Ecologically or Biologically Significant Areas (EBSAs)

PUBLISHED: 18 JAN 2019

Southeastern Baltic Sea Shallows

General Information

Summary

The Southeastern Baltic Sea shallows encompasses several geomorphologically distinct areas, including the Klaipeda-Ventspils plateau in the north, the Curonian-Sambian plateau in the south, the Klaipeda bank in the northwestern part of the area as well as the largest lagoons in the eastern Baltic Sea, Curonian and Vistula, each separated by a narrow spit. Driven by complex geomorphological structures, the area is a hotspot of biodiversity both in coastal and offshore waters. The shallow water area is one of the most important habitats for benthic communities. Its underwater reefs sustain coastal benthic communities, a high biodiversity of invertebrates, fishes and wintering birds. Reefs are also used as spawning and nursery grounds by commercially important fish species, such as sprat, herring, turbot and flounder. The offshore bank serves as a refuge for mobile species from short-term hypoxia in the deeper parts of the Gotland basin. The coastline is an important stopover site for waterbirds. During particularly severe winters, the abundance of some species of wintering seabirds (e.g., long-tailed duck Clangula hyemalis, velvet scoter Melanitta fusca and red-throated diver Gavia stellata) may increase by several or several tens of times. Lagoons exist as large and multiple freshwater ichthyofauna complexes and permanent or temporary habitats for migratory and marine fish species. The Curonian Lagoon is an important regional spawning and recovery area for twaite shad (Allosa fallax).

Introduction of the area

The Southeastern Baltic Sea shallows are formed by the unique combination of specific topography in underwater plateaus (Curonian-Sambian, Klaipeda-Ventspils) and the Klaipeda bank, the sheltered brackish environments of two large coastal lagoons (Curonian Lagoon and Vistula Lagoon), specific hydrological conditions (riverine plumes, thermoclines, high exposure of the open coast) and a wide variety of benthic substrates. The combination of these features has enabled the formation of unique conditions for local species and species assemblages of the brackish northern Europe ecosystems.

The area comprises the mesohaline (7-8 PSU) waters of the Baltic proper and oligohaline-to-freshwater (0-3 PSU) of the lagoons. Both lagoons are freshwater-dominated transitory basins where episodic inflows of seawater cause irregular rapid increase in salinity. In the coastal waters, major hydrological features are determined by the interaction between the south-eastern Baltic offshore waters and the runoff of the mostly freshwater lagoons (Olenin et al. 2004; Dailidienė et al., 2011). The mixed waters

of lower salinity (<5 PSU) dominate closer to the lagoons and may stretch several tens of kilometres from the outflow of the lagoons (Daunys et al. 2007). These hydrographical features generate environmental gradients, which affect the distribution of organisms (Marine Research Consortium, 2012).

The area varies in water depth from 0 to 70 m and represents a diversity of geomorphic features – lagoon plain, shallow water area, slopes of plateaus and a bank (Ezhova et al., 2012). A great variety of benthic habitats exist in the area as a result of the relationship between bottom types, depth and macrofauna communities. The hard substrate type occurs mostly in the shallow water area and in the area of gentle slopes. The deeper water area, lagoon plains, part of the slope and shallow water area are represented by soft bottom habitat. Reefs (habitat type 1170, according to Annex 1 of the EU Habitat Directive) are the most attractive and ecologically significant habitat types on hard bottoms in the area, sustaining high biodiversity, important feeding areas for diving birds, spawning or nursery sites for commercially important fishes or refuge areas for marine species (Marine Research Consortium, 2012). The most biologically valuable reefs in the shallow water area of the Klaipeda-Ventspils Plateau are dominated by perennial red algae Furcellaria lumbricalis (Olenin, 1997).

Benthic faunal assemblages in offshore waters on hard substrate vary in terms of species diversity and abundance but are dominated by sessile suspension feeders (blue mussels, barnacles, hydroids, bryozon), whereas soft bottom assemblages are dominated by selective and nonselective deposit feeders (bivalves, polychaetes). A habitat inventory showed that reefs with the above mentioned blue mussels (Mytilus trosulus) and barnacles (Balanus improvises) are found in offshore waters in both Klaipeda-Ventspils and Curonian-Sambian plateaus (Daunys et al., 2015).

