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Benthic marine habitats of the eastern Baltic Sea

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marine protected areas in the Eastern Baltic Sea

Latvijas Hidroekoloģijas institūts

Benthic Marine Habitats of Eastern Baltic Sea

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Contents

1. Introduction

In current report You will find results of the activities carried out in the framework of the multinational project "Marine Protected Areas in the Eastern Baltic Sea (Baltic MPAs)". This project had one of the aims to perform detailed inventarisation of Annex I habitat types of Habitat Directive in the three Baltic states at chosen pilot areas.

Before the start of the project the process of designation of marine Natura 2000 areas in three Baltic Sea countries was in different stages. The common problem for those three states was the lacking information about the distribution of Habitat Directive Annex I habitat types in coastal waters. As the general information about the distribution of habitats and biota in the coastal areas was quite poor due to historical reasons the process of designation of marine Natura 2000 ares was not very easy task. In many cases the designation decisions were made mainly on information either not scientifically confirmed or very low quality.

In all three countries institutions dealing with marine investigations had limited capacity and knowledge of large-scale mapping activities at sea. The national classification systems for benthic habitats were missing. Background information was scattered and not systematised.

Huge amount of work was carried out during the duration of the project. Activities included series of methodological workshops on the topics of benthic investigation techniques, application of underwater video systems, development of benthic classification systems and using spatial modelling for prediction of distribution of benthic habitats. Intensive filed works were carried out in the pilot areas where huge amount of new field data was collected. One of the very important results of the project was development of new benthic habitat classification system (EBHAB) which is currently already used in many analogous benthic inventory projects and EIA studies. The results of current investigations finally were transferred to competent authorities in the three Baltic countries to be used in further elaboration and updating Natura 2000 databases and improvement of Natura 2000 network.

Many people have been participating in the filed works, workshops, data and sample processing and commenting on the results and the habitat classification system presented in this report. It is really difficult to mention them all but we are very much grateful for this collective effort. Authors will be very grateful of any comments and suggestions concerning the EBHAB classification system or methods and techniques presented here.

2. Field studies

Material

The material for current study was collected during intensive field expeditions in the framework of project "Marine Protected Areas in the Eastern Baltic Sea (Baltic MPAs)". Field studies were carried out during the years 2006-2008.

In Estonian coastal waters during the field seasons of 2006 and 2007 the total area covered by mapping activities was approx 8400 km^2. In total 1220 locations were samplede by means of UW video recording, grab sampling and SCUBA diving covering six project areas completely (1 EST, 2 EST, 3 EST, 4 EST, 5 EST and 6 EST).

In Latvian coastal waters during the two field seasons in all 1567 stations were sampled. Observations were carried out in areas LAT 7 (327 stations), LAT 8 (394 stations), LAT 9 (116 stations) and LAT 11 (730 stations).

In Lithuanian waters the total area covered by mapping activities in 2006 and 2007 was 1850 km^2. Investigations were carried out in two project areas (LIT 12 and LIT 13). Total number of described stations was 266 video transects and 55 SCUBA stations.

Methods

Following research methods were applied during habitat inventory in project areas: 1) video survey using remote underwater video cameras; 2) standard grab sampling; 3) sampling by SCUBA divers; and 4) side scan surveys. The stations and areas were selected in order to cover full diversity of benthic habitats. Information from previous underwater investigations, available geological maps and nautical charts were also considered. Sampling was performed during late spring, summer and early autumn in 2006, 2007 and 2008.

Grab sampling
Quantitative sampling of soft bottom benthic organisms was performed from the different vessels: e.g. R/V "Darius" in project areas LIT12 and LIT13, R/V "Vilma" in project areas EST5 and EST6, small workboats were used in most project areas in Estonia and Latvia. Samples of macrofauna (benthic animals which size exceeds 1 mm) were taken with a 0.1 m^2 Van Veen grab (50 kg) or in case of operating from smaller workboats by handheld Ekman-Lenz sampler. All samples were washed through a 0.5 mm mesh sieve and preserved either with 4 % formalin neutralised with NaHCO3 or deep frozen. Further treatment of material was performed according to HELCOM COMBINE Gidelines. Organisms were identified to species level where practicable and counted. Biomass was determined as formalin wet weight (g m^{-2}).

Sampling by SCUBA divers
The SCUBA diving was primarily used to collect samples of benthic organisms from hard bottom substrates. Due to limited operation ability of research vessel in shallow depths, sandy areas up to 10 m depth were also sampled by divers.

Two different methods were applied on hard and soft bottoms. On hard bottoms, plants and animals were scraped from the measured surface (20 x 20 cm) of stones using a 0.04 m^2 Kautsky type frame. Four to eight samples were taken per station depending on the heterogeneity of the seabed. All quantitative samples obtained by SCUBA divers were registered and treated in the same way as indicated for grab samples.

In the soft bottoms SCUBA divers took samples with a cylindrical bottom sampler (diameter 10 cm). The bottom sampler was carefully pushed into the bottom to approximately 20 cm depth, upper end closed with a lid and then gently taken out together with the sediment. Sediment were immediately transferred into net bags and hence 3 replicate sample were taken in a single station per dive.

Remote underwater video (RUV) surveys

Remote underwater video surveys were performed using the RUV SUBSEA (Fig. 2.1) from a research vessel or handheld "Drop" camera in case of operation from smaller workboats (Fig. 2.2). The RUV SUBSEA consisted of the following principal components:

Black and white digital video camera (sensibility 0.05 lx);
Color digital video camera (sensibility 7 lx)
Depth sensor and GPS
Lights (4x100 W)
Two laser beams indicating a 10 cm scale
Control unit and digital recorder
150 m cable, connecting the cameras with the control unit onboard.

During survey the RUV was hauled down from the ship (or a boat) to the bottom at each station and the seabed was recorded in a control unit on board for 3 minutes from a drifting ship. Further analysis of collected material was carried out in the laboratory.

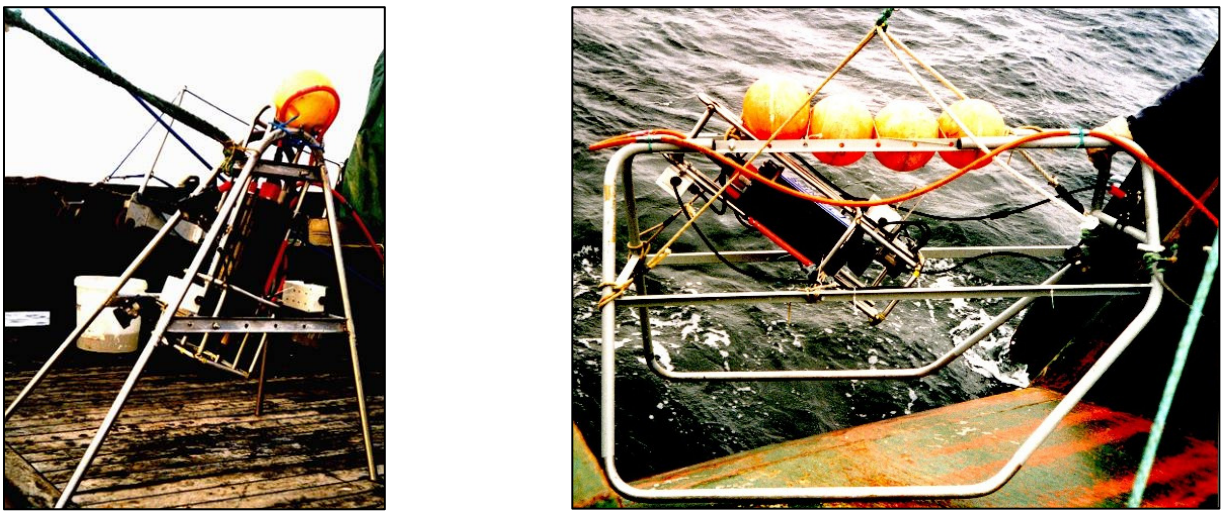


Figure 2.1. The RUV SUBSEA: frame and sledge used in stony (left) and soft (right) bottoms respectively.

Following types of software were used for analysis of video material:

Sony Vegas Video - video editing software used for technical manipulations of video material.

ArcGIS – mapping software used to identify transect characteristics (curvature, length etc.) and display sampling locations on the map.
Adobe Photoshop - image editing software used for video frame editing.
UTHSCSA ImageTool - image analyzing software used for accurate measurements in individual video frames.

Figure 2.2. Underwater "Drop" camera system operated from small boats. Depth range up to 30 m.

GIS analyses

Abiotic habitat parameters were treated in following manner:

1. Wave exposure level was set as exposed, moderate or sheltered. The borderline between moderate and sheltered was defined as follows:
    - Using "FOCAL" tool in ArcInfo 9.2 we sought how much each raster cell (50 m resolution) is surrounded by land within 2 km range. This 2 km range was justified due to the size of prevailing bays.
    - The "FOCAL" tool was run at 8 different directions (N, NE, E, SE, S, SW, W, NW).
    - Cell that encountered land at > 5 directions was considered as sheltered.
    - Other areas were defined as exposed.
2. Sediment was divided into hard and soft bottoms. The borderline between hard and soft substrates was set at 50% coverage.
3. According to light level the sea area was divided into photic and aphotic zones. The borderline between photic and aphotic layer was set at 20 m. This level reflects the deepest occurrences of macroalgal species in the majority of the Estonian coastal sea (either at present day or historical conditions).

Biotic habitat parameters were as treated as follows:

1. Coverage of the key perennial animal and macrophyte species (or groups). The coverage of the species has to exceed 10% level in order to be classified as a habitat of this particular species. The usage of such borderline is justified for two reasons: (1) 10% coverage represents the lowest level the species can be systematically detected using certain sampling effort (e.g. 5 minutes video observations or 5 minutes diving), (2) 10% coverage level corresponds to the

lowest biomass level that is stable over time i.e. using this criterion one has high probability of finding same habitat in same location in different years.
2. Dominance of the key perennial species.

3. EBHAB classification and habitat fact-sheets

The main aim of current project was to collect information and data on distribution of Habitat Directive Annex I habitat types in the project areas of Estonia, Latvia and Lithuania. At the same time amount and quality of field data collected enabled to get and present much more detailed information than required by Natura 2000 database forms. Other aspect was that HD Annex I habitat types covered only fraction of the investigated areas and large portions of seafloor remained unclassified. So the idea of more detailed benthic habitat classification system was born. As there was no ready classification system to be used in three Baltic countries the new system was developed which was based on principles of similar classification systems used for EUNIS.

Description of the EBHAB classification system

EBHAB (**E**astern **B**altic marine benthic **HAB**itats) classification system was developed to cover and describe the variability of benthic habitats in the coastal areas of Eastern Baltic Sea. All three countries have slightly different coastal conditions. Tha main ecological factors structuring the benthic communities in the area are exposure and benthic substrate. Salinity, otherwise important forcing factor in the Baltic Sea, have minual importance in this limited geographical scale. The northernmost sea areas of Estonian coastal sea in the Gulf of Finland and West-Estonian Archipelago area have the most sheletered conditions. Coastal areas of Gulf fo Riga are example of medium level of exposre while open coasts of open Baltic are extremely exposed.

EBHAB classification sheme was developed based on exposure (three exposure classes), substrate (hard and soft substrate are distinguished) and biological features (dominance of particular species or communities). Important classification factor was depth of photic zone. So the bottom above or below the border of photoc zone in case of hard substrate was classified into different classification units.

Classification system consist of 25 classification units (See list of habitats). Each habitat has been described into details based on material collected during present investigation or literature data.

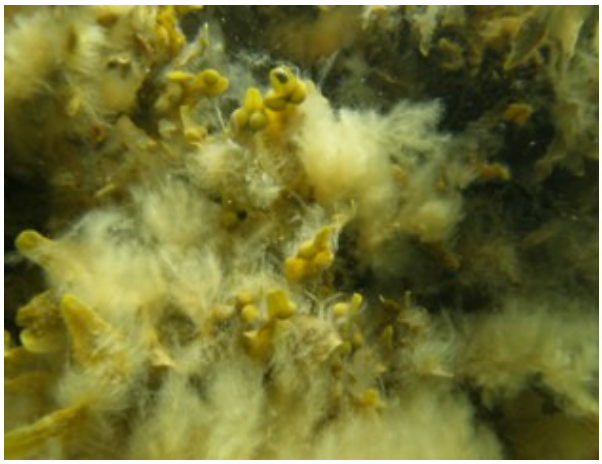
Geographical distribution of classification units reflects the diversity in coastal conditions. Habitats characterised by syheltered exposure conditions are mostly found in the northern part of the study area in Estonian coastal waters while mostly exposed conditions prevail along Lithuanian coast. Latvian areas have included both exposed and moderately exposed habitats.

List of habitats

Code	Habitat	Main characteristics
1	Sheltered hard bottoms with Fucus vesiculosus	High biomass and species diversity. *F. vesiculosus* dominates. Depth range 0-8 m.
2	Sheltered hard bottoms with bivalves and *Balanus improvisus*	Medium or high biomasses, low species diversity. Vegetation generally missing. Invertebrate species *Mytilus trossulus, Dreissena polymorpha, Balanus improvisis* dominate. Depth range 8-20m.
3	Sheltered hard bottoms with no particular species dominance	Low biomass and species diversity. Filamentous algae dominates in shallow area. Habitat is rarely found in depths >10m.
4	Sheltered soft bottoms with higher plants	High biomass and species diversity. Sandy, silty and muddy substrate with higher plants. Depth range 0.2-4 m.
5	Sheltered soft bottoms with charophytes	Medium or high biomass, low species diversity. Soft substrates, often mud, dominated by charophytes. Anoxic conditions trivial. Depth range 0.1-3 m.
6	Sheltered soft bottoms with bivalves	Medium biomass, low species diversity. Vegetation missing. Sandy and silty substrate dominated by bivalves. Depth range 5-20 m.
7	Sheltered soft bottoms with no particular species dominance	Low biomass and species diversity. Sandy or silty substrate, often anoxic.
8	Moderately exposed hard bottoms with *Fucus vesiculosus*	High biomass and species diversity. *F. vesiculosus* dominates. Depth range 0.2-8m.
9	Moderately exposed hard bottoms with *Furcellaria lumbricalis*	Medium biomass and species diversity. *F. lumbricalis* dominates. Depth range 6-15 m.
10	Moderately exposed hard bottoms with bivalves and Balanus improvisus	High biomass and low species diversity. Vegetation generally missing or has low biomass. Depth range (6)10-30 m.
11	Moderately exposed hard bottoms with no particular species dominance, <20m	Low to medium biomass, low species diversity. Filamentous algae may dominate in shallow areas. Depth range 0-20 m.
12	Moderately exposed hard bottoms with no particular species dominance, >=20m	Low biomass and species diversity. Vegetation missing, mussels occur but do not dominate. Found in depths >20 m.
13	Moderately exposed soft bottoms with Zostera marina	Medium to high biomass, high species diversity. Sandy substrate dominated by *Z. marina.* Depth range 1-6 m.

14	Moderately exposed soft bottoms with higher plants excluding Zostera marina.	Medium to high biomass, high species diversity. Sandy substrate dominated by higher plants (excl *Z. marina*). Anoxic conditions may apply. Depth range 0.3-5 m.
15	Moderately exposed soft bottoms with charophytes	Medium to high biomass, low species diversity. Sandy bottoms dominated by charophytes. Depth range 0.2-3m.
16	Moderately exposed soft bottoms with *Furcellaria lumbricalis*	Medium to high biomass, low species diversity. Sandy substrate dominated by loose *F. lumbricalis.* Found only in Väinameri area. Depth range 4-10 m.
17	Moderately exposed soft bottoms with bivalves	Low to medium biomass, low species diversity. Sandy and silty substrate dominated by bivalves. Depth range 0-100 m.
18	Moderately exposed soft bottoms with no particular species dominance	Low biomass and species diveristy. Sandy, silty or muddy substrates in depth range 0-100 m.
19	Exposed hard bottoms with *Furcellaria lumbricalis*	Low to medium biomass, low species diversity. *F.lumbricalis* dominates. Depth range 5-20 m.
20	Exposed hard bottoms with *Balanus improvisus*	Low to medium biomass, low species diversity. B. *improvisus* dominates. Depth range 5-20 m.
21	Exposed hard bottoms with Mytilus trossulus and *Balanus improvisus*	Medium or high biomasses, low speceis diversity. *M. trossulus* dominates with *B. improvisus* as co-dominant. Depth range 10-30 m.
22	Exposed moraine ridges with *Mytilus trossulus* and *Balanus improvisus*	Low to medium biomass, low species diversity. *M. trossulus* dominates with *B. improvisus* as co-dominant. Specific feature is the moraine ridge as substrate. Depth range 10-30 m.
23	Exposed soft bottoms with *Macoma balthica*	Low biomass and species diversity. Sandy and silty substrate dominated by bivalves. Depth range 0-100 m.
24	Exposed soft bottoms with the polychaetes *Pygospio elegans* and *Marenzelleria neglecta*	Low biomass and species diversity. Sandy and silty substrate dominated by polychaetes. Depth range 0-40 m.
25	Exposed soft bottoms with mobile amphipods	Low biomass and species diversity. Sandy and silty substrate dominated by amphipods. Depth range 0-40 m.

1. Sheltered hard bottoms with *Fucus vesiculosus*

Name: Sheltered hard bottoms with *Fucus vesiculosus*	**Characterising features:** *Fucus vesiculosus, Cladophora glomerata, Pilayella littoralis, Ruppia maritima*
Figure 1: In sheltered areas *F. vesiculosus* individuals grow larger compared to specimen in more exposed areas (4EST). 	**Figure 2:** *F. vesiculosus* overgrown with filamentous brown algae *Pilayella littoralis* (4EST). 
Description of the habitat: This habitat is largely dominated by the brown alga *Fucus vesiculosus* and other species contribute less than 10 % of total biomass. Among invertebrate species the gastropod *Theodoxus fluviatilis* prevails the biomasses. This habitat hosts relatively large number of plant and invertebrate species. Habitat occurs in coastal areas with low exposure to ice and waves. *Fucus vesiculosus,* which is regarded as key-species of the habitat, is wide spread on different types of hard substrate – rock, boulders and stones. Due to reduced current and water movement the sedimentation is somewhat higher and thus the share of soft substrates (sand, mud) may be higher than in moderately exposed coastal areas. Also with decreasing disturbance, *F. vesiculosus* individuals tend to be larger and more branched. Habitat is found in depth range 0.2-6 m. The lowest salinity tolerance for the species is around 4 psu, in few cases the species presence is reported at salinity 2 psu. Occurs in Estonia, in project areas the estimated coverage of the habitat is 22.95 km^2 (0.27 %).	
Functions: *F. vesiculosus* is characterised as one of the most important phytobenthic species in the Baltic coastal zone. Due to its wide distribution, high biomass and productivity along rocky and stony coasts *Fucus* belts play an important structuring role and have a positive effect on biodiversity, being habitats for species-rich epiphytic and epibenthic communities. Important food source for invertebrates. Changes in the distribution and abundance of *F. vesiculosus* are likely to markedly influence the coastal Baltic ecosystem including coastal fish catches, especially for species using vegetation as spawning substrate and shelter for juveniles.	
Conservation value: This habitat belongs to the reef habitat type (1170) included in the habitat Directive Annex I list. *F. vesiculosus* is threatened by toxic pollution both locally, close to point sources and on a larger scale due to a general eutrophication of the Baltic Sea. The direct effect of elevated	

nutrient concentrations to the *Fucus vesiculosus* physiological state is not so big but shading by filamentous, fast-growing species has much larger effect as they have ability to out compete Fucus in competition for light and space. Oil pollution has main negative effect on species found in Fucus community, though on sheltered areas the coagulated oil can directly suffocate the whole community. Habitat is important as fishes spawning and nursery ground. Habitat has also high recreational value and attracts divers.

