Baltic Sea as a whole. In order to achieve the good status of the Baltic Sea as a whole, international cooperation is important, the promotion of which is also one of the measures planned within the programme of measures.

Therefore, no significant adverse impact on the environment outside Estonia is expected to occur when implementing the new measures proposed in the programme of measures, and no significant impact on the environment of another country is expected to occur within the meaning of EIA&EMSA § 46 (Strategic environmental assessment in transboundary context) and Article 7 (transboundary consultations) of Directive 2001/42/EC of the European Parliament and of the Council.

Description of monitoring and ex-post assessment

Environmental monitoring is the continuous monitoring of the status of the environment and the factors affecting it, which includes environmental observations and analyses, and the processing of observational data. In the case of strategic documents of higher level, it is also potentially possible to monitor the achievement of the set objectives. Given the nature of the SEA object, two types of monitoring can be addressed in this case: environmental monitoring and monitoring the effectiveness of development documents. The purpose of the monitoring measures is to identify at an early stage whether significant environmental impact arises from the implementation of the strategic planning document and to take measures that prevent and mitigate adverse environmental impact (EIA&EMSA § 42 (10)).

The programme of measures does not plan measures the implementation of which is expected to have a significant unfavourable impact. Therefore, the SEA expert group does not provide for additional monitoring measures to assess and minimize the negative environmental impact.

The implementation of the Marine Strategy takes place in six-year cycles, where one cycle consists of three main stages: 1. stage – assessing the status of the maritime area and setting targets, 2. stage – development and implementation of marine monitoring programme and 3. stage – preparation and implementation of marine programme of measures. Each of the aforementioned stages of the Marine Strategy is updated every six years. Therefore, the effectiveness of the programme of measures is monitored through the implementation of the monitoring programme and the next assessment of the status of the marine environment.

The purpose of the marine monitoring programme is to collect data for the periodic assessment of the environmental status of the Estonian maritime area and to monitor the achievement or non-achievement of environmental targets and to assess the effectiveness of the Marine strateg's programme of measures. Marine Strategy's marine monitoring and data collection programme 2021-2026 is therefore sufficient to monitor the Marine Strategy.

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