The most distant part of the area to the north-west, Klaipeda Bank, located close to the steep Gotland Deep, is a less geomorphologically distinct basin, but it is particularly important for benthic fish, especially in summer when oxygen concentration is decreasing in the deeper areas and pelagic fishes find suitable conditions on the slopes of the bank. The major part of the bank is situated at a depth of 50-60 m, while about one fifth is exposed to the saline water layer (halocline) which typically supports different marine life (including glacial relicts) compared to more shallow saline waters (Daunys and Čebatariūnaitė, 2015).

Both lagoons are listed as priority habitat types (1150) in the Habitats Directive (EC 1992). Lagoons are important migration corridors for anadromic species, such as salmonids (Salmo salar and Salmo trutta), smelts (Osmerus eperlanus), vimba (Vimba vimba), European eel (Anguilla Anguilla), river lampreys (Lampetra fluviatilis) and spawning ground for twait shad (Alosa fallax) and whitefish (Coregonus lavaretus) (Repecka, 2002). The Curonian Lagoon is designated as a Natura 2000 area for the following EU declining fish species: salmon (Salmo salar), twaite shad (Allosa fallax), asp (Aspius aspius), sabrefish (Pelecus cultratus), spined loach (Cobitis taenia) and lamprey (Lampetra fluviatilis) (Order of Minister of Environment of Republic of Lithuania, No. D1-260, 2009).

Lagoons are also important for migrating birds – part of the Curonian Lagoon is a NATURA 2000 Special Protection Area (SPA) for birds – Bewick's Swan (Cygnus bewickii), pintail (Anas acuta), goosander (Mergus merganser), smew (Mergus albellus), little gull (Larus minutus), white-tailed eagle (Haliaeetus albicilla) (Order of Minister of Environment of Republic of Lithuania, No. D1-260, 2009).

Description of the location

EBSA Region

Baltic Sea

Description of location

The Southeastern Baltic Sea shallows encompasses several geomorphologically distinct areas, including the Klaipeda-Ventspils plateau in the north, the Curonian-Sambian plateau in the south, the Klaipeda bank in the northwestern part of the area as well as the largest lagoons in the eastern Baltic Sea, Curonian and Vistula, each separated by a narrow spit. The area extends 11,626 km2.

Geo-Location

- BALT_6_EBSA.geojson

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Area Details

Feature description of the area

Physical description

The sub-marine coastal slope, extending from the shore down to 25-30 m depth, is characterised by diverse bottom types. The uppermost part, 0 to 4 or 6 m deep, is covered by a thin layer of quartz sand, which moves around during storms. The morainic bench (pebble-gravel deposits with large boulders) lies beneath the sand strip, extending down to 25-30 m depth. Patches of pebble and gravel deposits occur on sites down to 60 m. Also, patches of coarse aleurites are found at 20-40 m, extending down to 60-70 m depth (Olenin S., 1997).

The Klaipeda-Ventspils Plateau is a large portion of the seabed with its slopes sinking into Gotland Deep and Gdansk Deep. Part of the seabed is covered with contemporary and relict bottom sediment. Relict bottom sediment is deposits and sediment that formed during the glacial age and earlier stages in the development of the Baltic Sea. They are deposited in hydrodynamically active areas of the sea where accumulation of contemporary bottom sediment does not take place, or where there is even some evidence of abrasion processes. The glacial deposits (moraines) of many similar areas have been extensively washed out, and their surface is covered by boulders, pebbles, gravel and sand of varying grade. Moraine bottoms, including boulder and cobble reefs, extend over larger territories (including slopes) (Marine Research Consortium, 2012).

The seabed of the Sambian-Curonian Plateau, which occupies the southern part of the area, is characterized by bars and furrows. Medium and fine sands prevail in the south of the Plateau and form extended fields joined to the Curonian and Vistula spits. Predominance of various sands is observed at the intermediate depth zone (50-60 m), while mud, silt and clay are typical for the deeper parts. Sand of different grain size, pebble, gravel and tillstones are in the north and northwest of Plateau, while bedrock and tillstones as well are present adjacent to the Sambian Peninsula (Ezhova et al., 2012).