Species list (algae and plants):

1. *Ceramium tenuicorne*
2. *Ceramium virgatum*
3. *Chara aspera*
4. *Chara canescens*
5. *Chorda filum*
6. *Cladophora glomerata*
7. *Coccotylus truncatus*
8. *Dictyosiphon foeniculaceus*
9. *Elachista fucicola*
10. *Fucus vesiculosus*
11. *Furcellaria lumbricalis*
12. *Myriophyllum spicatum*
13. *Pilayella littoralis*
14. *Polysiphonia fibrillosa*
15. *Polysiphonia fucoides*
16. *Potamogeton pectinatus*
17. *Ruppia maritima*
18. *Sphacelaria arctica*
19. *Stictyosiphon tortilis*
20. *Tolypella nidifica*
21. *Ulothrix sp*
22. *Ulva intestinalis*
23. *Zannichellia palustris*

Species list (invertebrates):

1. *Asellus aquaticus*
2. *Bithynia tentaculata*
3. *Cerastoderma glaucum*
4. *Chironomidae*
5. *Coleoptera*
6. *Gammarus oceanicus*
7. *Gammarus salinus*
8. *Gammarus tigrinus*
9. *Gammarus zaddachi*
10. *Hediste diversicolor*
11. *Hydrobia ulvae*
12. *Hydrobia ventrosa*
13. *Idotea balthica*
14. *Idotea chelipes*
15. *Jaera albifrons*
16. *Lepidoptera*
17. *Leptocheirus pilosus*
18. *Lymnaea peregra*
19. *Macoma balthica*
20. *Mya arenaria*
21. *Mytilus trossulus*
22. *Odonata*
23. *Oligochaeta*
24. *Praunus inermis*
25. *Prostoma obscurum*
26. *Theodoxus fluviatilis*
27. *Trichoptera*

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Schramm, W. 1996. Marine benthic vegetation. Recent changes and the effects of eutrophication. Ecological Studies, vol. 123. Springer.

Torn, K., Krause-Jensen, D. & Martin, G. 2006. Present and past depth distribution of bladderwrack (*Fucus vesiculosus*) in the Baltic Sea. Aquat. Bot. 84: 53–62.

2. Sheltered hard bottoms with bivalves and *Balanus improvisus*

Name: Sheltered hard bottoms with bivalves and *Balanus improvisus*

Characterising features: *Mytilus trossulus, Balanus improvisus*

Figure 1: *B. Improvisus* with filamentous red and brown algae (1EST).

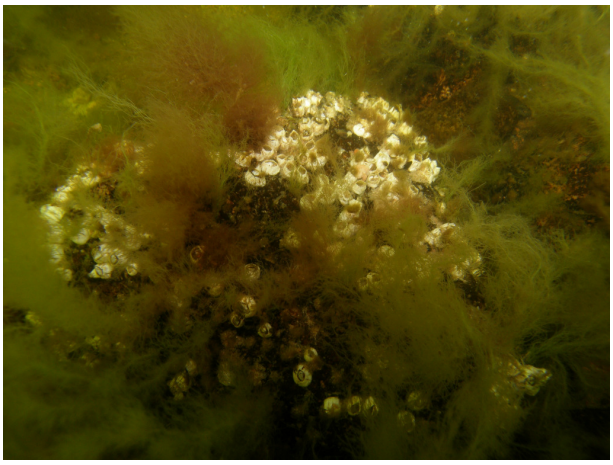
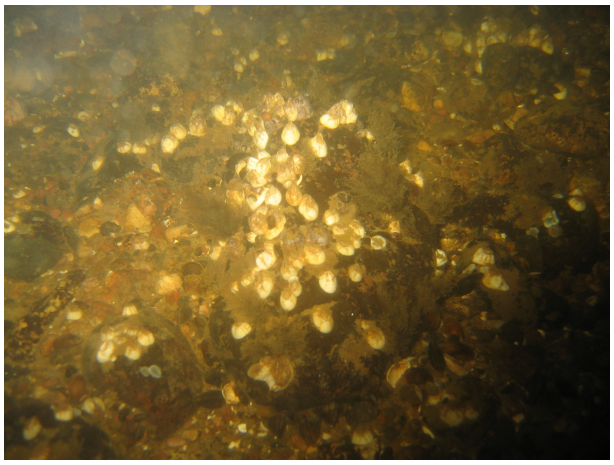


Figure 2: *B. improvisus* with brown algae *Sphacelaria arctica* (1EST).



Description of the habitat: This habitat is largely co-dominated by the red alga *Furcellaria lumbricalis*, other co-dominants are various green and brown algal species and higher plants. Other species contribute less than 10 % of total biomass. Among invertebrate species bivalve dominate. This habitat hosts relatively small number of plant and invertebrate species.

Habitat occurs in coastal areas with low exposure to ice and waves. Bivalves and barnacle colonize different types of hard substrate - rock, boulders and stones. Due to reduced current and water movement the sedimentation is somewhat higher and thus the share of soft substrates (sand, mud) may be higher than in moderately exposed coastal areas. Habitat is found in depth range 1-20 m. The lowest salinity for the habitat is around 2 psu. Occurs in Estonia, in project areas the estimated coverage of the habitat is 11.79 km^2 (0.14 %).

Functions: This habitat is found usually below the photic zone in the areas with high hydrological activity. Communities of bivalves act as sink for nutrients and organic matter as well as have important role in forming the biodiversity in the aphotic zone.

Conservation value: This habitat belongs to the reef habitat type (1170) included in the habitat Directive Annex I list.

Bivalves below photic zone form the main source of food for predators and have the structuring role of the biological communities in this environment.

Species list (algae and plants):

1. *Ceramium tenuicorne*
2. *Cladophora glomerata*
3. *Coccotylus truncatus*
4. *Dictyosiphon foeniculaceus*
5. *Furcellaria lumbricalis*
6. *Pilayella littoralis*

Species list (invertebrates):

1. *Asellus aquaticus*
2. *Cerastoderma glaucum*
3. *Chironomidae*
4. *Gammarus sp*
5. *Gammarus salinus*
6. *Hediste diversicolor*

7. *Polysiphonia fibrillosa* 8. *Polysiphonia fucoides* 9. *Rhodomela confervoides* 10. *Ruppia maritima* 11. *Sphacelaria arctica* 12. *Stictyosiphon tortilis* 13. *Tolypella nidifica*	7. *Hydrobia ulvae* 8. *Idotea balthica* 9. *Idotea chelipes* 10. *Jaera albifrons* 11. *Leptocheirus pilosus* 12. *Lymnaea peregra* 13. *Macoma balthica* 14. *Mya arenaria* 15. *Mytilus trossulus* 16. *Theodoxus fluviatilis*

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Westrbom, M. 2006. Population dynamics of blues mussels in a variable environment at the edge of their range. PhD. Dissertaion. Helsinki.

Kautsky, N. 1982. Growth and size structure in the Baltic *Mytilus trossulus* population. Mar. Biol. 68:117-133.

3. Sheltered hard bottoms with no particular species dominance

Name: Sheltered hard bottoms with no particular species dominance

Characterising features: Green, brown and red filamentous algae

Figure 1: Bioherm rock covered with green and brown filamentous algae (4EST).

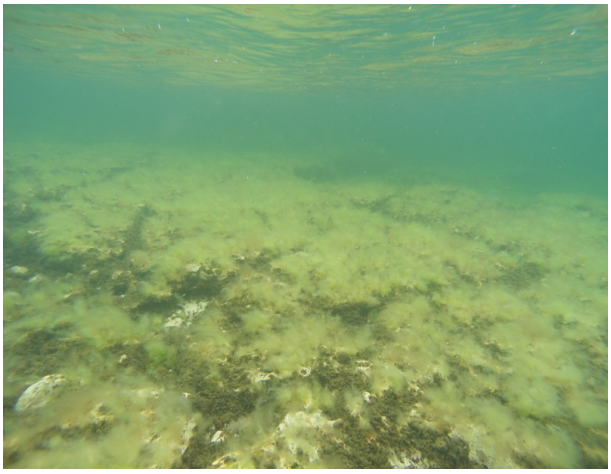


Figure 2: Gravel, stones and pebbles with brown filamentous algae *Pilayella littoralis* (4EST).

Description of the habitat: In this habitat the brown alga *Fucus vesiculosus*, the red alga *Furcellaria lumbricalis*, filamentous algae and high plants are often found. There is no clear dominance of any invertebrate species. This habitat hosts relatively small number of plant and invertebrate species.

Habitat occurs in coastal areas with low exposure to ice and waves. Different types of hard substrate (rock, boulders and stones) dominate. Due to reduced current and water movement the sedimentation is somewhat higher and thus the share of soft substrates (sand, mud) may be higher than in moderately exposed coastal areas. Habitat is found in depth range 0-20 m. The lowest salinity for the habitat is near 1 psu. Habitat occurs in Estonia, in project areas the estimated coverage of the habitat is 33.84 km^2 (0.4 %).

Functions: Diversity of species and potential of development of biomass rich communities makes this habitat attractive for several invertebrate and fish species as feeding and nursing area.

Conservation value: Conservation value of this habitat itself is low and mainly connected to the species it is hosting.

Species list (algae and plants):

1. *Chorda filum*
2. *Cladophora glomerata*
3. *Fucus vesiculosus*
4. *Furcellaria lumbricalis*
5. *Pilayella littoralis*
6. *Zannichellia palustris*

Species list (invertebrates):

1. *Macoma balthica*
2. *Mytilus trossulus*
3. *Theodoxus fluviatilis*

References:

Malm, T , Kautsky, L. & Claesson, T. 2003. The density and survival of *Fucus vesiculosus* L. (Fucales, Phaeophyta) on different bedrock types on a Baltic Sea moraine coast. Bot. Mar. 46: 256–262.

Berger, R., Bergström, L., Granéli, E.& Kautsky, L. 2004. How does eutrophication affect different life stages of *Fucus vesiculosus* in the Baltic Sea? – a conceptual model. Hydrobiol. 514: 243–248.

4. Sheltered soft bottoms with higher plants

Name: Sheltered soft bottoms with higher plants

Characterising features: *Potamogeton* spp, *Ruppia maritima*, *Zannichellia palustris*, *Myriophyllum spicatum*

Figure 1: *Z. palustris* together with loose filamentous algae (5EST).

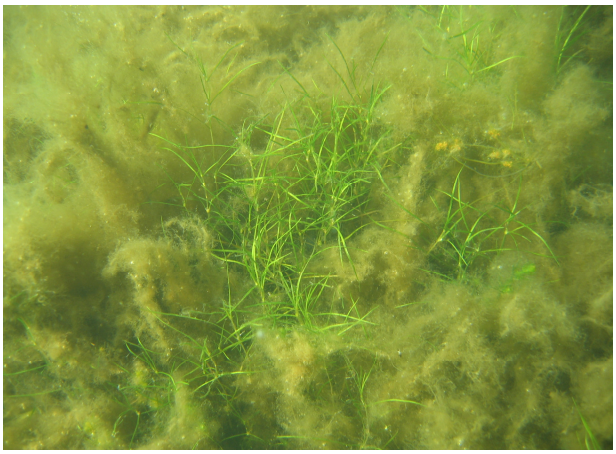


Figure 2: *P. perfoliatus* community (3EST).

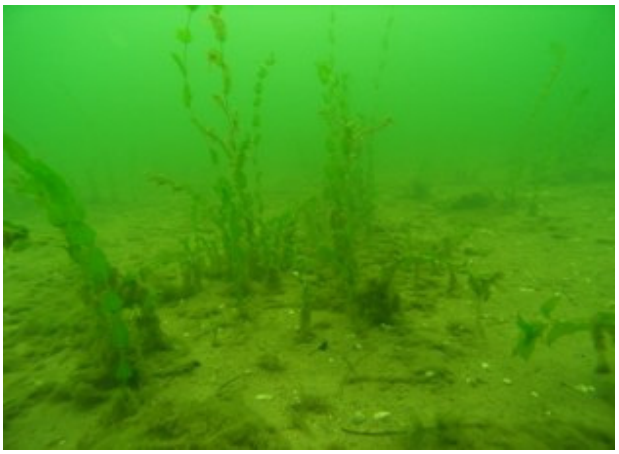


Figure 3: *P. pectinatus* in early spring (5EST).

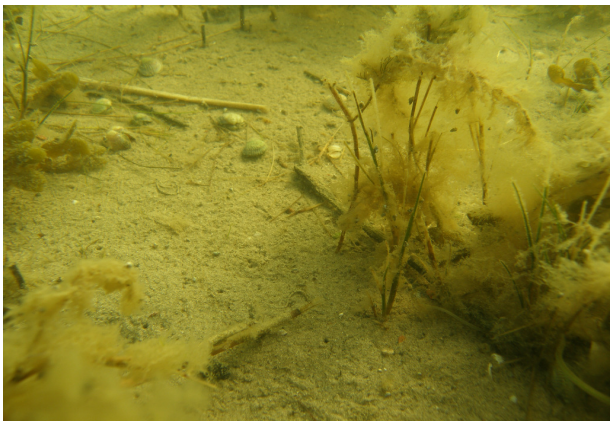


Figure 4: *M. spicatum* community (5EST).

Description of the habitat: Besides higher plants this habitat hosts high biomasses of the brown alga *Fucus vesiculosus* and filamentous algae. Invertebrate biomasses are low and mainly dominated by gastropods and bivalves. The habitat hosts relatively large number of plant and invertebrate species.

Habitat occurs in coastal areas with low exposure to ice and waves. Soft substrates (sand, silt, clay) dominate. Habitat is found in depth range 0.2-8 m. The lowest salinity for the habitat is near 1 psu. Habitat occurs in Estonia, in project areas the estimated coverage of the habitat is 100.74 km^2 (1.2 %).

Functions: Soft bottom areas are very important as sink of nutrients and organic matter. In this type of communities a great amount of organic matter is accumulated in the sediment. Structure f the communities enables large number of invertebrate species and fish to have their permanent habitat here.

Conservation value: This habitat may belong to the habitat types sandbanks (1110), estuaries (1130), large shallow inlets and bays (1160) and sandflats (1140) included in the habitat Directive Annex I list.

Conservation value is due to the large number of species hosted by this habitat and also great biological productivity of the communities inhabiting this type of habitats.

Species list (algae and plants):

1. *Ceramium tenuicorne*
2. *Ceratophyllum demersum*
3. *Chaetomorpha linum*
4. *Chara aspera*
5. *Chara baltica*
6. *Chara canescens*
7. *Chara connivens*
8. *Chara tomentosa*
9. *Chorda filum*
10. *Cladophora glomerata*
11. *Cladophora rupestris*
12. *Coccotylus truncatus*
13. *Dictyosiphon foeniculaceus*
14. *Fontinalis sp*
15. *Fucus vesiculosus*
16. *Furcellaria lumbricalis*
17. *Monostroma balticum*
18. *Myriophyllum spicatum*
19. *Najas marina*
20. *Percursaria percursa*
21. *Pilayella littoralis*
22. *Polysiphonia fibrillosa*
23. *Polysiphonia fucoides*
24. *Potamogeton pectinatus*
25. *Potamogeton perfoliatus*
26. *Ranunculus circinatus*
27. *Rhizoclonium riparium*
28. *Rhodomela confervoides*
29. *Ruppia maritima*
30. *Sphacelaria arctica*
31. *Stictyosiphon tortilis*
32. *Tolypella nidifica*
33. *Ulothrix sp*
34. *Ulva intestinalis*
35. *Zannichellia palustris*
36. *Zostera marina*

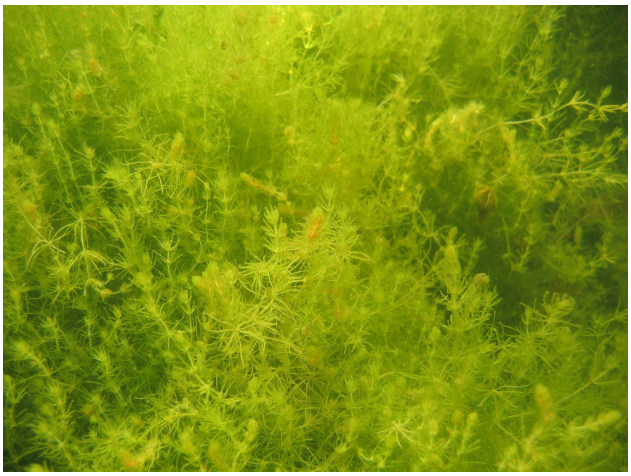
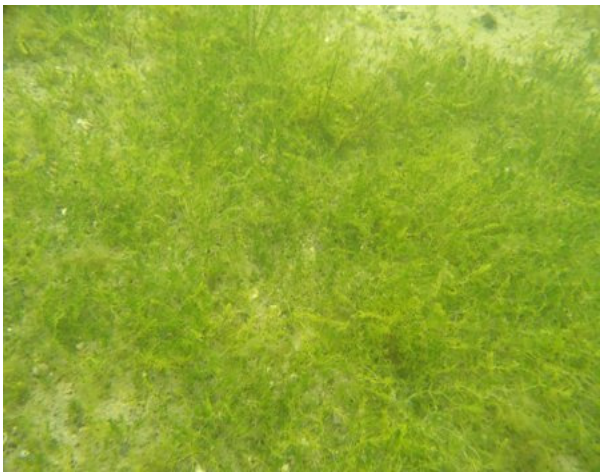
Species list (invertebrates):

1. *Asellus aquaticus*
2. *Bathyporeia pilosa*
3. *Bithynia tentaculata*
4. *Cerastoderma glaucum*
5. *Chironomidae*
6. *Coleoptera*
7. *Cordylophora caspia*
8. *Corophium volutator*
9. *Diptera*
10. *Gammarus oceanicus*
11. *Gammarus salinus*
12. *Gammarus tigrinus*
13. *Gammarus zaddachi*
14. *Hediste diversicolor*
15. *Hirudinea sp*
16. *Hydracarina*
17. *Hydrobia ulvae*
18. *Hydrobia ventrosa*
19. *Idotea balthica*
20. *Idotea chelipes*
21. *Lepidoptera*
22. *Lymnaea peregra*
23. *Lymnaea stagnalis*
24. *Macoma balthica*
25. *Mya arenaria*
26. *Mytilus trossulus*
27. *Odonata*
28. *Oligochaeta*
29. *Palaemon adspersus*
30. *Potamopyrgus antipodarum*
31. *Theodoxus fluviatilis*
32. *Trichoptera*

References:

Eriksson, B.K., Sandstrom, A., Isaeus, M., Schreiber, H. & Karas, P. 2004. Effects of boating activities on aquatic vegetation in the Stockholm archipelago, Baltic Sea. Estuar. Coast. Shelf S. 61: 339–349.