On the Klaipeda bank, the shallow zone (<50 m depth) gradually deepens towards the Gotland depression, up to 75 m water depth, and south-east towards the Gdansk depression, up to 64 m water depth. The most extensive gravel and pebble fields are mainly situated in the shallow zonen with water depth range from 46 to 54 m. Patches of silty clay mostly appear at 52-60 m water depth, and sandy sediments are observed in the area as well (Daunys et al., 2015).

Both lagoons are very shallow and floored with soft sediments. Silty-clayey mud prevails in the central part of the basins, and sand accurs along the lagoon coasts (Ezhova et al., 2012). The average depth of the lagoon is 3.8 m, and the greatest depths (up to 5.8 m) are found in the southern part of the lagoon. Water depths up to 14.5 m are located in the Klaipeda channel, which forms the entrance to the lagoon. The Vistula Lagoon has an average depth of 2.7 m and is characterized by relatively large areas of shallow water, although the maximum depth of 5.2 m is comparable to that of the Curonian Lagoon. The lagoons are a terrestrial runoff-dominated system, and their hydrology is strictly related to the discharge from the catchment area. The biggest river in the Vistula Lagoon catchment is Pregolja River, which accounts for 42 % of total discharge. In the Curonian Lagoon the Neman River contributes 92 % of the total freshwater yield (Chubarenko et al., 2002). The ice-cover in the Curonian Lagoon forms annually during winter and lasts about 90 days, from December until early March (Lange, 2011).

Biological features

More than 50 species of macrofauna are found in the benthic zone of the open eastern Baltic Sea. Coastal waters, up to a depth of 30 m, have a higher diversity of species than waters deeper than 50 m (Marine Research Consortium, 2012).

The diversity of macrophytobenthos consists of 35 taxa belonging to five phyla: red algae Rhodophyta, brown algae Ochrophyta, green algae Chlorophyta, charophyceae Charophyta and angiosperms Magnoliophyta. Green algae are growing in shallow waters up to 6-7 depth, red algae are adapted to grow at greater depths (e.g., perennial red algae Furcellaria lumbricalis up to 15-17 m depth) and brown algae prefers shallow water but can reach 10 m depths (Marine Research Consortium, 2012).

Hard bottom reefs with perennial red algae (Furcellaria lumbricalis) streches along the exposed coastlines of the Klaipeda-Ventspils Plateau. The habitat comprises fields of stones and boulders colonized by blue mussel (Mytilus trosulus) and red algae (Furcellaria lumbricalis). Approximately 30 macroinvertebrate species are recorded in the habitats, with an average of 14±4 species per sample. The habitat is characterised by relatively high benthic primary production and supports high macro-invertebrate species diversity. Typically, the habitat is found in depths between 6 and 12 metres. Locally, however, the habitat may also occur in depths down to 2 m (sheltered conditions) and as deep as 15 m deep (Martin G., 2010).

Another sub-type of reefs, stones and boulders adjacent to coarse sand fields dominated by Mytilus trossulus and Balanus improvises, is found in shallow areas and may occur up to 25 m or up to 40-50 m depth.

The above-mentioned reef habitat is preferred by mobile grazing crustacean species, including isopods, amphipods and mysids. It also provides shelter for small fishes and fish fry, serves as spawning substrate for Baltic herring (Clupea harengus membras), especially reefs with Furcellaria lumbricalis. The habitat provides a food source for important bird species, such as. long-tailed duck (Clangula hyemalis) and Steller's eider (Polysticta stelleri). Since mussels remove large amounts of organic particles from the water column, in terms of functional type this habitat is usually defined as a biological filter (Martin, 2010).

Also exposed moraine ridges overgrown with mussels (Mytilus trossulus) and barnacles (Balanus improvises) are found in the lowest depth range of the photic zone. The habitat comprises steep and narrow 4-5 m-high elongated ridges, which may occur individually or in groups at depths of 19-20 m. Moraine ridges are surrounded either by hard or soft bottoms. The size of an individual ridge may vary considerably: up to 10 m in width and 110 m in length, with the total area from 15 to 3825 m2. Deep canyons are formed in cases of two parallel ridges. The habitat supports typical hard bottom functions: it provides a complex environment for benthic species and is colonised by active suspension feeders. The importance of the habitat for fishes and birds is unknown (Martin, 2010).

In the offshore part, mixed or hard bottom habitats of cobble, pebble, gravel and boulders covered by epifaunal Mytilus trossulus and Balanus improvisus dominate in the uppermost parts of plateau and bank, while silty to fine-sand bottoms with different assemblages of macroinvertebrates (including glacial species Saduria entomon, Diastylis rathkey, Monoporeia affinis and Pontoporeia femorata) are typical for the slopes (Daunys et al., 2015).

Reefs in the open sea are highly valuable for the nutrition of demersal fish, primarily European flounder and cod, as well as wintering birds, such as long-tailed ducks (Daunys, Čebatariūnaitė et al., 2015).

Soft-bottom habitats dominated by bivalves (Macoma balthica) or polychaetes (Pygospio elegans and

Marenzelleria neglecta), or mobile amphipods are widespread in the central part of the Baltic Sea. Exposed soft bottoms with the polychaetes Pygospio elegans and Marenzelleria neglecta are typical for the shallow part of the area in depths down to 10-11 m. Soft bottoms with Macoma balthica are the most widespread in a wide depth range up to 60-70 m. At depths of 25-30 m, typical shallow taxa are oligochaetes, cockles (Cerastoderma edule, Mya arenaria), whereas ostracods and the crustaceans (Pontoporeia affinis and Diastylis rathkei) are usually restricted to deeper zones. The amphipod crustacean Bathyporeia pilosa is typically found in the shallowest part down to a depth of 3-5 m. Sandy-bottom habitats provide important food source for demersal fishes (turbot, flounder) and some migratory bird species (e.g., velvet scoter).

There are 65 species of lampreys and other fish recorded in the southeastern Baltic Sea; 21 of them are freshwater species, and 11 are diadromous fish species. Around 19 species of lampreys and other fish are protected under the Habitats Directive, the Bern or CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) Conventions, five are included on the IUCN Red List of Threatened Species, and 18 are considered to be very rare (Marine Research Consortium, 2012).

The dominant species are the Atlantic herring (Clupea harengus membras), the European sprat (Sprattus sprattus), European flounder (Platichthys flesus) and Atlantic cod (Gadus morhua). Migratory species, such as salmonids (Salmo trutta), vimba (Vimba vimba), smelts (Osmerus eperlanus), pike-perch (Stizostedion lucioperca) and the relatively rare Bern Convention species twait shad (Alosa fallax) are also rather common in certain seasons. Freshwater fish are more abundant closer to the outflow of rivers or lagoons (Martin, 2010).

There are more than 30 species of seabirds found regularly in the area. The majority of seabirds are found here during the migration period, in particular a wintering period. Long-tailed duck (Clangula hyemalis), velvet scoter (Melanitta fusca) and red-throated diver (Gavia stellate) are the most abundant wintering sea ducks in the waters of the Baltic Sea. Great cormorant (Phalacrocorax carbo) is the main abundant breeding species in the rea – a colony in Curonian Lagoon numbers over 3 000 breeding pairs (Marine Research Consortium, 2012).

Grey seals (Halichoerus grypus) and ringed seals (Pusa hispida) are found in marine waters, as well. The seals do not permanently live here, but swim here with the migratory fish with increasing frequency (Grusas et al, 2008). There have also been observations of harbour porpoises (Phocoena phocoena) along the coast . The southeastern Baltic Sea area is the northern boundary for the Baltic Sea harbour porpoise population listed as critically endangered by the IUCN (Hammond et al., 2008) and by HELCOM (HELCOM, 2013a); during winter porpoises are more dispersed, spreading even to the far north, as well as along the southeastern Baltic coasts (SAMBAH, 2016).

A lagoon plain is characterized by soft sediments (sand, silt, mud) and inhabited by uniform soft-bottom communities. The Chironomidae and Oligochaeta communities occupy 70% of bottoms in the Curonian Lagoon, and the polychaete worm Marenzelleria neglecta occupies 90% of bottoms in the Vistula Lagoon. Communities dominated by invasive alien species occupy sparse hard substrata in both lagoons. The Ponto-Caspian bivalve Dreissena polymorpha occurs in the Curonian Lagoon, and the New Zealand snail Potamopyrgus antipodarum occurs in the Vistula Lagoon. Lagoon plain habitats demonstrate high levels of benthic productivity, and total biomass averages 20–90 g/m2 but reaches hundreds of grams per square metre locally (Ezhova et al., 2012).