5. Sheltered soft bottoms with Charophytes

Name: Sheltered soft bottoms with Charophytes	**Characterising features:** *Chara* spp.
Figure 1: Charophyte meadow (3EST). 	**Figure 2:** Charophyte meadow (3EST). 

Description of the habitat: Besides charophytes this habitat hosts high biomasses of the brown alga *Fucus vesiculosus*. Invertebrate biomasses are low and mainly dominated by gastropods and bivalves. The habitat hosts relatively high number of plant and small number of invertebrate species.

Habitat occurs in coastal areas with low exposure to ice and waves. Substrate is mainly silt, silty sand or clay. Habitat is found in depth range 0-4, in salinities 0-7 psu. In project areas the estimated coverage of the habitat is 129.46 km^2 (1.5 %).

Functions: Charophytes have different roles in aquatic ecosystems. Charophyte meadows have a strong positive effect on water transparency in lakes through stabilizing the sediment with rhizoids and reducing zoo- and phytoplankton densities. *Chara* beds are acting as nutrient sinks in shallow lakes. They are an important component in the food-web belonging into the diet of benthic invertebrates, waterfowl, fish and fish larvae. Besides, charophytes offer a shelter for numerous invertebrates.

Conservation value: This habitat may belong to the habitat types sandbanks (1110), estuaries (1130), large shallow inlets and bays (1160) and sandflats (1140) included in the habitat Directive Annex I list.

Charophytes are considered to be a valuable part of the coastal ecosystem in the Baltic Sea. Several Charophyte species are included in national Red Lists and are recognised on the HELCOM level as species of high conservation value. Due to their uniqueness of physiology they are indicators of undisturbed marine environment and rapidly declining all over the Baltic Sea area.

Species list (algae and plants):	**Species list (invertebrates):**
1. *Ceramium tenuicorne*	1. *Asellus aquaticus*
2. *Ceratophyllum demersum*	2. *Bithynia tentaculata*
3. *Chaetomorpha linum*	3. *Cerastoderma glaucum*
4. *Chara aspera*	4. *Chironomidae*
5. *Chara baltica*	5. *Coleoptera*
6. *Chara canescens*	6. *Corophium volutator*

7. *Chara connivens* 8. *Chara horrida* 9. *Chara sp* 10. *Chara tomentosa* 11. *Cladophora glomerata* 12. *Coccotylus truncatus* 13. *Elodea canadensis* 14. *Fontinalis sp* 15. *Fucus vesiculosus* 16. *Furcellaria lumbricalis* 17. *Lemna trisulca* 18. *Monostroma balticum* 19. *Myriophyllum spicatum* 20. *Najas marina* 21. *Pilayella littoralis* 22. *Polysiphonia fibrillosa* 23. *Polysiphonia fucoides* 24. *Potamogeton pectinatus* 25. *Potamogeton perfoliatus* 26. *Ranunculus baudotii* 27. *Rhizoclonium riparium* 28. *Ruppia maritima* 29. *Sphacelaria arctica* 30. *Tolypella nidifica* 31. *Ulva intestinalis* 32. *Urospora penicilliformis* 33. *Vaucheria sp* 34. *Zannichellia palustris*	7. *Diptera* 8. *Ephemeroptera* 9. *Erpobdella* 10. *Gammarus lacustris* 11. *Gammarus oceanicus* 12. *Gammarus salinus* 13. *Gammarus tigrinus* 14. *Gonothyraea loveni* 15. *Hediste diversicolor* 16. *Hydrobia ulvae* 17. *Hydrobia ventrosa* 18. *Idotea balthica* 19. *Idotea chelipes* 20. *Lepidoptera* 21. *Leptocheirus pilosus* 22. *Lymnaea peregra* 23. *Lymnaea sp* 24. *Lymnaea spx* 25. *Lymnaea stagnalis* 26. *Macoma balthica* 27. *Odonata* 28. *Physa fontinalis* 29. *Planorbis sp* 30. *Potamopyrgus antipodarum* 31. *Theodoxus fluviatilis* 32. *Trichoptera*

References:

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Nõges, P., Tuvikene, L., Feldmann, T., Tõnno, I., Künnap, H., Luup, H., Salujõe, J. & Nõges, T. 2003 The role of charophytes in increasing water transparency: A case study of two shallow lakes in Estonia. Hydrobiol. 506-509: 567–573.

Noordhuis, R., van der Molen.,D.T., van den Berg, M.S. 2002 Response of herbivorous water-

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Rodrigo, M.A., Rojo, C., Álvarez-Cobelas, M. & Cirujano, S. 2007 *Chara hispida* beds as a sink of nitrogen: Evidence from growth, nitrogen uptake and decomposition. Aquat. Bot. 87: 7–14.

Schmieder, K., Werner, S. & Bauer, H.G. 2006. Submersed macrophytes as a food source for wintering waterbirds at Lake Constance. Aquat. Bot. 84: 245–250.

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van Donk, E. & van de Bund, W.J. 2002. Impact of submerged macrophytes including charophytes on phyto- and zooplankton communities: Allelopathy versus other mechanisms. Aquat. Bot. 72: 261–274.

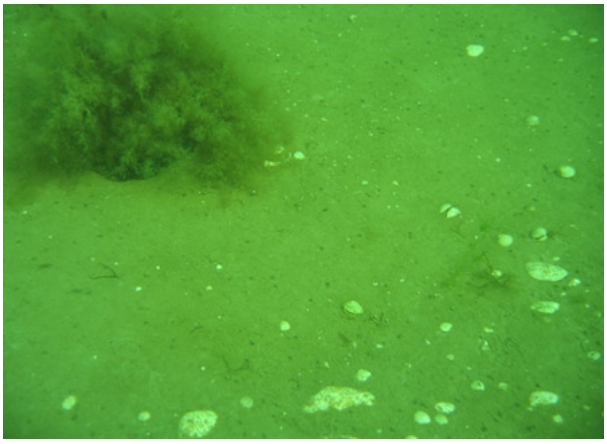
6. Sheltered soft bottoms with bivalves

Name: Sheltered soft bottoms with bivalves

Characterising features: *Macoma baltica, Cerastoderma glaucum, Mya arenaria*

Figure 1: *Mya arenaria* and *Cerastoderma glaucum* sieved out from coarse sand (4EST).

Figure 2: Silty sand provides habitat for bivalves (3EST).



Description of the habitat: This habitat has low plant biomasses. Among plants the brown alga *Fucus vesiculosus*, the red alga *Furcellaria lumbricalis* (mainly loose forms; or attached to standalone stones) and filamentous algae dominate. Different bivalve species prevail among invertebrates. The habitat hosts moderate number of plant and invertebrate species.

Habitat occurs in coastal areas with low exposure to ice and waves. Substrate is mainly sand and clay. Habitat is found in depth range 0-20 m. The lowest salinity for the habitat is around 3 psu. Habitat occurs in Estonia, in project areas the estimated coverage of the habitat is 81.15 km^2 (0.96 %).

Functions: This habitat forms important ecological unit as it occur in the areas with accumulation bottoms with increased sedimentation. Hydrological processes favour the accumulation of sediments. Usually short-term anoxic conditions may develop. Habitat is important as sink for nutrients.

Conservation value: This habitat may belong to the habitat types sandbanks (1110), estuaries (1130), large shallow inlets and bays (1160) and sandflats (1140) included in the habitat Directive Annex I list. Conservation value of the habitat is highly dependant on whether the high productivity is supported by natural (i.e. upwelling areas) or human-related causes (i.e. river estuaries, sewage pipelines).

Species list (algae and plants):

1. *Aglaothamnion roseum*
2. *Ceramium tenuicorne*
3. *Chaetomorpha linum*
4. *Chara aspera*
5. *Chara baltica*
6. *Chara canescens*
7. *Chara connivens*
8. *Chorda filum*

Species list (invertebrates):

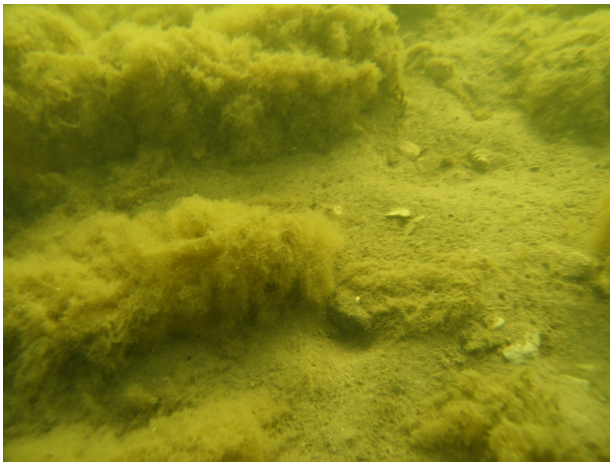
1. *Asellus aquaticus*
2. *Bathyporeia pilosa*
3. *Bithynia tentaculata*
4. *Cerastoderma glaucum*
5. *Chironomidae*
6. *Coleoptera*
7. *Corophium volutator*
8. *Diptera*

9. *Cladophora glomerata* 10. *Coccotylus truncatus* 11. *Dictyosiphon foeniculaceus* 12. *Fucus vesiculosus* 13. *Furcellaria lumbricalis* 14. *Myriophyllum spicatum* 15. *Pilayella littoralis* 16. *Polysiphonia fibrillosa* 17. *Polysiphonia fucoides* 18. *Potamogeton pectinatus* 19. *Potamogeton perfoliatus* 20. *Rhizoclonium riparium* 21. *Rhodomela confervoides* 22. *Ruppia maritima* 23. *Sphacelaria arctica* 24. *Stictyosiphon tortilis* 25. *Tolypella nidifica* 26. *Ulothrix sp* 27. *Ulva intestinalis* 28. *Zannichellia palustris* 29. *Zostera marina*	9. *Gammarus juv* 10. *Gammarus oceanicus* 11. *Gammarus salinus* 12. *Gammarus tigrinus* 13. *Hediste diversicolor* 14. *Hydracarina* 15. *Hydrobia ulvae* 16. *Hydrobia ventrosa* 17. *Idotea balthica* 18. *Idotea chelipes* 19. *Idotea granulosa* 20. *Jaera albifrons* 21. *Lepidoptera* 22. *Lymnaea peregra* 23. *Macoma balthica* 24. *Mya arenaria* 25. *Mytilus trossulus* 26. *Oligochaeta* 27. *Potamopyrgus antipodarum* 28. *Theodoxus fluviatilis* 29. *Trichoptera*

References:

Kotta, I., Orav-Kotta, H. & Kotta, J. 2003. Macrozoobenthos assemblages in highly productive areas of the Estonian coastal sea. Proc. Estonian Acad. Sci. Biol. Ecol. 52: 149–165.

7. Sheltered soft bottoms with no particular species dominance

<table>
<tr><td>Name: Sheltered soft bottoms with no particular species dominance</td><td>Characterising features: No particular species dominance</td></tr>
<tr><td>Figure 1: Sheltered soft bottoms are often covered with loose algal mats (5EST).
  </td><td>Figure 2: Filamentous algae can also be found in soft bottom habitats attached to few occurring stones and pebbles (3EST).
  </td></tr>
<tr><td colspan="2">Description of the habitat: The habitat has high biomasses of the brown alga Fucus vesiculosus (loose), the red alga Furcellaria lumbricalis (loose), higher plants, charophytes and filamentous algae. Among invertebrate species the bivalve Mytilus trossulus and Palaemon adspersus prevail. The habitat hosts high number of plant and invertebrate species.
Habitat occurs in coastal areas with low exposure to ice and waves. Soft substrates such as sand and clay prevail, the share of hard substrate varies. Habitat is found in depth range 0-20 m. The lowest salinity for the habitat is around 0 psu. Habitat is found in Estonia, in project areas the estimated coverage of the habitat is 208.94 km^2 (2.48 %).</td></tr>
<tr><td colspan="2">Functions: This habitat forms the important ecological unit as it occurs in the areas with accumulation bottoms with increased sedimentation. Hydrological processes favour the accumulation of sediments. Usually short-term anoxic conditions may develop. Habitat is important as sink for nutrients.</td></tr>
<tr><td colspan="2">Conservation value: This habitat has low conservation value.</td></tr>
<tr><td>Species list (algae and plants):
1. Ceramium tenuicorne
2. Ceramium virgatum
3. Chaetomorpha linum
4. Chara aspera
5. Chara baltica
6. Chara canescens
7. Chara connivens
8. Chara sp
9. Chara tomentosa</td><td>Species list (invertebrates):
1. Asellus aquaticus
2. Balanus improvisus
3. Bathyporeia pilosa
4. Bithynia tentaculata
5. Cerastoderma glaucum
6. Chironomidae
7. Coleoptera
8. Corophium volutator
9. Diptera</td></tr>
</table>

10. Cladophora glomerata *11. Cladophora rupestris* *12. Coccotylus truncatus* *13. Dictyosiphon foeniculaceus* *14. Fucus vesiculosus* *15. Furcellaria lumbricalis* *16. Leathesia difformis* *17. Monostroma balticum* *18. Myriophyllum spicatum* *19. Pilayella littoralis* *20. Polysiphonia fibrillosa* *21. Polysiphonia fucoides* *22. Potamogeton pectinatus* *23. Potamogeton perfoliatus* *24. Rhizoclonium riparium* *25. Rhodomela confervoides* *26. Ruppia maritima* *27. Sphacelaria arctica* *28. Stictyosiphon tortilis* *29. Tolypella nidifica* *30. Ulva intestinalis* *31. Urospora penicilliformis* *32. Zannichellia palustris* *33. Zostera marina*	*10. Ephemeroptera* *11. Gammarus locusta* *12. Gammarus oceanicus* *13. Gammarus salinus* *14. Gammarus tigrinus* *15. Gammarus zaddachi* *16. Gonothyraea loveni* *17. Hediste diversicolor* *18. Hydrobia sp* *19. Hydrobia ulvae* *20. Hydrobia ventrosa* *21. Idotea balthica* *22. Idotea chelipes* *23. Jaera albifrons* *24. Lepidoptera* *25. Leptocheirus pilosus* *26. Lymnaea peregra* *27. Lymnaea sp* *28. Macoma balthica* *29. Monoporeia affinis* *30. Mya arenaria* *31. Mytilus trossulus* *32. Odonata* *33. Oligochaeta* *34. Palaemon adspersus* *35. Potamopyrgus antipodarum* *36. Saduria entomon* *37. Theodoxus fluviatilis* *38. Trichoptera*

References:

Gray, J. S. 2002. Species richness of marine soft sediments. Mar. Ecol. Prog. Ser. 244: 285–297.

8. Moderately exposed hard bottoms with *Fucus vesiculosus*

Name: Moderately exposed hard bottoms with *Fucus vesiculosus*

Characterising features: *Fucus vesiculosus*

Figure 1: *F. vesiculosus* community together with filamentous green algae *Cladophora glomerata* at 0.5 m depth on rock (4EST).

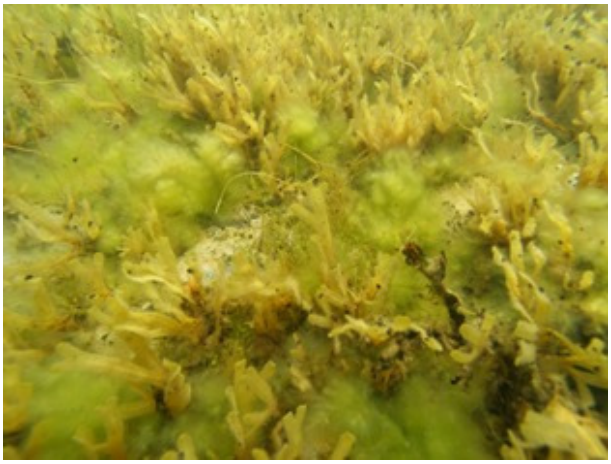


Figure 2: *F. vesiculosus* together with filamentous brown algae *Pilayella littoralis* at 1 m depth on rock (2EST).

Figure 3: School of sticklebacks *Gasterosteus aculeatus* (4EST).

Figure 4: Signs of eutrophication in *Fucus* community – overgrowth with filamentous algae and increased sedimentation (4EST).

Description of the habitat: This habitat is largely dominated by the brown alga *Fucus vesiclosus* and the bivalve *Mytilus trossulus*. Other species contribute less than 10 % of total biomass. This habitat hosts relatively large number of plant and invertebrate species.

Habitat prevails in coastal areas with low-moderate exposure to ice and waves. *Fucus vesiculosus,* which is regarded as key-species of the habitat, is wide spread on different types of hard substrate – rock, boulders and stones. Habitat is found in the Estonian coastal sea in depth range 0.2-10 m. The lowest salinity tolerance for the species is around 4 psu, in few cases the species presence is reported at salinity 2 psu. In project areas the estimated coverage of the habitat is 83.73 km^2 (0.99 %).

Functions: *F. vesiculosus* is characterised as one of the most important phytobenthic species in the Baltic coastal zone. Due to its wide distribution, high biomass and productivity along rocky and stony coasts *Fucus* belts play an important structuring role and have a positive effect on biodiversity, being habitats for species-rich epiphytic and epibenthic communities. Important food source for invertebrates. Changes in the distribution and abundance of *F. vesiculosus* are likely to markedly influence the coastal Baltic ecosystem including coastal fish catches.

Conservation value: This habitat belongs to the habitat type reefs (1170) included in the habitat Directive Annex I list.

F. vesiculosus is threatened by pollution both locally close to point sources and on a larger scale due to a general eutrophication of the Baltic Sea. There is small direct effect of increased nutrient load on Fucus itself, Fucus is mainly affected by the massoccurrence of filamentous ephemeral algae that out compete Fucus in competition for light and space. Oil pollution has main negative effect on species found in Fucus community, though on sheltered areas the coagulated oil can directly suffocate the whole community. Habitat is important as fishes spawning and nursery ground. Habitat has also high recreational value and attracts divers.

Species list (algae and plants):

1. *Aglaothamnion roseum*
2. *Ceramium tenuicorne*
3. *Ceramium virgatum*
4. *Chaetomorpha linum*
5. *Chara aspera*
6. *Chara baltica*
7. *Chara canescens*
8. *Chorda filum*
9. *Cladophora glomerata*
10. *Cladophora rupestris*
11. *Coccotylus truncatus*
12. *Dictyosiphon foeniculaceus*
13. *Elachista fucicola*
14. *Fucus vesiculosus*
15. *Furcellaria lumbricalis*
16. *Leathesia difformis*
17. *Myriophyllum spicatum*
18. *Pilayella littoralis*
19. *Polysiphonia fibrillosa*
20. *Polysiphonia fucoides*
21. *Potamogeton pectinatus*
22. *Rhizoclonium riparium*
23. *Rhodomela confervoides*
24. *Ruppia maritima*
25. *Sphacelaria arctica*
26. *Stictyosiphon tortilis*
27. *Tolypella nidifica*
28. *Ulothrix sp*
29. *Ulva intestinalis*
30. *Zannichellia palustris*

Species list (invertebrates):

1. *Argulus sp*
2. *Asellus aquaticus*
3. *Balanus improvisus*
4. *Bithynia tentaculata*
5. *Calliopius laevisculus*
6. *Cerastoderma glaucum*
7. *Chironomidae*
8. *Corophium volutator*
9. *Gammarus juv*
10. *Gammarus oceanicus*
11. *Gammarus salinus*
12. *Gammarus tigrinus*
13. *Gammarus zaddachi*
14. *Hediste diversicolor*
15. *Hydracarina*
16. *Hydrobia ulvae*
17. *Hydrobia ventrosa*
18. *Idotea balthica*
19. *Idotea chelipes*
20. *Jaera albifrons*
21. *Lymnaea peregra*
22. *Lymnaea spx*
23. *Macoma balthica*
24. *Mya arenaria*
25. *Mysis mixta*
26. *Mytilus trossulus*
27. *Oligochaeta*
28. *Palaemon adspersus*
29. *Piscicola geometra*
30. *Planorbis sp*
31. *Praunus inermis*
32. *Theodoxus fluviatilis*

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Kautsky, H., Kautsky, L., Kautsky, N., Kautsky, U. & Lindblad, C. 1992. Studies on the *Fucus vesiculosus* community in the Baltic Sea. Acta Phytogeogr. Suec. 78:33–48.

Kautsky, N., Kautsky, H., Kautsky, U. & Waern, M. 1986. Decreased depth penetration of *Fucus vesiculosus* (L.) since the 1940's indicates eutrophication of the Baltic Sea. Mar. Ecol. Prog. Ser. 28:1–8.

Torn, K., Krause-Jensen, D. & Martin, G. 2006. Present and past depth distribution of bladderwrack (*Fucus vesiculosus*) in the Baltic Sea. Aquat. Bot. 84:53–62.

9. Moderately exposed hard bottoms with *Furcellaria lumbricalis*

Name: Moderately exposed hard bottoms with *Furcellaria lumbricalis*

Characterising features: *Furcellaria lumbricalis*

Figure 1: *F. lumbricalis* with filamentous red algae (4EST).

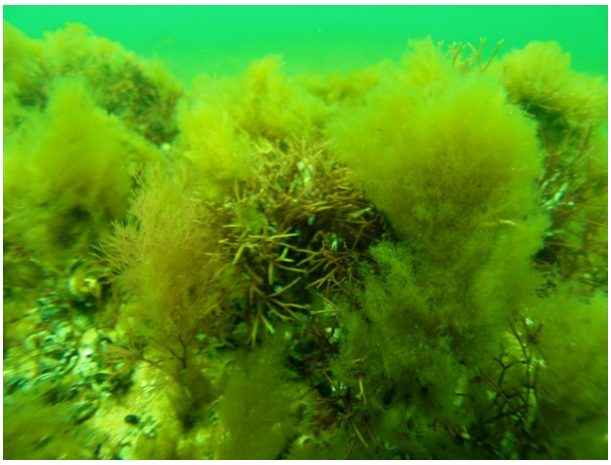


Figure 2: *F. lumbricalis* with filamentous red algae (4EST).

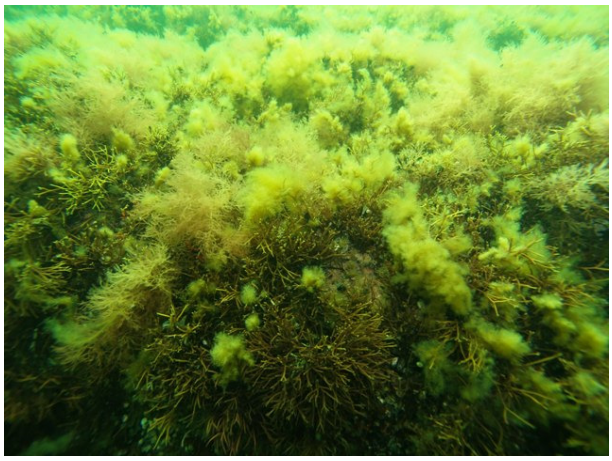


Figure 3: *F. lumbricalis* overgrown with filamentous algae (6EST).

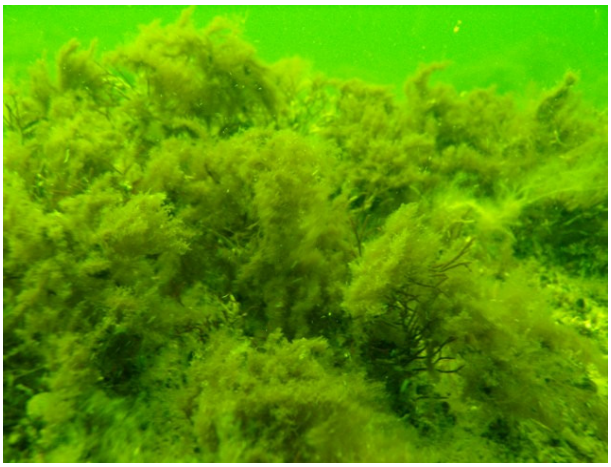


Figure 4: *F. lumbricalis* overgrown with filamentous algae (3EST).

Description of the habitat: This habitat is largely dominated by the red algae *Furcellaria lumbricalis* and the bivalve *Mytilus trossulus*. The brown alga *Fucus vesiclosus* co-dominates. Other species contribute less than 10 % of total biomass. This habitat hosts very small number of plant and invertebrate species.

Habitat occurs in coastal areas with moderate exposure to ice and waves. Substrate is mainly boulders and stones. Habitat is found in depth range 4-15 m. The lowest salinity for the habitat is around 4 psu. In project areas the estimated coverage of the habitat is 117.4 km^2 (1.39 %).

Functions: This habitat usually forms belt just below the communities dominated by bladder wrack. The ecological function is similar to bladder wrack communities as they have the structuring effect on the hard and mixed substrates were hydrological conditions allow.

Conservation value: This habitat belongs to the habitat type reefs (1170) included in the habitat Directive Annex I list.

This habitat has high conservation value hosting some of the key species. Habitat is threatened by increased sedimentation, deteriorating light climate caused by eutrophication and also by construction and dumping activities and toxic and oil pollution.

Species list (algae and plants):

1. *Ceramium tenuicorne*
2. *Ceramium virgatum*
3. *Cladophora glomerata*
4. *Cladophora rupestris*
5. *Coccotylus truncatus*
6. *Dictyosiphon foeniculaceus*
7. *Fucus vesiculosus*
8. *Furcellaria lumbricalis*
9. *Pilayella littoralis*
10. *Polysiphonia fibrillosa*
11. *Polysiphonia fucoides*
12. *Potamogeton pectinatus*
13. *Rhizoclonium riparium*
14. *Rhodomela confervoides*
15. *Sphacelaria arctica*
16. *Stictyosiphon tortilis*
17. *Tolypella nidifica*
18. *Zannichellia palustris*

Species list (invertebrates):

1. *Asellus aquaticus*
2. *Balanus improvisus*
3. *Calliopius laevisculus*
4. *Cerastoderma glaucum*
5. *Chironomidae*
6. *Corophium volutator*
7. *Gammarus juv*
8. *Gammarus oceanicus*
9. *Gammarus salinus*
10. *Gammarus zaddachi*
11. *Hediste diversicolor*
12. *Hydrobia ulvae*
13. *Idotea balthica*
14. *Idotea chelipes*
15. *Jaera albifrons*
16. *Leptocheirus pilosus*
17. *Lymnaea peregra*
18. *Macoma balthica*
19. *Mya arenaria*
20. *Mytilus trossulus*
21. *Oligochaeta*
22. *Piscicola geometra*
23. *Prostoma obscurum*
24. *Saduria entomon*
25. *Theodoxus fluviatilis*
26. *Trichoptera*

References:

Schiel, D.R., Wood, S.A., Dunmore, R.A. & Taylor, D.I. 2006. Sediment on rocky intertidal reefs: effects on early post-settlement stages of habitat-forming seaweeds. J. Exp. Mar. Biol. Ecol. 331:158–172.

Waern, M. 1952. Rocky-shore algae in the Oregrund archipelago. Acta Phytogeogr. Suec. 30:1–298.

Bučas, M., Daunys, D. & Olenin, S. 2007. Overgrowth patterns of the red algae *Furcellaria lumbricalis* at an exposed Baltic Sea coast: The results of a remote underwater video data analysis. Est. Coast. Shelf. Sci. 75:308–316.

10. Moderately exposed hard bottoms with bivalves

Name: Moderately exposed hard bottoms with bivalves

Characterising features: *Mytilus trossulus*, *Dreissena polymorpha*, *Balanus improvisus*

Figure 1: Adult flounder *Platichthys flesus* feeds on bivalves (4EST).

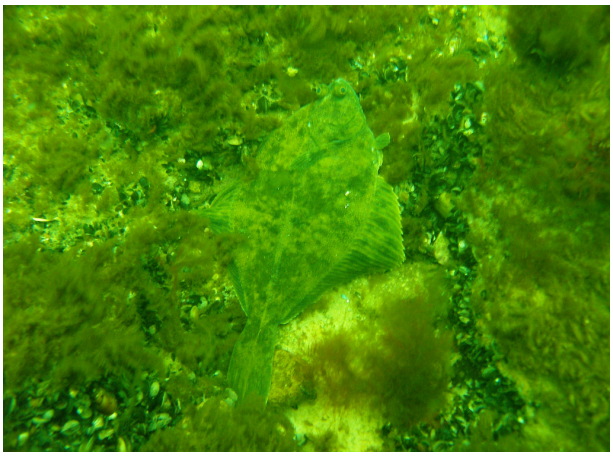


Figure 2: Blue mussel *M. trossulus* community (4EST).

Figure 3: Bay barnacle *B. improvisus*, *M. trossulus* and young *Fucus vesiculosus* in fight for space (4EST).

Figure 4: *M. trossulus* (4EST).

Description of the habitat: This habitat is largely dominated by the green filamentous algae and the bivalve *Mytilus trossulus* and the cirriped *Balanus improvisus*. The red alga *Furcellaria lumbricalis* and the brown filamentous algae co-dominate. This habitat hosts very small number of plant and high number of invertebrate species.

Habitat occurs in coastal areas with moderate exposure to ice and waves. Substrate is mainly rock, boulders or stones. Habitat is found in depth range 0.2-20 m. The lowest salinity for the habitat is around 4 psu. In project areas the estimated coverage of the habitat is 883.93 km^2 (10.48 %).

Functions: This habitat has important structuring role in the areas with higher hydrodynamic activity. Bivalves act as important food source for some fish species and also in shallower areas support the migrating waterbirds populations by being a feeding ground.

Conservation value: This habitat belongs to the habitat type reefs (1170) included in the habitat Directive Annex I list.

Habitat is of great conservation value due to usually high biomass and importance in trophic networks.

Species list (algae and plants):

1. *Ceramium tenuicorne*
2. *Ceramium virgatum*
3. *Chaetomorpha linum*
4. *Cladophora glomerata*
5. *Cladophora rupestris*
6. *Coccotylus truncatus*
7. *Dictyosiphon foeniculaceus*
8. *Ectocarpus siliculosus*
9. *Fucus vesiculosus*
10. *Furcellaria lumbricalis*
11. *Myriophyllum spicatum*
12. *Pilayella littoralis*
13. *Polysiphonia fibrillosa*
14. *Polysiphonia fucoides*
15. *Rhodomela confervoides*
16. *Sphacelaria arctica*
17. *Stictyosiphon tortilis*
18. *Ulva intestinalis*
19. *Zannichellia palustris*

Species list (invertebrates):

1. *Asellus aquaticus*
2. *Balanus improvisus*
3. *Calliopius laeviusculus*
4. *Cerastoderma glaucum*
5. *Chironomidae*
6. *Corophium volutator*
7. *Gammarus duebeni*
8. *Gammarus juv*
9. *Gammarus locusta*
10. *Gammarus oceanicus*
11. *Gammarus salinus*
12. *Gammarus tigrinus*
13. *Gammarus zaddachi*
14. *Gonothyraea loveni*
15. *Hediste diversicolor*
16. *Hydrobia ulvae*
17. *Hydrobia ventrosa*
18. *Idotea balthica*
19. *Idotea chelipes*
20. *Jaera albifrons*
21. *Laomedea flexuosa*
22. *Lymnaea peregra*
23. *Macoma balthica*
24. *Monoporeia affinis*
25. *Mya arenaria*
26. *Mytilus trossulus*
27. *Oligochaeta*
28. *Palaemon adspersus*
29. *Prostoma obscurum*
30. *Saduria entomon*
31. *Theodoxus fluviatilis*

References:

Kautsky, N. 1982. Growth and size structure in the Baltic Mytilus trossulus population. Mar. Biol. 68:117–133.

Kautsky, N., Johannesson, K. & Tedengren, M. 1990. Genotypic and phenotypic differences between Baltic and north Sea populations of *Mytilus trossulus* evaluated through reciprocal transplantations. I Growth and morphology. Mar. Ecol. Prog. Ser. 59:203–210.

Littorin, B. 1998. Structure and organisation in the *Mytilus trossulus* population of the northern Baltic Proper. Licentiate in philosophy thesis. Stockholm University. Department of Systems Ecology, Stockholm. ISSN 1401-4106; 1998:2:20.

Westrbom, M. 2006. Population dynamics of blue mussels in a variable environment at the edge of their range. PhD. Dissertation. University of Helsinki.

11. Moderately exposed hard bottoms with no particular species dominance, <20 m

Name: Moderately exposed hard bottoms with no particular species dominance

Characterising features: Filamentous ephemeral algae, Gastropoda

Figure 1: Bioherm rock covered with filamentous green and brown algae (4EST).

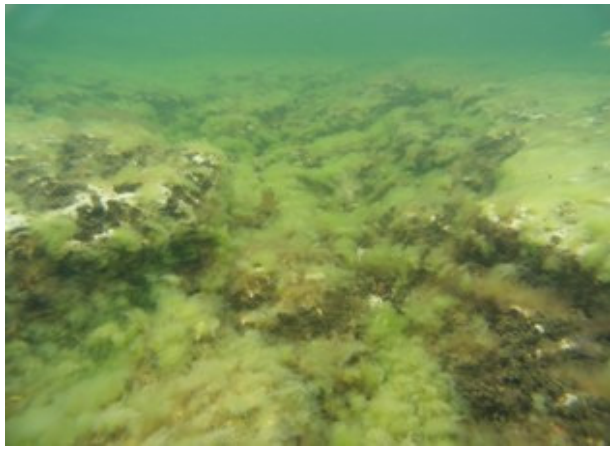


Figure 2: Limestone with few filamentous algae (4EST).

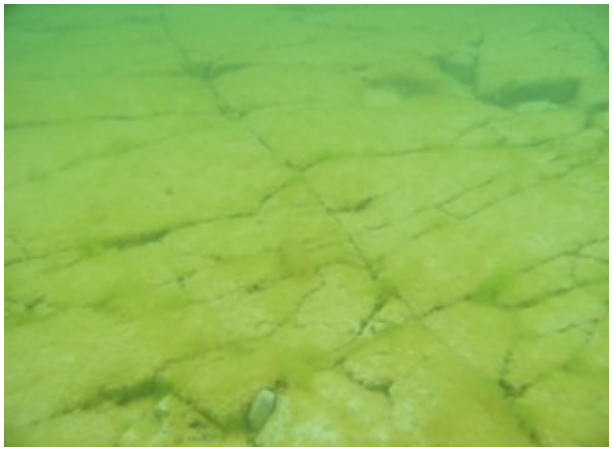
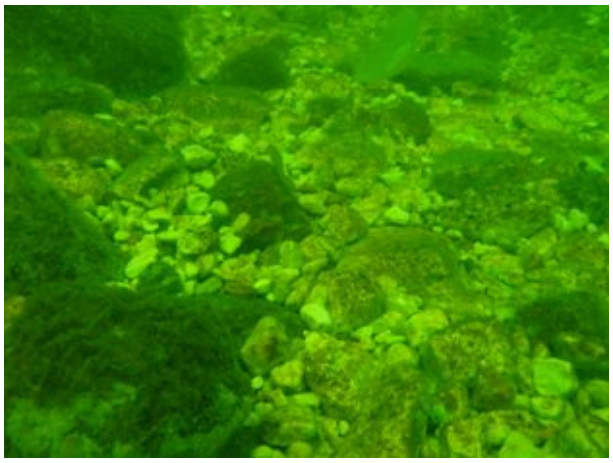


Figure 3: *Cladophora* sp. in moderately exposed conditions (2EST).

Figure 4: Filamentous brown algae on pebbles (6EST).



Description of the habitat: This habitat is not dominated by any plant or invertebrate species. The most prevailing species are the brown alga *Fucus vesiculosus* and filamentous algae. Among invertebrates different bivalves are characteristic of this habitat. This habitat hosts moderate number of plant and high number of invertebrate species.

Habitat prevails in shallow moderately exposed areas, where the growth of perennials (and mussels) is disfavoured mainly by ice scouring and wave action in shallow waters and by low light and higher sedimentation in deeper waters. Substrate varies from rock to pebbles. The depth range is 0-20 m. Habitat is found in Estonia, in project areas the estimated coverage of the habitat is 543.15 km^2 (6.44 %).

Functions: Mass occurrence of filamentous algae in this habitat is mainly related to eutrophication but usually has seasonal character. Large biomass of filamentous algae supports

seasonal outbreaks of herbivorous invertebrates.

Conservation value: This habitat is of high conservation value as they occur usually in hydrologically active cliff areas and support remarkable biological diversity in this dynamic environment.