Among the 57 fish species recorded in the Curonian Lagoon, 11 are of marine origin. The most common are roach (Rutilus rutilus), perch (Perca fluviatilis), redeye (Scardinius erythrophalmus), white

bream (Blicca bjoerkna) and common bream (Abramis brama). Lagoons are very important as feeding places for many freshwater or diadromous fishes, but also as spawning and juvenile-schooling habitat. The juvenile fish assemblage is dominated by smelt and pikeperch (Sander lucioperca) in the lagoon habitats, while roach, perch, three-spined stickle-back (Gasterosteus aculeatus) and gudgeon (Gobio gobio) prevail in the littoral.

Feature conditions and future outlook of the area

The lagoons are affected by eutrophication, therefore short-term hypoxic events occur during summers under particular environmental conditions. The lagoons are also intensively used for fishing, shipping and recreation. Communities dominated by invasive alien species occupy sparse hard substrata in both lagoons. On the other hand, coastal areas have high biodiversity with respect to macroinvertabrates, birds and fishes. Despite intensive industrial activities and some observed impacts, the area remains ecologically and biologically valuable and has a relatively high level of naturalness (Ezhova et al., 2012; Stankevicius et al., 2002).

The area includes a number of protected sites, some with international designations (e.g., “Wetland of International Importance” (Ramsar Sites), Sites of Community Importance under the EU Habitats Directive, Special Protection Areas under the EU Birds Directive), regional designations (marine Baltic Sea protected areas under HELCOM (HELCOM MPAs), and a range of national designations (e.g., Nature Park, Monument and Reserve, Protected Marine Area, State Park) (https://www.protectedplanet.net/). Some of these sites include both terrestrial and marine parts, while others are truly marine. National sites in this area range from IUCN protected area categories II (“National Park”) to VI (“Protected Area with sustainable use of natural resources”) (Dudley, 2008). The site regulations also protect migratory waterbirds (Melanitta fusca, Bucephala clangula, Clangula hyemalis, Cygnus columbianus, Anas acuta, Mergus merganser, Mergus albellus, Larus minutus, Alca torda, Polysticta stelleri)) (Orders of Minister of Environment of Republic of Lithuania, No. D1-260, 2009 and No. D1-333, 2015).

There are 11 HELCOM MPAs in the area: one in the Russian Federation (Curonian Spit State National Park – southern part), eight in Lithuania (Curonian Spit State National Park – northern part, Nemunas Delta Regional Park, Kursiu Marios Biosphere Polygon, Baltic Sea Biosphere Polygon, Sambijos plynaukštė, Pajuris Regional Park, The state Baltic Sea marine reserve, Klaipėdos–Ventspilio plynaukštė), and one in Latvia - Nida-Perkone (HELCOM Map and Data Service).

The entire Baltic coasts of Latvia, Lithuania and the Russian Federation, including the important Curonian Lagoon, are home to important socio-ecological systems and indigenous peoples and local communities since time immemorial. For example, the coastal Livonians, a Finno-Ugric minority living today close to Kolka, Latvia, have referred to themselves as “People of the Sea Coast” or people of the “white sand” (Vaalgamaa 2001), stressing their close connection to the sea (Mustonen 2015).

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- Additional figures_Southeastern Baltic Sea Shallows.pdf *(/api/v2013/documents/443C0B59-5D22-6AED-FA1C-CE1C5CCA7219/attachments/Additional%20figures_Southeastern%20Baltic%20Sea%20Shallows.pdf)*
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Status of submission

Areas described as meeting EBSA criteria that were considered by the Conference of the Parties

COP Decision

- 14/9

Assessment of the area against CBD EBSA criteria

C1: Uniqueness or rarity **High**

Justification

The area is formed by the unique combination of underwater plateaus (Curonian-Sambian, Klaipeda-Ventspils), the Klaipeda bank as well as coastal and nearshore landscapes with large coastal lagoons separated from the open sea by the narrow Curonian and Vistula spits.
Sites with unique underwater moraine ridges, up to 5 m in height, formed by glacial processes (currently at 15-20 m depth) are among few known worldwide. Such steep seabed elevations surrounded by deeper waters is a unique sub-type of reefs overgrown with mussels (Mytilus trosulus) and barnacles (Balanus improvises) (Daunys et al., 2015).