Species list (algae and plants):

1. *Ceramium tenuicorne*
2. *Ceramium virgatum*
3. *Chaetomorpha linum*
4. *Chara aspera*
5. *Chara baltica*
6. *Chara canescens*
7. *Chara sp*
8. *Chorda filum*
9. *Cladophora glomerata*
10. *Cladophora rupestris*
11. *Coccotylus truncatus*
12. *Dictyosiphon foeniculaceus*
13. *Elachista fucicola*
14. *Fucus vesiculosus*
15. *Furcellaria lumbricalis*
16. *Myriophyllum spicatum*
17. *Pilayella littoralis*
18. *Polysiphonia fibrillosa*
19. *Polysiphonia fucoides*
20. *Potamogeton pectinatus*
21. *Potamogeton perfoliatus*
22. *Rhizoclonium riparium*
23. *Rhodomela confervoides*
24. *Ruppia maritima*
25. *Sphacelaria arctica*
26. *Stictyosiphon tortilis*
27. *Tolypella nidifica*
28. *Ulothrix sp*
29. *Ulva intestinalis*
30. *Zannichellia palustris*
31. *Zostera marina*

Species list (invertebrates):

1. *Asellus aquaticus*
2. *Balanus improvisus*
3. *Bithynia tentaculata*
4. *Cerastoderma glaucum*
5. *Chironomidae*
6. *Corophium volutator*
7. *Diastylis rathkei*
8. *Dreissena polymorpha*
9. *Gammarus juv*
10. *Gammarus oceanicus*
11. *Gammarus salinus*
12. *Gammarus tigrinus*
13. *Gammarus zaddachi*
14. *Hediste diversicolor*
15. *Hydrobia ulvae*
16. *Hydrobia ventrosa*
17. *Idotea balthica*
18. *Idotea chelipes*
19. *Jaera albifrons*
20. *Lepidoptera*
21. *Leptocheirus pilosus*
22. *Lymnaea peregra*
23. *Macoma balthica*
24. *Marenzelleria neglecta*
25. *Mya arenaria*
26. *Mytilus trossulus*
27. *Neomysis integer*
28. *Oligochaeta*
29. *Physa fontinalis*
30. *Praunus flexuosus*
31. *Prostoma obscurum*
32. *Saduria entomon*
33. *Theodoxus fluviatilis*
34. *Trichoptera*

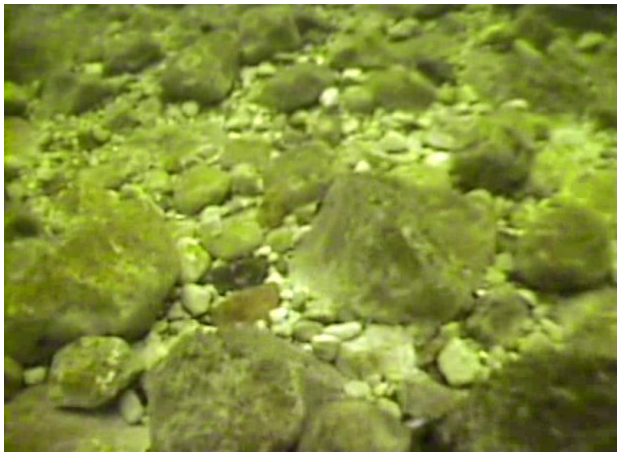
References:

Schramm, W. 1996. Marine benthic vegetation. Recent changes and the effects of eutrophication. Ecological Studies, 123. Springer.

Engström-Öst, J., Immonen, E., Candolin, U. & Mattila, J. 2007. The indirect effects of eutrophication on habitat choice and survival of fish larvae in the Baltic Sea. Mar. Biol. 151:393–400.

Kautsky, L. & Kautsky, H. 1989. Algal diversity and dominance along gradients of stress and disturbance in marine environments. Vegetation 83:259–267.

12. Moderately exposed hard bottoms with no particular species dominance, >20m

<table>
<tr><td>Name: Moderately exposed hard bottoms with no particular species dominance</td><td>Characterising features: Mytilus trossulus, Balanus improvisus</td></tr>
<tr><td>Figure 1: Pebbles and cobbles with few barnacles (1EST).
  </td><td>Figure 2: Pebbles, cobbles and gravel in exposed marine deeps (6EST).
  </td></tr>
<tr><td colspan="2">Description of the habitat: This habitat supports presence of very few species, no plants are found in this habitat. Invertebrates such as Cordylophora caspia and Mytilus trossulus can be found, but their coverage stays below 10%. There can be several reasons behind low species richness. Hydrodynamic conditions overrule as currents and upwelling of anoxic bottom waters in the area clean out the oxygen-dependant life. At the same the substrate is mainly pebbles, cobbles and coarse gravel which move with water masses and do not form solid base for epifauna to settle.
Habitat occurs in coastal areas with no exposure to ice and waves. Substrate is mainly rock or stones. Habitat is found in depth below 20 m. The lowest salinity for the habitat is around 3 psu. In project areas the estimated coverage of the habitat is 541.66 km^2 (6.42 %).</td></tr>
<tr><td colspan="2">Functions: This habitat is found in areas below photic zone and its' main ecological function is generation of secondary production.</td></tr>
<tr><td colspan="2">Conservation value: This habitat itself is of low conservation value due to low biological diversity and low level of biological productivity. The conservation value depends on surrounding habitats and dominating physical features.</td></tr>
<tr><td>Species list (algae and plants):
-</td><td>Species list (invertebrates):
1. Cordylophora caspia
2. Mytilus trossulus</td></tr>
<tr><td colspan="2">References:</td></tr>
</table>

13. Moderately exposed soft bottoms with *Zostera marina*

Name: Moderately exposed soft bottoms with *Zostera marina*

Characterising features: *Zostera marina*

Figure 1: *Z. marina* community, old leaves of eelgrass are overgrown with epiphytic filamentous brown algae *Cladosiphon zosterae* (4EST).

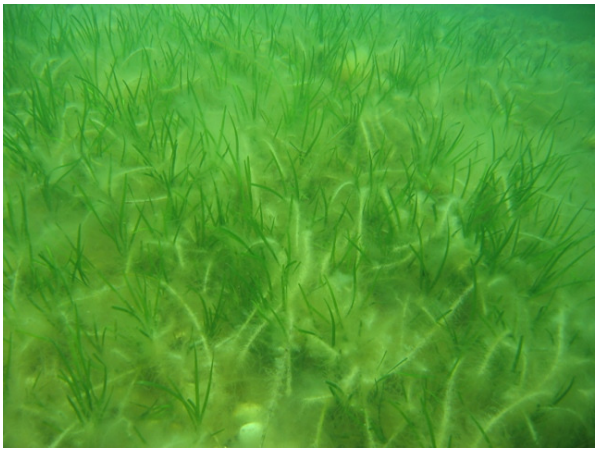


Figure 2: Blue mussel *Mytilus trossulus* often finds shelter in eelgrass community (4EST).

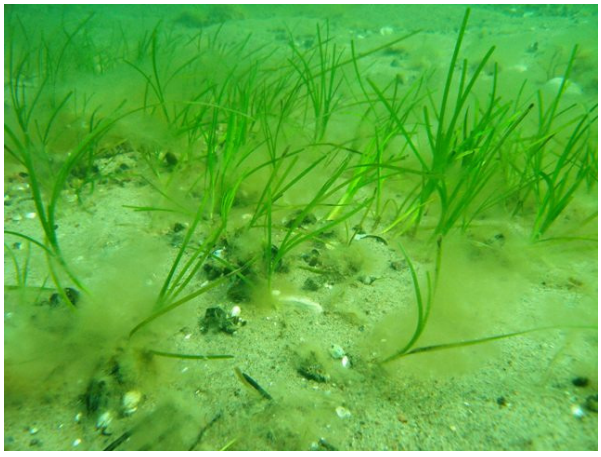


Figure 3: *Potamogeton* spp often grow together with *Z. marina* (1EST).

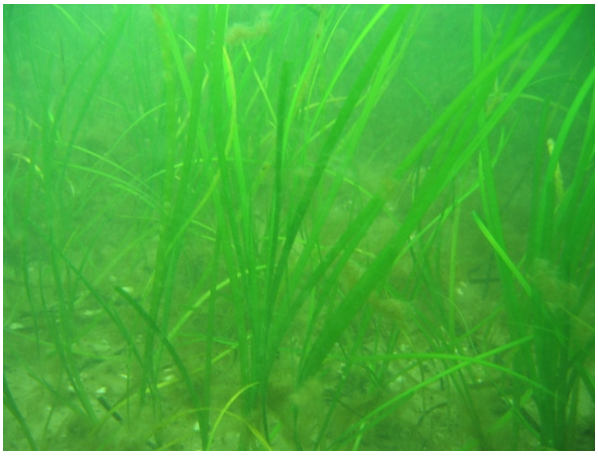


Figure 4: Loose filamentous algae tangling in *Z. marina* leaves can suffocate the species and cause its disappearance (3EST).

Description of the habitat: This habitat is largely dominated by the higher plant *Zostera marina* and the filamentous brown algae. Other higher plants co-dominate. Invertebrate biomasses are very low and the habitat is characterised by different bivalve species. This habitat hosts very small number of plant and invertebrate species. Habitat prevails in coastal areas with low-moderate exposure to ice and waves. *Zostera marina,* which is regarded as key-species of the habitat, can inhabit sandy substrate. Presence of this species decreases the water movement, the overall species richness, sedimentation rate and thus the organic content is higher within the eelgrass bed compared to surrounding unvegetated sand.

Habitat is found in the Estonian coastal sea in depth range 2-6 m. The lowest salinity tolerance for the species is around 5 psu. In project areas the estimated coverage of the habitat is 85.92 km^2 (1.02 %).

Functions: Eelgrass beds are considered to be highly productive and support a wide range of flora and fauna as well as being a refuge and nursery area for a range of fish species.They provide a diversity of microhabitats, especially compared to macroalgal species. Also eelgrass beds form an important food resource for overwintering herbivorous wildfowl.

Conservation value: Although seagrass beds are not listed as an Annex I habitat under the European Community (EC) Habitats Directive 92/43/EEC they are a recognised component of Coastal Lagoons (1150) and Submerged sandbanks covered by seawater all of the time (1110). They are also a characteristic feature of the Annex I habitats Large shallow inlets and bays (1160), Estuaries (1130) and Mudflats and sandflats not covered by the tide at low water (1140).

This habitat is of high conservation value and very vulnerable with threats originating from alla range of human activity (dredging/dumping, eutrophication, toxic and oil pollution) and climate change.

Species list (algae and plants):

1. *Ceramium tenuicorne*
2. *Ceramium virgatum*
3. *Chaetomorpha linum*
4. *Chara connivens*
5. *Chorda filum*
6. *Cladophora glomerata*
7. *Cladophora rupestris*
8. *Coccotylus truncatus*
9. *Dictyosiphon foeniculaceus*
10. *Fucus vesiculosus*
11. *Furcellaria lumbricalis*
12. *Monostroma balticum*
13. *Myriophyllum spicatum*
14. *Pilayella littoralis*
15. *Polysiphonia fucoides*
16. *Potamogeton pectinatus*
17. *Potamogeton perfoliatus*
18. *Rhodomela confervoides*
19. *Ruppia maritima*
20. *Sphacelaria arctica*
21. *Stictyosiphon tortilis*
22. *Tolypella nidifica*
23. *Zannichellia palustris*
24. *Zostera marina*

Species list (invertebrates):

1. *Asellus aquaticus*
2. *Cerastoderma glaucum*
3. *Chironomidae*
4. *Corophium volutator*
5. *Gammarus juv*
6. *Gammarus oceanicus*
7. *Gammarus salinus*
8. *Gonothyraea loveni*
9. *Hediste diversicolor*
10. *Hydrobia sp*
11. *Hydrobia ulvae*
12. *Hydrobia ventrosa*
13. *Idotea balthica*
14. *Idotea chelipes*
15. *Jaera albifrons*
16. *Lymnaea peregra*
17. *Lymnaea stagnalis*
18. *Macoma balthica*
19. *Melita palmata*
20. *Mya arenaria*
21. *Mytilus trossulus*
22. *Oligochaeta*
23. *Saduria entomon*
24. *Theodoxus fluviatilis*

References:

Baden, S. & Boström, C. 2001. The leaf canopy of *Zostera marina* meadows – faunal community structure and function in marine and brackish waters. In: Reise K (ed). Ecological comparisons of Sedimentary shores. Springer Verlag, Berlin. pp 213–236.

Bostrom C. & Bonsdorff E. 1997. Community structure and spatial variation of benthic invertebrates associated with *Zostera marina* (L.) beds in the northern Baltic Sea. J. Sea

Res. 37:153–166.

Fjøsne, K. &J. Gjøsæter. 1996. Dietary composition and the potential food competition between 0-group cod (*Gadus morhua* L.) and some other fish species in the littoral zone. ICES J. Mar. Sci 53:757–770.

Möller, T. & Martin, G. 2007. Distribution of the eelgrass *Zostera marina* L. in the coastal waters of Estonia, NE Baltic Sea. Proc. Estonian Acad. Sci. Biol. Ecol. 56:270–277.

Baden, S. P. & Pihl, L. 1984. Abundance, biomass and production of mobile epibenthic fauna in *Zostera marina* (L.) meadows, western Sweden. Ophelia 23:65–90.

14. Moderately exposed soft bottoms with higher plants (excluding *Zostera marina*)

Name: Moderately exposed soft bottoms with higher plants (excluding *Zostera marina*)

Characterising features: *Potamogeton* spp, *Zannichellia palustris, Ruppia maritima*

Figure 1: *P. perfoliatus* in splendid isolation (3EST).

Figure 2: *Z. palustris* seizing mobile sand (3EST).

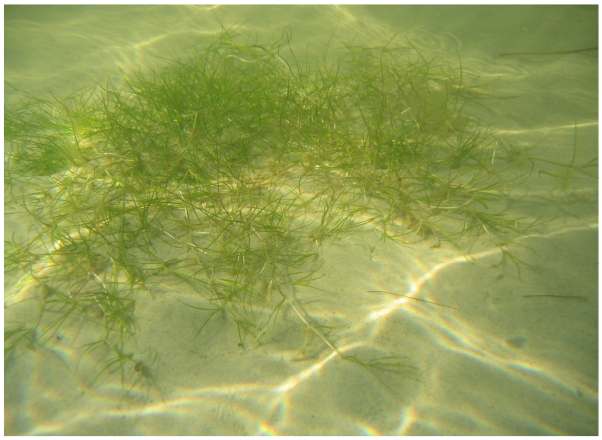


Figure 3: Mixed stand of *Z. palustris, R. maritima*, *P. pectinatus* and charophytes (3EST).

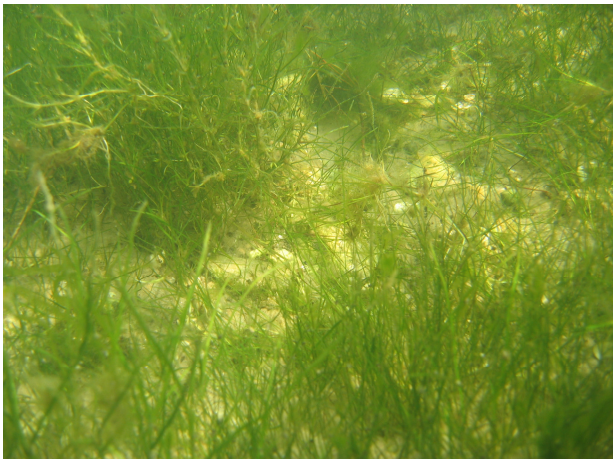
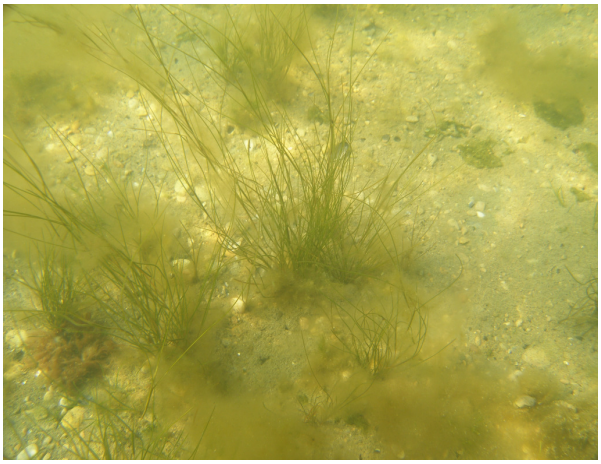


Figure 4: *P. pectinatus* together with loose filamentous algae (2EST).



Description of the habitat: This habitat hosts a large number of different higher plants. The habitat is also characterized by the brown alga *Fucus vesiculosus* and charophytes. Invertebrate biomasses are very low and the habitat is characterised by different bivalve species. This habitat hosts high number of plant and moderate number of invertebrate species.

Habitat prevails in coastal areas with low-moderate exposure to ice and waves. Sand, clay and gravel prevail in substrate. Habitat is found in the Estonian coastal sea in depth range 2-6 m. The lowest salinity for the habitat is around 2 psu. In project areas the estimated coverage of the habitat is 184.24 km^2 (2.18 %).

Functions: This habitat hosts high biological diversity and remarkable animal and plant biomass in sheltered coastal areas. This habitat is spawning and nursing areas for many fish species.

Conservation value: This habitat may belong to the habitat types sandbanks (1110), estuaries (1130), large shallow inlets and bays (1160) and sandflats (1140) included in the habitat Directive Annex I list.

This habitat is of high conservation value due to supporting high biodiversity in particular type of coastal environment. Threats for the habitat are mainly connected to eutrophication induced by freshwater runoff from terrestrial environment and mechanical disturbance due to variety of human activities.

Species list (algae and plants):

1. *Ceramium tenuicorne*
2. *Ceramium virgatum*
3. *Chaetomorpha linum*
4. *Chara aspera*
5. *Chara baltica*
6. *Chara canescens*
7. *Chara connivens*
8. *Chara sp*
9. *Chara tomentosa*
10. *Chorda filum*
11. *Cladophora glomerata*
12. *Coccotylus truncatus*
13. *Dictyosiphon foeniculaceus*
14. *Elachista fucicola*
15. *Fucus vesiculosus*
16. *Furcellaria lumbricalis*
17. *Myriophyllum spicatum*
18. *Pilayella littoralis*
19. *Polysiphonia fibrillosa*
20. *Polysiphonia fucoides*
21. *Potamogeton pectinatus*
22. *Potamogeton perfoliatus*
23. *Rhizoclonium riparium*
24. *Rhodomela confervoides*
25. *Ruppia cirrhosa*
26. *Ruppia maritima*
27. *Sphacelaria arctica*
28. *Stictyosiphon tortilis*
29. *Tolypella nidifica*
30. *Ulothrix sp*
31. *Ulva intestinalis*
32. *Urospora penicilliformis*
33. *Zannichellia palustris*
34. *Zostera marina*

Species list (invertebrates):

1. *Bithynia tentaculata*
2. *Cerastoderma glaucum*
3. *Chironomidae*
4. *Coleoptera*
5. *Corophium volutator*
6. *Gammarus juv*
7. *Gammarus oceanicus*
8. *Gammarus salinus*
9. *Gammarus tigrinus*
10. *Gammarus zaddachi*
11. *Gonothyraea loveni*
12. *Hediste diversicolor*
13. *Hydrobia ulvae*
14. *Hydrobia ventrosa*
15. *Idotea balthica*
16. *Idotea chelipes*
17. *Jaera albifrons*
18. *Laomedea flexuosa*
19. *Lepidoptera*
20. *Leptocheirus pilosus*
21. *Lymnaea peregra*
22. *Macoma balthica*
23. *Melita palmata*
24. *Mya arenaria*
25. *Mytilus trossulus*
26. *Neomysis integer*
27. *Odonata*
28. *Oligochaeta*
29. *Praunus flexuosus*
30. *Praunus inermis*
31. *Prostoma obscurum*
32. *Theodoxus fluviatilis*
33. *Trichoptera*

References:

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15. Moderately exposed soft bottoms with charophytes

Name: Moderately exposed soft bottoms with charophytes

Characterising features: *Chara* spp.

Figure 1: *Chara tomentosa* (3EST).