All lagoons in the Baltic Sea are known to have significantly high biodiversity, but the Curonian Lagoon is exceptional in the whole region as the last spawning ground for twait shad (Alosa fallax), the only herring that migrate to rivers or freshwater lagoons to spawn. It is the only successfully spawning population of twait shad in the Baltic Sea basin. Twait shad disappeared from the catch in the 1950s, but the population has been recovering since the 1990s (Ložys, 2016). Due to its decrease in number and distribution, twait shad has been included in a number of European national Red Lists (Magath and Thiel, 2013). It has been included in the Red Data Book of Lithuania since 1992, in Appendix III of the Bern Convention and Annexes II and V of the EC Habitats Directive.

C2: Special importance for life-history stages of species **High**

Justification

Stony coastal bottom reefs with perennial red algae Furcellaria lumbricalis along the coast of the Klaipeda-Ventspils Plateau are valuable natural spawning grounds for Baltic herring (Clupea harengus membras)and sprat (Spratus spratus) (Olenin and Labanauskas 1994). The area's coastal zone is also an important spawning ground for flatfishes, especially European flounder (Platichthys flesus) and turbot (Scophthalmus maximus) (Orio et al., 2017).
The Curonian-Sambian and Klaipeda-Ventspils Plateau are important nursery areas for juveniles of European sprat, European flounder and cod. Offshore reefs are valuable for the nutrition of seabed fish (Daunys et al., 2015).
Reefs up to 35-40 m depth are important as feeding areas for wintering birds, e.g., long-tailed duck (Clangula hyemalis), while the sandy slopes are important for velvet scoter (Melanitta fusca) (Daunys et al., 2015).
Klaipeda Bank may serve as an important refuge area for mobile organisms from neighbouring Gotland Deep slopes during hypoxic or anoxic periods (Daunys et al., 2015).
The Curonian Lagoon is the spawning ground for whitefish (Coregonus lavaretus), sabrefish (Pelecus cultratus), asp (Aspius aspius) and the only spawning ground for twait shad (Alosa fallax) in the Baltic region. Other existing spawning grounds of twaite shad in the Baltic Sea are not significant and cannot significantly support the Baltic sea population (Repečka, 2007).
In some winters, the area supports more than 10% of the western Palearctic population of velvet scoter (Melanitta fusca), with densities of up to 1000 birds/km2. Some parts of the area include important wintering sites for other seaduck and seabirds, including more than 10 000 long-tailed duck (Clangula hyemalis) (Daunys et al., 2015).
Lagoons are biodiversity hotspots as well as important transitional zones for anadromic fish and migratory birds.

C3: Importance for threatened, endangered or declining species and/or habitats **Medium**

Justification

- All Baltic lagoons have been assessed as endangered biotopes in the HELCOM Red List (HELCOM, 2013).
- The area is important for wintering of the following threatened species:
- Red-throated diver (Gavia stellate), which is listed on Annex II of the Convention on Migratory Species, and under the African Eurasian Waterbird Agreement. It is listed on Annex II of the Bern Convention, Annex I of the EU Birds Directive and listed as critically endangered under the HELCOM Convention.
- Velvet scoter (Melanitta fusca) (IUCN Red list, VU A2abcde).
- Long-tailed duck (Clangula hyemalis) (IUCN Red list, VU A2abcde+3bcde+4abcde) (HELCOM, 2013).
- The area supports protected wintering and migrating bird species: goosander (Mergus merganser), crested grebe (Podiceps cristatus), golden eye (Bucephala clangula) and tufted duck (Aythia fuligula) (BirdLife International).
- Two large bird migration routes belonging to the East Atlantic Flyway cross in the area – north-south branch and east-west, or White Sea-Baltic Sea route. The Baltic seabird community is highly seasonally variable. Many species, such as velvet scoter, long-tailed duck and goosander, use the area as a wintering ground (HELCOM, 2017).
- Salmon (Salmo salar), vimba (Vimba vimba), sea trout (Salmo truta), asp (Aspius aspius) and sabrefish (Pelecus cultratus) are protected and conserved under the Bern Convention and the Habitat Directive (Repečka R., 2012).