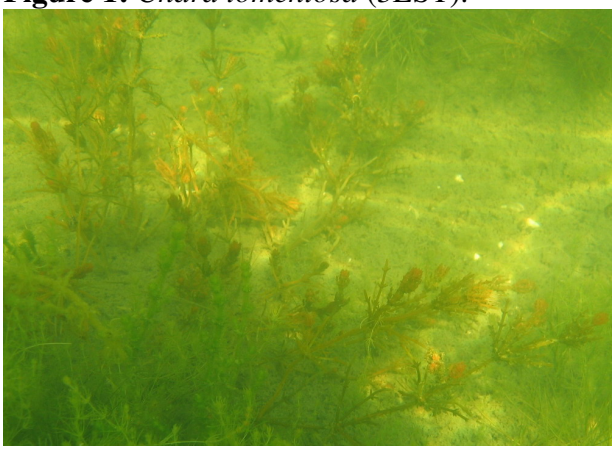

Figure 2: ***Chara baltica*** (3EST).

Description of the habitat: This habitat hosts a large number of different charophyte species. The habitat is also characterized by the presence of some higher plants. Invertebrate biomasses are very low and the habitat is characterised by different bivalve species. This habitat hosts small number of plant and invertebrate species.

Habitat occurs in coastal areas with moderate-high exposure to ice and waves. Substrate is mainly sand, clay and pebbles. Habitat is found in depth range 0.2-5 m. The lowest salinity for the habitat is around 1 psu. In project areas the estimated coverage of the habitat is 97.56 km^2 (1.12 %).

Functions: Charophytes have different roles in aquatic ecosystems. Charophyte meadows have a strong positive effect on water transparency in lakes through stabilizing the sediment with rhizoids and reducing zoo- and phytoplankton densities. *Chara* beds are acting as nutrient sinks in shallow lakes, bays and inlets. They are an important component in the food-web belonging into the diet of benthic invertebrates, waterfowl, fish and fish larvae. Besides, charophytes offer a shelter for numerous invertebrates.

Conservation value: This habitat may belong to the habitat types sandbanks (1110), estuaries (1130), large shallow inlets and bays (1160) and sandflats (1140) included in the habitat Directive Annex I list.

This habitat has high conservation value due to hosting specific species and also providing important ecological function. Threats are mainly connected to human induced eutrophication, mechanical disturbance as well as pollution.

Species list (algae and plants):

1. *Ceramium tenuicorne*
2. *Ceratophyllum demersum*
3. *Chaetomorpha linum*
4. *Chara aspera*
5. *Chara baltica*
6. *Chara canescens*
7. *Chara connivens*

Species list (invertebrates):

1. *Bithynia tentaculata*
2. *Cerastoderma glaucum*
3. *Chironomidae*
4. *Coleoptera*
5. *Cordylophora caspia*
6. *Corophium volutator*
7. *Diptera*

8. *Chara tomentosa* 9. *Cladophora glomerata* 10. *Cladophora rupestris* 11. *Coccotylus truncatus* 12. *Dictyosiphon foeniculaceus* 13. *Fontinalis* 14. *Fucus vesiculosus* 15. *Furcellaria lumbricalis* 16. *Lemna trisulca* 17. *Myriophyllum spicatum* 18. *Najas marina* 19. *Pilayella littoralis* 20. *Polysiphonia fucoides* 21. *Potamogeton pectinatus* 22. *Potamogeton perfoliatus* 23. *Rhizoclonium riparium* 24. *Rhodomela confervoides* 25. *Ruppia maritima* 26. *Sphacelaria arctica* 27. *Stictyosiphon tortilis* 28. *Tolypella nidifica* 29. *Ulothrix sp* 30. *Ulva intestinalis* 31. *Urospora penicilliformis* 32. *Zannichellia palustris* 33. *Zostera marina*	8. *Gammarus oceanicus* 9. *Gammarus salinus* 10. *Gammarus tigrinus* 11. *Gammarus zaddachi* 12. *Gonothyraea loveni* 13. *Hediste diversicolor* 14. *Hirudinea sp* 15. *Hydrobia ulvae* 16. *Hydrobia ventrosa* 17. *Idotea balthica* 18. *Idotea chelipes* 19. *Jaera albifrons* 20. *Lymnaea peregra* 21. *Macoma balthica* 22. *Melita palmata* 23. *Mya arenaria* 24. *Mytilus trossulus* 25. *Odonata* 26. *Theodoxus fluviatilis* 27. *Trichoptera*

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Dugdale, T.M., Hicks, B.J., de Winton, M. & Taumoepeau, A. 2006. Fish exclosures versus intensive fishing to restore charophytes in a shallow New Zealand lake. Aquat Conserv: Mar. Freshw. Ecosyst. 16: 193–202.

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16. Moderately exposed soft bottoms with *Furcellaria lumbricalis*

Name: Moderately exposed soft bottoms with *Furcellaria lumbricalis*

Characterising features: Loose *Furcellaria lumbricalis*

Figure 1: Loose furcellaria exists nowadays only in the West-Estonian Archipelago Sea (3EST).

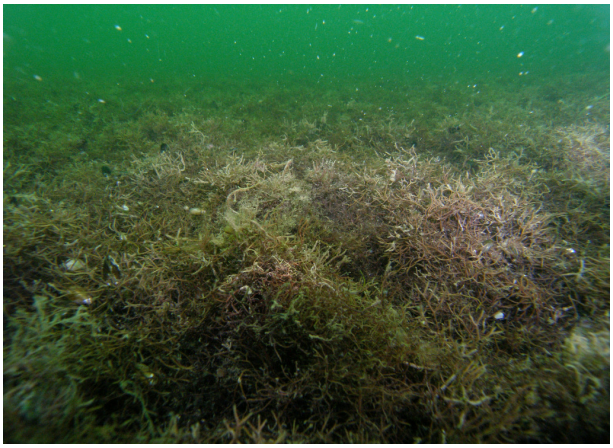

Figure 2: At the edge of the mat (3EST).

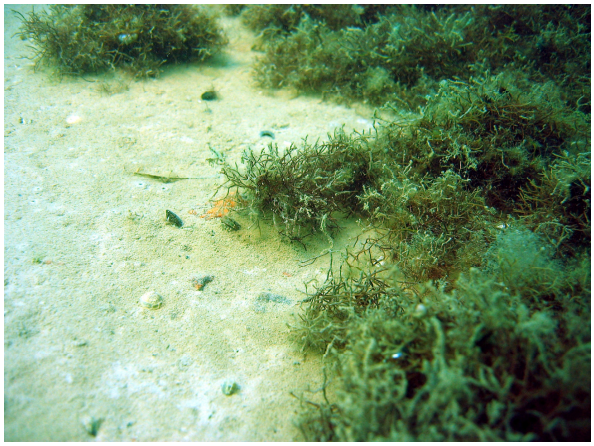

Figure 3: Drifting anchor causes the disturbance in loose furcellaria community**.**

Figure 4: *F. lumbriacalis* and *Coccotylus truncates.*

Description of the habitat: This habitat hosts a free floating red algae *Furcellaria lumbricalis* and *Coccotylus truncates* which form a 0.15-0.3 m thick carpet on the seafloor. The proportion of the two main dominant species differs slightly depending on locality but usually 60–70% of the biomass is made up by *F. lumbricalis*, while *C. truncatus* accounts for 30–35%, on average. The share of other species is usually low, less than 5%. Among invertebrates the bivalve *Mytilus trossulus* has the highest biomass. Invertebrate biomasses are very high. This habitat hosts small number of plant and invertebrate species.

Habitat occurs in coastal areas with low exposure to ice and waves. Substrate is mainly sand and clay. Habitat is found in depth range (3)5-9 m at salinity around 6 psu. In project areas the estimated coverage of the habitat is 477.76 km^2 (5.66 %).

Functions: This unique habitat has a very specific function. Characteristic hydrological conditions create possibility of establishing high biological productivity on soft bottom below the depth usually inhabited by macrovegetation. Loose algal community creates habitat for different species which otherwise would not be able to colonize the substrate. Besides ecological value this habitat host communities used commercially as raw material for agar production.

Conservation value: This habitat may belong to the habitat types sandbanks (1110) and large shallow inlets and bays (1160) included in the habitat Directive Annex I list.

Habitat has high conservation value due to unique loose-lying algal communities.

Species list (algae and plants):

1. *Aglaothamnion roseum*
2. *Ceramium tenuicorne*
3. *Ceramium virgatum*
4. *Chaetomorpha linum*
5. *Cladophora glomerata*
6. *Cladophora rupestris*
7. *Coccotylus truncates*
8. *Dictyosiphon foeniculaceus*
9. *Fucus vesiculosus*
10. *Furcellaria lumbricalis*
11. *Pilayella littoralis*
12. *Polysiphonia fibrillosa*
13. *Polysiphonia fucoides*
14. *Potamogeton pectinatus*
15. *Rhizoclonium riparium*
16. *Rhodomela confervoides*
17. *Ruppia maritima*
18. *Sphacelaria arctica*
19. *Stictyosiphon tortilis*
20. *Tolypella nidifica*
21. *Ulothrix sp*
22. *Zostera marina*

Species list (invertebrates):

1. *Asellus aquaticus*
2. *Balanus improvisus*
3. *Cerastoderma glaucum*
4. *Chironomidae*
5. *Corophium volutator*
6. *Gammarus juv*
7. *Gammarus oceanicus*
8. *Gammarus salinus*
9. *Gonothyraea loveni*
10. *Hediste diversicolor*
11. *Hydrobia ulvae*
12. *Idotea balthica*
13. *Idotea chelipes*
14. *Jaera albifrons*
15. *Leptocheirus pilosus*
16. *Lymnaea peregra*
17. *Macoma balthica*
18. *Marenzelleria neglecta*
19. *Monoporeia affinis*
20. *Mya arenaria*
21. *Mytilus trossulus*
22. *Oligochaeta*
23. *Piscicola geometra*
24. *Saduria entomon*
25. *Theodoxus fluviatilis*
26. *Trichoptera*

References:

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Martin, G., Paalme, T. & Torn, K. 2006. Seasonality pattern of biomass accumulation in a drifting *Furcellaria lumbricalis* community in the waters of the West Estonian Archipelago, Baltic Sea. J. of Appl. Phycol. 18(3): 557–563.

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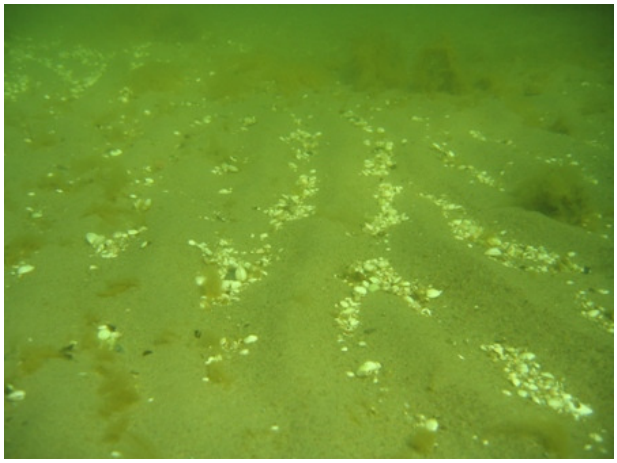
17. Moderately exposed soft bottoms with bivalves

Name: Moderately exposed soft bottoms with bivalves

Characterising features: *Macoma balthica, Mya arenaria, Cerastoderma glaucum*

Figure 1: Bivalve shells together with brown filamentous algae (3EST).

Figure 2: Bivalve shells in between sand dunes (3EST).



Description of the habitat: This habitat hosts different macroalgal species but their biomasses are low. The benthic biomasses are dominated by many bivalve species. Invertebrate biomasses are very high. This habitat hosts high number of plant and invertebrate species. Habitat prevails in coastal areas with low-moderate exposure to ice and waves. Sand and clay prevail as substrate.

Habitat is found in the Estonian and Latvian coastal sea in depth range 0-20 m at lowest salinity 2 psu. In project areas (EST) the estimated coverage of the habitat is 1852.75 km^2 (21.96 %).

Functions: This habitat has ecological function as sink for organic matter and nutrients.

Conservation value: This habitat may belong to the habitat types sandbanks (1110), estuaries (1130), large shallow inlets and bays (1160) and sandflats (1140) included in the habitat Directive Annex I list.

The conservation value of the habitat depends highly on mechanisms behind the high biomass of bivalves – whether they are natural or human-introduced. Nevertheless the habitats are valuable productive areas. Threats to the habitats are mainly connected to occurrence of oxygen deficiency or anoxic conditions due to increase of eutrophication. Also dredging and dumping activities cause large-scale disturbances.

Species list (algae and plants):

1. *Aglaothamnion roseum*
2. *Ceramium tenuicorne*
3. *Ceramium virgatum*
4. *Chaetomorpha linum*
5. *Chara aspera*
6. *Chara baltica*
7. *Chara canescens*
8. *Chara connivens*

Species list (invertebrates):

1. *Asellus aquaticus*
2. *Balanus improvisus*
3. *Bathyporeia pilosa*
4. *Bithynia tentaculata*
5. *Cerastoderma glaucum*
6. *Chironomidae*
7. *Corophium volutator*
8. *Crangon crangon*

9. *Chorda filum* 10. *Cladophora glomerata* 11. *Cladophora rupestris* 12. *Coccotylus truncatus* 13. *Dictyosiphon foeniculaceus* 14. *Ectocarpus siliculosus* 15. *Fucus vesiculosus* 16. *Furcellaria lumbricalis* 17. *Monostroma balticum* 18. *Myriophyllum spicatum* 19. *Pilayella littoralis* 20. *Polysiphonia fibrillosa* 21. *Polysiphonia fucoides* 22. *Potamogeton pectinatus* 23. *Potamogeton perfoliatus* 24. *Rhizoclonium riparium* 25. *Rhodomela confervoides* 26. *Ruppia maritima* 27. *Sphacelaria arctica* 28. *Stictyosiphon tortilis* 29. *Zannichellia palustris* 30. *Zostera marina* 31. *Tolypella nidifica* 32. *Ulothrix sp* 33. *Ulva intestinalis* 34. *Urospora penicilliformis*	9. *Gammarus oceanicus* 10. *Gammarus salinus* 11. *Gammarus zaddachi* 12. *Gammarus tigrinus* 13. *Gonothyraea loveni* 14. *Halicryptus spinulosus* 15. *Hediste diversicolor* 16. *Hydrobia ulvae* 17. *Hydrobia ventrosa* 18. *Idotea balthica* 19. *Idotea chelipes* 20. *Jaera albifrons* 21. *Leptocheirus pilosus* 22. *Lymnaea peregra* 23. *Macoma balthica* 24. *Marenzelleria neglecta* 25. *Monoporeia affinis* 26. *Mya arenaria* 27. *Mysis mixta* 28. *Mytilus trossulus* 29. *Neomysis integer* 30. *Odonata* 31. *Oligochaeta* 32. *Potamopyrgus antipodarum* 33. *Saduria entomon* 34. *Theodoxus fluviatilis* 35. *Trichoptera*

References:

Kotta, I., Orav-Kotta, H. & Kotta, J. 2003. Macrozoobenthos assemblages in highly productive areas of the Estonian coastal sea. Proc. Estonian Acad. Sci. Biol. Ecol. 52: 149–165.

Gray, J. S. 2002. Species richness of marine soft sediments. Mar. Ecol. Prog. Ser. 244: 285–297.

18. Moderately exposed soft bottoms with no particular species dominance

Name: Moderately exposed soft bottoms with no particular species dominance

Characterising features: No particular species dominance

Figure 1: Shallow sandy sea with few charophytes (4EST).

Figure 2: Sand dunes (1EST).

Description of the habitat: This habitat has no clear dominance of plant and invertebrate species. Among plants the most characteristic species is the brown alga *Fucus vesiculosus* and filamentous algae but their biomasses are low. Among invertebrates various gastropod and bivalve species predominate. This habitat hosts moderate number of plant and high number of invertebrate species. Habitat prevails in coastal areas with low-moderate exposure to ice and waves.

Habitat is found in the Estonian and Latvian coastal sea in depth range 0-20 m, the lowest salinity for the habitat is around 2 psu. In project areas (EST) the estimated coverage of the habitat is 2980.12 km^2 (35.32 %).

Functions: This habitat has ecological function as sink for organic matter and nutrients.

Conservation value: This habitat has low conservation value due to low biodiversity. Threats to the habitats are mainly connected to occurrence of oxygen deficiency or anoxic conditions due to increase of eutrophication. Also dredging and dumping activities cause large-scale disturbances.

Species list (algae and plants):

1. *Aglaothamnion roseum*
2. *Ceramium tenuicorne*
3. *Ceramium virgatum*
4. *Chaetomorpha linum*
5. *Chara aspera*
6. *Chara baltica*
7. *Chara canescens*
8. *Chara connivens*
9. *Chara sp*

Species list (invertebrates):

1. *Asellus aquaticus*
2. *Balanus improvisus*
3. *Bathyporeia pilosa*
4. *Bithynia tentaculata*
5. *Cerastoderma glaucum*
6. *Chironomidae*
7. *Coleoptera*
8. *Cordylophora caspia*
9. *Corophium volutator*

10. Chorda filum *11. Cladophora glomerata* *12. Cladophora rupestris* *13. Coccotylus truncatus* *14. Dictyosiphon foeniculaceus* *15. Elodea canadensis* *16. Fucus vesiculosus* *17. Furcellaria lumbricalis* *18. Monostroma balticum* *19. Myriophyllum spicatum* *20. Pilayella littoralis* *21. Polysiphonia fibrillosa* *22. Polysiphonia fucoides* *23. Potamogeton pectinatus* *24. Potamogeton perfoliatus* *25. Rhizoclonium riparium* *26. Rhodomela confervoides* *27. Ruppia maritima* *28. Sphacelaria arctica* *29. Stictyosiphon tortilis* *30. Tolypella nidifica* *31. Ulothrix sp* *32. Ulva intestinalis* *33. Urospora penicilliformis* *34. Zannichellia palustris* *35. Zostera marina*	*10. Crangon crangon* *11. Gammarus juv* *12. Gammarus locusta* *13. Gammarus oceanicus* *14. Gammarus salinus* *15. Gammarus tigrinus* *16. Gammarus zaddachi* *17. Gonothyraea loveni* *18. Halicryptus spinulosus* *19. Hediste diversicolor* *20. Hirudinea sp* *21. Hydrobia ulvae* *22. Hydrobia ventrosa* *23. Idotea balthica* *24. Idotea chelipes* *25. Jaera albifrons* *26. Lepidoptera* *27. Leptocheirus pilosus* *28. Lymnaea peregra* *29. Macoma balthica* *30. Marenzelleria neglecta* *31. Monoporeia affinis* *32. Mya arenaria* *33. Mytilus trossulus* *34. Neomysis integer* *35. Oligochaeta* *36. Palaemon adspersus* *37. Potamopyrgus antipodarum* *38. Saduria entomon* *39. Tenellia adspersa* *40. Theodoxus fluviatilis*

References:

Kotta, I., Orav-Kotta, H. & Kotta, J. 2003. Macrozoobenthos assemblages in highly productive areas of the Estonian coastal sea. Proc. Estonian Acad. Sci. Biol. Ecol. 52: 149–165.

Gray, J. S. 2002. Species richness of marine soft sediments. Mar. Ecol. Prog. Ser. 244: 285–297.

19. Exposed hard bottoms with *Furcellaria lumbricalis*

Name: Exposed hard bottoms with *Furcellaria lumbricalis*

Characterising features: *F. lumbricalis, Mytilus trossulus*

Figure 1: Dense coverage of *F. lumbricalis* on hard bottoms.

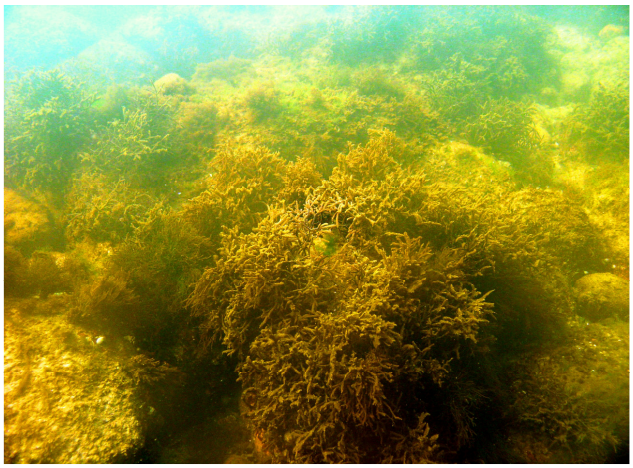


Figure 2: Habitat forming red macroalgae *F. lumbricalis* in the eastern Baltic.

Figure 3: Small-scale fragmentation of exposed hard bottoms with *F. lumbricalis*.

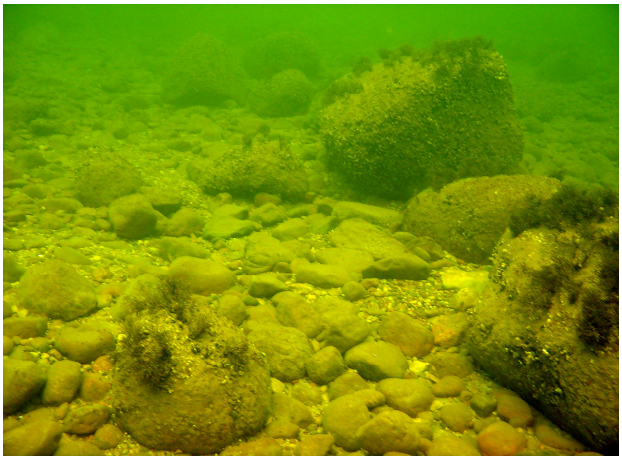


Figure 4: Exposed hard bottoms with *F. lumbricalis* at depth of 6 m in the eastern Baltic.

Description of the habitat: The habitat comprises fields of stones and boulders colonised by blue mussels *Mytilus trossulus* and red algae *F. lumbricalis*. Other substrate types (e.g. hard glacial clay, sand and gravel) occur occasionally forming high seabed heterogeneity.
The habitat stretches along the exposed coastlines: Latvian coastline in the Baltic Proper and mainland coastline of Lithuania. Typically habitat is found in depths between 6 and 12 meters. Locally, however, the habitat may also occur in depths down to 2 m (sheltered conditions) and as deep as 15 m.

Approximately 30 macro-invertebrate species are recorded in the habitat with the average of 14±4 species per sample. Due to high small-scale patchiness of substrate macro-invertebrate density and biomass are highly variable (2 875 – 243 875 ind m^{-2} and 10 -5 110 g m^{-2} respectively).

Macroalgae community consist of 19 species or higher taxonomic units. Depending on local

seabed structure, exposure level and distance to the sand fields, the species composition and coverage vary in a wide range. Typically coverage of benthic algae do not exceed 30-50% of the hard surface. In optimal conditions coverage and biomass of benthic algae is much higher than that of mussels. The highest coverage (>80%) of *F. lumbricalis* is found in depths of 6 to 9 m, however visually it might be underestimated due to overgrowth of epiphytic *Ceramium* species. High coverage areas (biomass of *F. lumbricalis* as high as 4 kg fresh weight m^{-2}) are relatively small and area of such patches is often less than several hundreds square meters.

Functions: The habitat is characterised by relatively high benthic primary production and supports high macro-invertebrate species diversity in exposed waters. The habitat is preferred by grazing crustacean species such as isopod and amphipod crustaceans. It also provides shelter for small fishes and fish fry, dominant red algae serve main spawning substrate for Baltic herring (*Clupea harengus membras*). The habitat provides food source for important bird species e.g. long-tailed duck (*Clangula hyemalis*) and Steller's eider (*Polysticta stelleri*).

Conservation value: The habitat is one of the most valuable along the exposed eastern Baltic Sea coast and belongs to the reef habitat type (1170) included in the Habitat Directive Annex I list.

Available data show local habitat alteration and fragmentation since 1960's. Local alterations were primarily associated with the areas of dense *F. lumbricalis* stands, which have been transformed into seabed patches with individual specimens only. In the eastern Baltic the habitat is resistant to eutrophication, since maximum depth limit of habitat forming red algae did not change over the last 40 years. There are scientific evidences on the limiting role of exposure and sand abrasion effects on degradation exposed hard bottoms with *F. lumbricalis*, therefore habitat is likely to be vulnerable to increased significant wave height which was reported to be characteristic for recent climate change period. Coastline modifications including beach nourishment and build up of shore protection structures may have significant impacts on habitat status if considerable changes in local hydrodynamic conditions and sediment transport are observed.

Species list (algae and plants):

1. *Ceramium siliquosum*
2. *Ceramium tenuicorne*
3. *Ceramium virgatum*
4. *Chroodactylon ornatum*
5. *Cladophora glomerata*
6. *Cladophora rupestris*
7. *Coccotylus truncatus*
8. *Ectocarpus siliculosus*
9. *Furcellaria lumbricalis*
10. *Hildenbrandia rubra*
11. *Polyides rotundus*
12. *Polysiphonia fibrillosa*
13. *Polysiphonia fucoides*
14. *Pseudolithoderma spp.*
15. *Pylaiella littoralis*
16. *Rhodochorton purpureum*
17. *Rhodomela confervoides*
18. *Sphacelaria arctica*
19. *Sphacelaria plumigera*

Species list (invertebrates):

1. *Balanus improvisus*
2. *Bathyporea pilosa*
3. *Chelicorophium curvispinum*
4. *Corophium lacustre*
5. *Corophium multisetosum*
6. *Corophium volutator*
7. *Dendrocoelum lacteum*
8. *Electra crustulenta*
9. *Fabricia sabella*
10. *Gammarus duebeni*
11. *Gammarus locusta*
12. *Gammarus oceanicus*
13. *Gammarus salinus*
14. *Gammarus tigrinus*
15. *Gammarus zaddachi*
16. *Hediste diversicolor*
17. *Jaera albifrons*
18. *Leptocheirus pilosus*
19. *Marenzelleria neglecta*

	20. Mya arenaria *21. Mytilus trossulus* *22. Neomysis integer* *23. Palaemon elegans* *24. Pygospio elegans* *25. Theodoxus fluviatilis*

References:

Bučas, M., Daunys, D. & Olenin, S. 2007. Overgrowth patterns of the red algae *Furcellaria lumbricalis* at an exposed Baltic Sea coast: The results of a remote underwater video data analysis. Est. Coast. Shelf Sci. 75: 308–316

Bučas, M., Daunys, D. & Olenin, S. 2009. Recent distribution and stock assessment of the red alga *Furcellaria lumbricalis* on an exposed Baltic Sea coast: combined use of field survey and modelling methods. Oceanologia 51: 341–359.

20. Exposed hard bottoms with *Balanus improvisus*

Name: Exposed hard bottoms with *Balanus improvisus*

Characterising features: *B. improvisus*

Figure 1: Sparse barnacles and mussels on a boulders and stones adjacent to a coarse sand field.

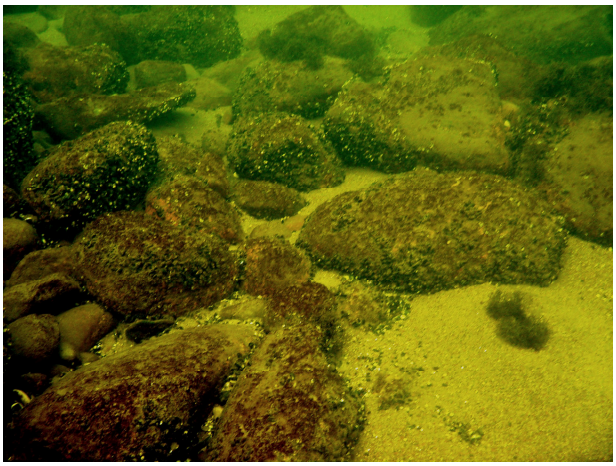


Figure 2: Shell deposits of large mussels in shallow and highly exposed areas.

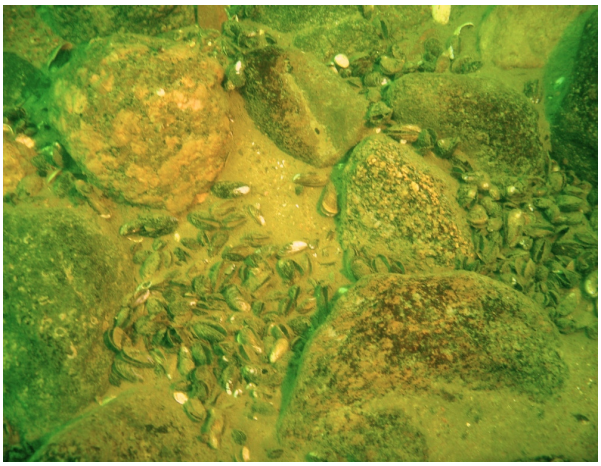


Figure 3: Hard glacial clay and single stones colonized by sparse colonies of barnacles *B. improvisus.*

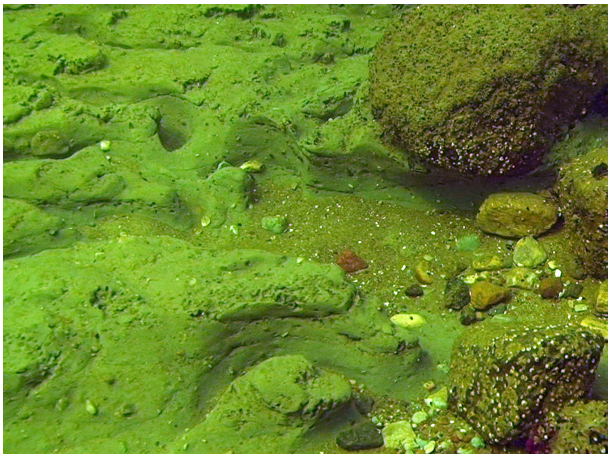
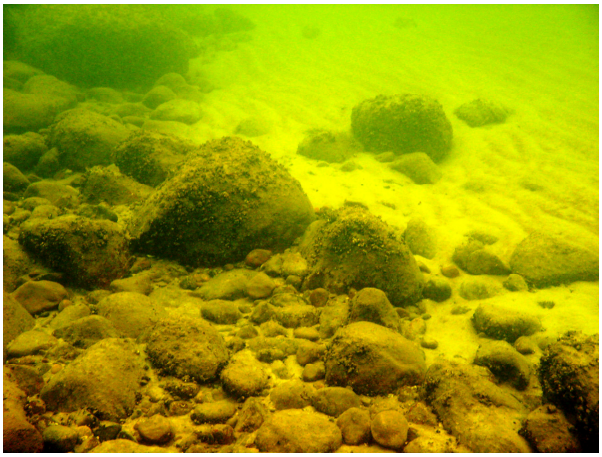


Figure 4: Large scale view of exposed hard bottoms dominated by barnacles *B. improvisus.*



Description of the habitat: The habitat typically comprises intermediate zone between exposed hard bottoms with *Mytilus trossulus* and *B. improvisus* and exposed soft bottoms with *Macoma balthica*. The most distinctive feature of the habitat is individual groups of stones and (less frequently) boulders predominantly colonised by barnacles *B. improvisus*. The blue mussels (*M. trossulus*) might also be abundant, although never dominant. On scale of few meters, hard bottom substrates typically alternate with patches of sand, gravel and moraine. Coverage of these sediment types may vary significantly. Due to high heterogeneity of bottom substrates and local hydrodynamic effects, the distribution of dominant organisms is highly patchy: from zones devoid of attached organisms up to sparse colonies of barnacles, which dominate over mussels.

The habitat is found in shallow areas along the Lithuanian mainland and Latvian coastlines

and may occur up to 25 meters depth, where single boulders are surrounded by mobile sand and mussels are limited by intensive abrasion. In the photic zone the habitat is found in areas, where growth of perennial macroalgae species is limited by hydrodynamic conditions. In these conditions habitat can be also considered as a result of degradation of exposed hard bottoms with *M. trossulus* or *Furcellaria lumbricalis*.

Approximately 25 macro-invertebrate species are recorded in the habitat with the average of 8±4 species per sample. Due to high small-scale patchiness of substrate density and biomass of benthic invertebrates are highly variable (4 790 – 933 000 ind m^{-2} and 5 -24 875 g m^{-2} respectively).

Macroalgae community consist of 8 species. Their composition and coverage vary in a wide range depending on local seabed structure, exposure level and distance to the sand fields. Typical coverage of benthic algae is low except during vegetation period in shallow areas preferred by seasonal species.

Functions: Benthic species diversity is lower than in the hard bottoms dominated by *M. trossulus* and *F. lumbricalis*. The habitat is preferred by mobile amphipod species and polychaetes.

Conservation value: The habitat belongs to the reef habitat type (1170) included in the Habitat Directive Annex I list.

In the Baltic the habitat is resistant to existing levels of nutrient loads and increase in biomass of mussels was reported in course of eutrophication. In enclosed bays the habitat is threatened by temporary anoxia in case of extreme organic enrichment; however such cases have not been reported for exposed south-eastern Baltic.

Species list (algae and plants):

1. *Hildenbrandia rubra*
2. *Coccotylus truncatus*
3. *olysiphonia fucoides*
4. *Polyides rotundus*
5. *Pylaiella littoralis*
6. *Ectocarpus siliculosus*
7. *Sphacelaria arctica*
8. *Sphacelaria plumigera*

Species list (invertebrates):

1. *Balanus improvisus*
2. *Bathyporeia pilosa*
3. *Chelicorophium curvispinum*
4. *Corophium volutator*
5. *Crangon crangon*
6. *Electra crustulenta*
7. *Fabricia sabella*
8. *Gammarus salinus*
9. *Gammarus zadachi*
10. *Gammarus tigrinus*
11. *Harmothoe sarsi*
12. *Hediste diversicolor*
13. *Hydrobia spp.*
14. *Idothea baltica*
15. *Jaera albifrons*
16. *Marenzelleria neglecta*
17. *Mysis mixta*
18. *Mytilus trossulus*
19. *Neomysis integer*
20. *Pygospio elegans*
21. *Theodoxus fluviatilis*

References:

Bučas, M., Daunys, D. & Olenin, S. 2007. Overgrowth patterns of the red algae *Furcellaria lumbricalis* at an exposed Baltic Sea coast: The results of a remote underwater video data

analysis. Est. Coast. Shelf Sci. 75(3):308–316.

Cederwall, H., Jermakovs, V. & Lagzdins, G. 1999. Long-term changes in the soft-bottom macrofauna of the Gulf of Riga. ICES Journal of Marine Science 56: 41–48.

Elmgren, R., Rosenberg, R., Andersin, A.-B., Evans, S., Kangas, P., Lassig, J., Leppakoski, E. & Varmo, R. 1984. Benthic macrofauna in the Gulf of Bothnia (Northern Baltic). Finnish Marine Research 250: 3–18.

Kube, J., Gosselck, F., Powilleit, M. & Warzocha, J. 1997. Long-term changes in the benthic communities of the Pomeranian Bay (southern Baltic Sea). Helgolander Meeresunt 51: 399–416.

Zmudzinski, L. & Osowiecki, A. 1991. Long-term changes in the bottom macrofauna of the Puck Bay. Acta Ichthyol. Piscat. 21: 259–264.

21. Exposed hard bottoms with *Mytilus trossulus* and *Balanus improvisus*

Name: Exposed hard bottoms with *Mytilus trossulus* and *Balanus improvisus*

Characterising features: Colonies of mussels and barnacles on boulders and stones.

Figure 1: Large boulders with high coverage of *M. trossulus* and *B. improvisus* colonies.

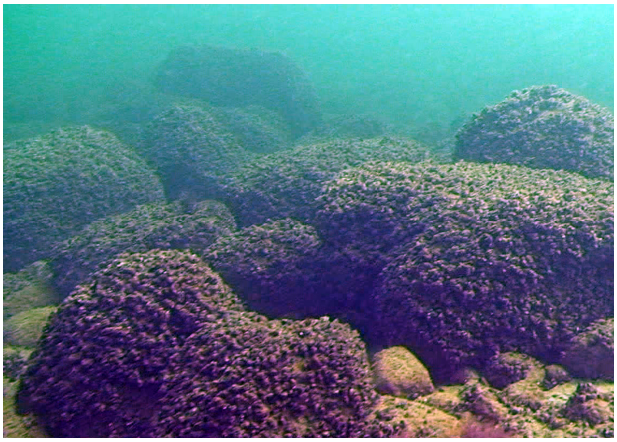


Figure 2: Typical view of exposed hard bottoms with patchy distribution of mussel and barnacle colonies.

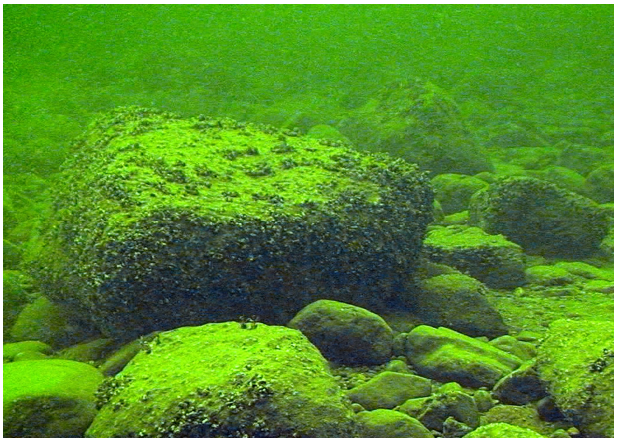


Figure 3: Dense mussel colonies on boulders and stones in the aphotic zone.