C4: Vulnerability, fragility, sensitivity, or slow recovery **Medium**

Justification

The area’s salinity gradient, from pure freshwater in lagoons to saline water in deeper areas, leads to an extraordinary mixture of marine and freshwater species that have adapted to these special conditions. But the same conditions also make the species and habitats extremely vulnerable to changes in ecological conditions. Salinity of 7-8 PSU in the area is critical for many marine species from the southern Baltic regions, while oligohaline waters of lagoons create a salinity border for brackish and freshwater species (Daunys, 2001; Gasiūnaitė, 2000). Significant changes have been observed in the past decades in the distribution of many macroalgae species along the depth gradient including southern Baltic Sea area. The maximum depth of distribution of Furcellaria lumbricalis (19 m) was recorded in 1955 (Kireeva, 1960). From 2003 to 2008, this depth ranged from 6 to 10 m in the southern part of the continental coastal waters and from 10 to 16 m in the northern part of the continental coastal waters (Bučas, 2009). Velvet is scoter is classified as vulnerable in the IUCN Red List of threatened species.

C5: Biological productivity **Medium**

Justification

The lagoon’s waters are three to five times richer in nutrients than the marine waters of the area, which contributes to the area’s productivity (Jašinskaitė, 2008).
A general feature of the Curonian Lagoon food web is the very high phytoplankton biomass (Gasiūnaitė et al., 2008).
The Curonian Lagoon is characterized as a eutrophic water body with high fish productivity. The average fish biomass in the Lithuanian part of the lagoon exceeded 200 kg/ha between 1997 and 2012. The Curonian Lagoon is an important water body for both commercial and recreational fishing (Ložys, 2016).
The biological production of the Vistula Lagoon is below the potentially possible level as the hydrodynamic activity (high-flow velocity) and brackish water prevent the intensive development of cyanobacteria (Aleksandrov, 2010).
The highest level of species diversity and productivity occurs in hard-bottom habitats. Density and biomass of macrozoobenthos are highly variable, but can reach respectively 134 175 ind./m2 and 9000 g/m2 in exposed hard bottom with Mytilus trosulus and Balanus improvisus and up to 933 000 ind./m2 and 24875 g/m2 in exposed hard bottom with Balanus improvisus. Other parts of the shallow water area contain soft bottom inhabited by bivalves Macoma balthica, polychaetes and mobile amphipods. Density and biomass reach, respectively 11 340 ind./m2 and 100 g/m2 in exposed soft bottom with polychaetes Pygospio elegans and Marenzellaria neglecta, or 6 000 ind./m2 and 200 g/m2 in exposed soft bottoms with Macoma balthica (Martin et al., 2010).

C6: Biological diversity **High**

Justification

In the Baltic Sea the reefs are spots of biological diversity, which are important for the survival of many species. Since reefs are distinct from many other seabed areas, they ensure particularly close links between different elements of marine ecosystems.
Variety in benthic habitats is characteristic of the area as various biotopes are distinguished in the Plateaus. At the Baltic Sea coastal zone the most valuable habitats are stony bottom reefs with perennial red algae (Furcellaria lumbricalis) which dominates along the exposed coast of the Klaipeda-Ventspils Plateau. Densely vegetated areas of the red alga are valuable marine biodiversity spots surrounded by vast sandy bottoms (Olenin and Daunys, 2004; Bucas et al., 2007).
In the offshore area stony bottom reefs are covered by keystone species in the Baltic Sea ecosystem – blue mussel (Mytilus trossulus) complex. The blue mussel creates complex structures acting as substrate for many organisms, and it is an important food source for many fish and bird species (Koivisto, 2011). Moreover, a recent study shows that blue mussel populations in this area are genetically different from other parts of the Baltic Sea (Larsson et al., 2017).
Due to the high substrate variability and the high freshwater input from the Nemunas River, the Curonian Lagoon has among the most diverse macrozoobenthos of any estuary in the Baltic Sea. Littoral habitats show considerably higher species diversity than soft bottoms in the open lagoon (Zettler and Daunys, 2007).
The lagoons are rich in natural recourses. Its large size, peculiar geological structure and geographical location provide the Curonian Lagoon with a diverse freshwater ichthyofauna and

make it a permanent or temporary habitat for migratory and marine fish species (Zolubas et al., 2014).

C7: Naturalness Medium

Justification

The naturalness of the area needs to be further explored, given the high levels of anthropogenic activities occurring within the area, such as fishing, navigation and recreation.