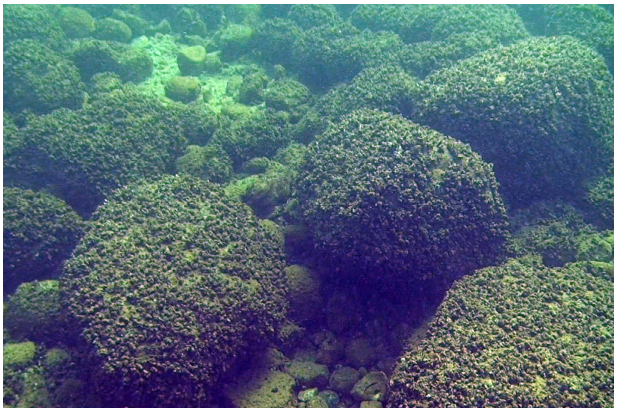


Figure 4: Dense mussel colony on a boulder.

Description of the habitat: The habitat comprises stone and boulder fields colonised by blue mussels *M. trossulus* and barnacles *B. improvisus*. On scale of few meters, hard bottom substrates may alternate with patches of sand, gravel and moraine. Due to high heterogeneity of bottom substrates and local hydrodynamic effects the distribution of dominant organisms can be extremely patchy: from zones devoid of attached organisms up to dense colonies of mussels and barnacles.

The habitat stretches along the Lithuanian mainland and Latvian coastlines up to 40-50 meters depth. In the photic zone the habitat is found in areas, where growth of perennial macroalgae species is limited by hydrodynamic conditions.

Approximately 30 macro-invertebrate species are recorded in the habitat with the average of 13±3 species per sample. Due to high small-scale patchiness of substrate density and biomass of benthic invertebrates are highly variable (11 350 – 134 175 ind m^{-2} and 100 -9 000 g m^{-2}

respectively).

In photic zone macroalgae community consist of up to 8 species. Their composition and coverage vary in a wide range depending on local seabed structure, exposure level and distance to the sand fields. Typically coverage of benthic algae is low except during vegetation period in shallow areas preferred by seasonal species.

Functions: The habitat is characterised by relatively high secondary production and supports high benthic species diversity. The habitat is preferred by mobile crustacean species including amphipods and mysids. It also provides shelter for small fishes and fish fry and serves a spawning substrate for Baltic herring (*Clupea harengus membras*). The habitat provides food source for important bird species e.g. long-tailed duck (*Clangula hyemalis*) and Steller's eider (*Polysticta stelleri*). Since mussels remove large amounts of organic particles from the water column, by the functional type this habitat is usually defined as a biological filter.

Conservation value: The habitat belongs to the reef habitat type (1170) included in the Habitat Directive Annex I list.

In the Baltic the habitat is resistant to existing levels of nutrient loads and increase in biomass of mussels was reported in course of eutrophication. In enclosed bays the habitat is threatened by temporary anoxia in case of extreme organic enrichment; however such cases have not been reported for exposed south-eastern Baltic. Locally, in areas of sand extraction and sediment disposal. Coastline modifications including beach nourishment and build up of shore protection structures usually affect local hydrodynamic conditions and sediment transport, therefore may have significant impacts on habitat status.

Species list (algae and plants):

1. *Hildenbrandia rubra*
2. *Coccotylus truncatus*
3. *Polysiphonia fucoides*
4. *Polyides rotundus*
5. *Pylaiella littoralis*
6. *Ectocarpus siliculosus*
7. *Sphacelaria arctica*
8. *Sphacelaria plumigera*

Species list (invertebrates):

1. *Balanus improvisus*
2. *Bathyporea pilosa*
3. *Chelicorophium curvispinum*
4. *Corophium lacustre*
5. *Corophium multisetosum*
6. *Corophium volutator*
7. *Dendrocoelum lacteum*
8. *Electra crustulenta*
9. *Fabricia sabella*
10. *Gammarus duebeni*
11. *Gammarus inaequicauda*
12. *Gammarus oceanicus*
13. *Gammarus salinus*
14. *Gammarus tigrinus*
15. *Gammarus zaddachi*
16. *Harmothoe sarsi*
17. *Hediste diversicolor*
18. *Idothea baltica*
19. *Jaera albifrons*
20. *Leptocheirus pilosus*
21. *Marenzelleria neglecta*
22. *Mytilus trossulus*
23. *Neomysis integer*
24. *Planaria torva*
25. *Praunus inermis*

	26. Pygospio elegans *27. Theodoxus fluviatilis*

References:

Bučas, M., Daunys, D. & Olenin, S. 2007. Overgrowth patterns of the red algae *Furcellaria lumbricalis* at an exposed Baltic Sea coast: The results of a remote underwater video data analysis. Est. Coast. Shelf Sci. 75(3):308–316-

Cederwall, H., Jermakovs, V. & Lagzdins, G. 1999. Long-term changes in the soft-bottom macrofauna of the Gulf of Riga. ICES Journal of Marine Science 56: 41–48.

Elmgren, R., Rosenberg, R., Andersin, A-B., Evans, S., Kangas, P., Lassig, J., Leppakoski, E. & Varmo, R. 1984. Benthic macrofauna in the Gulf of Bothnia (Northern Baltic). Finnish Marine Research 250: 3–18.

Kube, J., Gosselck, F., Powilleit, M. & Warzocha, J. 1997. Long-term changes in the benthic communities of the Pomeranian Bay (southern Baltic Sea). Helgolander Meeresunt. 51: 399–416.

Zmudzinski, L. & Osowiecki, A. 1991. Long-term changes in the bottom macrofauna of the Puck Bay. Acta Ichthyol. Piscat. 21: 259–264.

22. Exposed moraine ridges with *Mytilus trossulus* and *Balanus improvisus*

Name: Exposed moraine ridges with *Mytilus trossulus* and *Balanus improvisus*

Characterising features: Hard glacial clay ridges with dense colonies of small sized mussels and barnacles.

Figure 1: Elongated moraine ridge of variable width with 2.5 m wide and flat terrace.

Figure 2: Eroded 5 m height round shaped individual moraine ridge.

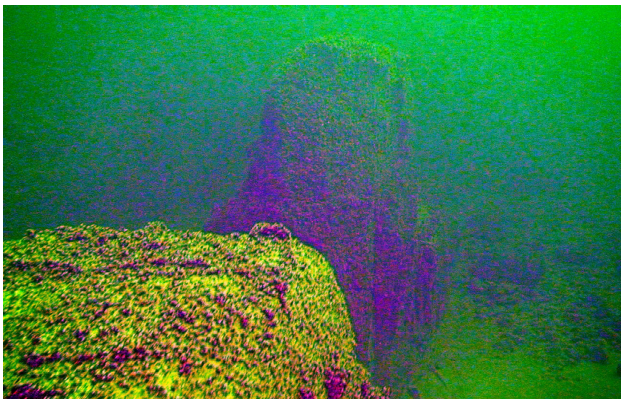


Figure 3: Typical view of strait and narrow 4 m high elongated ridge surrounded by soft bottoms.

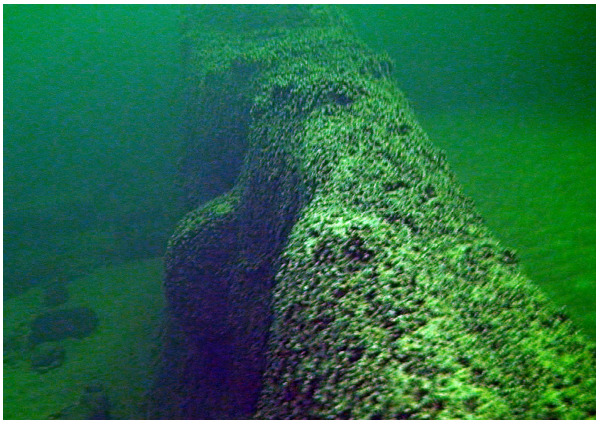
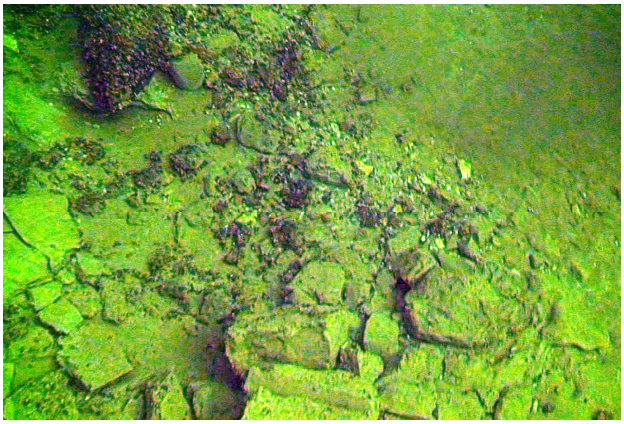


Figure 4: Degraded part of moraine ridge on adjacent soft bottoms.



Description of the habitat: 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. In total 137 ridges have been identified in the area of 4 km^2 along the mainland coast of Lithuania. Size of individual ridge may vary considerably: up to 10 m in width and 110 m in length, with the total area from 15 to 3825 m^{-2}. Deep canyons are formed in case of two parallel ridges.

Moraine ridges are overgrown by dense colonies of mussels *M. trossulus* and barnacles *B. improvisus* high densities of hydroids on sites. Since the habitat is found in the lowest depth range of the photic zone, macroalgae occurrence (if any) is very low.

Functions: The habitat supports typical hard bottom functions: it provides complex environment for benthic species and is colonised by active suspension feeders. The importance

<table>
<tr><td colspan="2">of the habitat for fishes and birds is unknown.</td></tr>
<tr><td colspan="2">Conservation value: The habitat belongs to the reef habitat type (1170) included in the Habitat Directive Annex I list. The habitat is sensitive to physical damage (e.g. anchoring) and its geomorphological structure is not recoverable after such impacts.</td></tr>
<tr><td>Species list (algae and plants):
-</td><td>Species list (invertebrates):
1. Balanus improvisus
2. Electra crustulenta
3. Fabricia sabella
4. Gammarus salinus
5. Mytilus trossulus
6. Cordylophora caspia</td></tr>
</table>

23. Exposed soft bottoms with *Macoma balthica*

Name: Exposed soft bottoms with *Macoma balthica*

Characterising features: *M. balthica*, *Pygospio elegans*.

Figure 1: Shallow exposed soft bottoms with rippled surface and organic material aggregates.

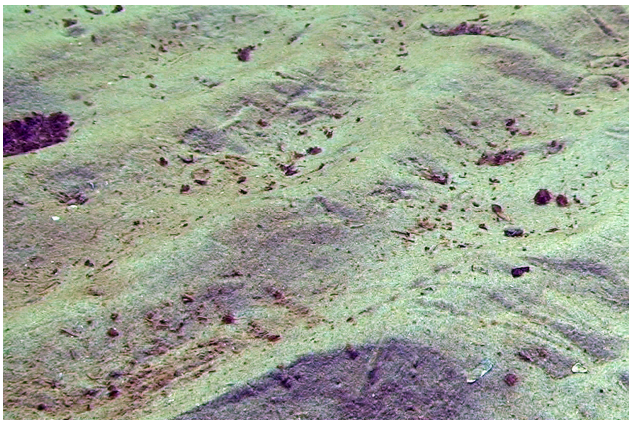


Figure 2: Small-scale heterogeneity of exposed soft bottoms: crawling traces, shells deposits and burrows of *M. balthica*, and tubes of *P. elegans* on sediment surface.

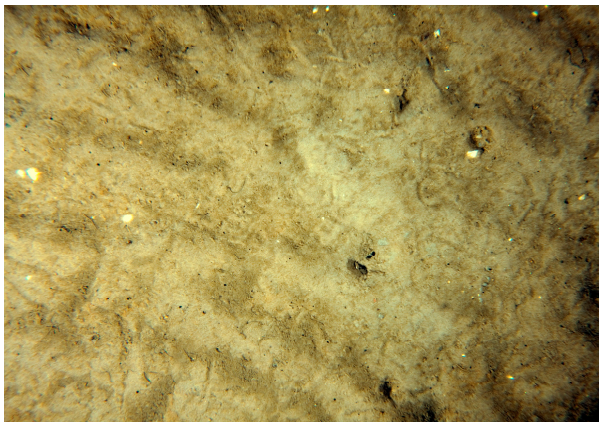


Figure 3: Large scale view of eroded soft bottoms.

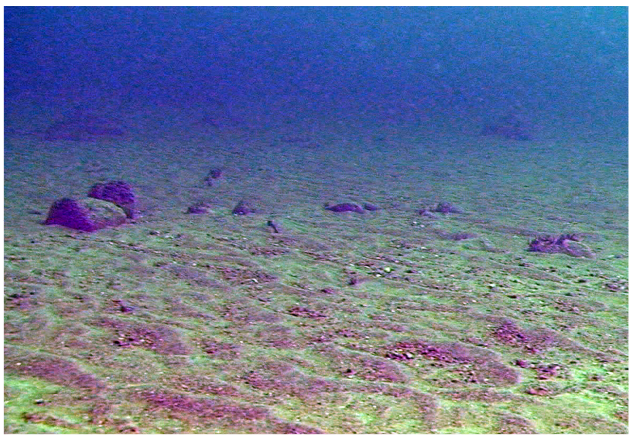
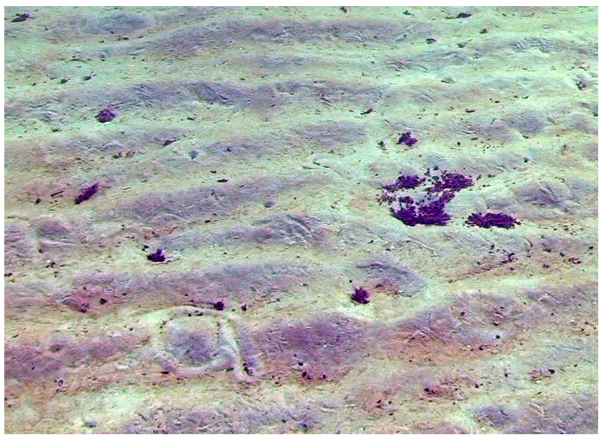


Figure 4: Rippled sediment surface with patches of fine detritus and burrowing traces of flatfishes.



Description of the habitat: The habitat comprises fields of very fine to medium sand inhabited by clams *M. balthica*. Typical habitat features on the sediment surface are crawling traces and narrow openings of *M. balthica* burrows, sandy tubes of spionid worms *Pygospio elegans*. Records of the later feature, however, require still video and close-up photo image. On sites, calcareous shells of bivalve molluscs can be abundant; however this feature depends on local hydrodynamic conditions and meteorological situation. Patches of hard glacial clay, stones and gravel may increase local heterogeneity of the seabed, however these substrates are not typical for the habitat.

The habitat stretches along the exposed Latvian and Lithuanian coastlines and typically is found in depths more than 15 m. Approximately 18 macro-invertebrate species are recorded in the habitat with the average of 6±2 species per sample. The biomass of benthic invertebrates is usually in range of 2-200 g m^{-2}. The dominant species *M. balthica* typically comprises approx.

80 to 90% of the total benthic invertebrate biomass. Numerically, however, polychaete *P. elegans* may reach densities up to 6 000 ind m^{-2}. The structure of the benthic community is changing from more diverse shallow to less heterogeneous deep water at depths of 30-35 m.

Habitat is usually devoid of plants and there are no scientific records on the growth of eelgrass *Zostera marina* in this habitat along the exposed coasts of Latvia and Lithuania. Freely moving fragments of macroalgae as well as single specimens of perennial algae on individual stones can be found in shallow areas.

Functions: The habitat is characterised by relatively high soft sediment macro invertebrate production. The habitat provides important food source for demersal fishes (turbot, flounder) and some migratory bird species (e.g. velvet scouter).

Conservation value: The habitat is widespread in the Baltic Sea and characterised by several typical sand dwelling and glacial relict species. Increase in biomass of benthic invertebrates was reported to be typical response to eutrophication in the period of 1960-1990. Long-term reduction in stock of demersal fishes (e.g. flounder) was also mentioned to be likely reason for biomass increase of dominant bivalve species. The habitat is threatened in areas of sand extraction and sediment disposal.

Species list (algae and plants):

1. *Coccotylus truncatus.*
2. *Polysiphonia fibrillosa*
3. *Polysiphonia fucoides*
4. *Rhodochorton purpureum*
5. *Sphacelaria arctica*
6. *Sphacelaria plumigera*

Species list (invertebrates):

1. *Bathyporea pilosa*
2. *Fabricia sabella*
3. *Halicryptus spinulosus*
4. *Harmothoe sarsi*
5. *Hediste diversicolor*
6. *Marenzelleria neglecta*
7. *Pygospio elegans*
8. *Streblospio shrubsoli*
9. *Corophium lacustre*
10. *Corophium multisetosum*
11. *Corophium volutator*
12. *Crangon crangon*
13. *Saduria entomon*
14. *Cerastoderma glaucum*
15. *Mya arenaria*
16. *Macoma balthica*
17. *Hydrobia spp.*
18. *Potamopyrgus antipodarum*

References:

Cederwall, H., Jermakovs, V. & Lagzdins, G. 1999 Long-term changes in the soft-bottom macrofauna of the Gulf of Riga. ICES Journal of Marine Science 56: 41–48.

Elmgren, R., Rosenberg. R., Andersin. A.-B., Evans, S., Kangas, P., Lassig, J., Leppakoski, E. & Varmo, R. 1984. Benthic macrofauna in the Gulf of Bothnia (Northern Baltic). Finnish Marine Research 250: 3–18.

Kube, J., Gosselck, F., Powilleit, M. & Warzocha, J. 1997. Long-term changes in the benthic communities of the Pomeranian Bay (southern Baltic Sea).Helgolander Meeresun.51: 399–416.

Perrson, L.E. 1987. Baltic eutrophication: a contribution to the discussion. Ophelia 27(1): 31–42.

Zmudzinski, L. & Osowiecki, A. 1991 Long-term changes in the bottom macrofauna of the Puck Bay. Acta Ichthyol. Piscat. 21: 259–264.

24. Exposed soft bottoms with the polychaetes *Pygospio elegans* and *Marenzelleria neglecta*

Name: Exposed soft bottoms with the polychaetes *Pygospio elegans* and *Marenzelleria neglecta*

Characterising features: *P. elegans*.

Figure 1: Exposed soft bottoms with the polychaetes *P. elegans* and organic material aggregates.

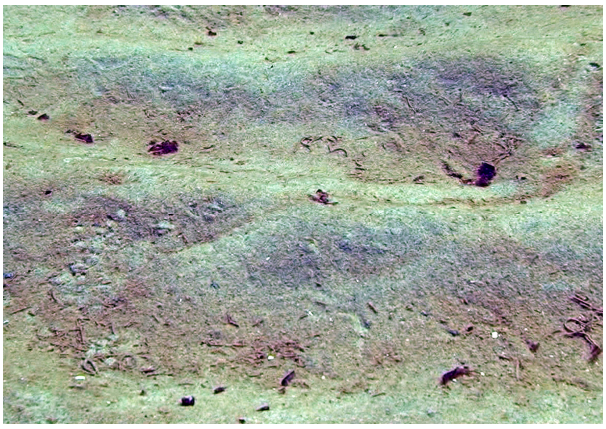


Figure 2: Dense cover of *P. elegans* tubes is the main visual habitat feature at the small-scales.

Description of the habitat: The habitat comprises rippled coarse to fine sand fields colonised by benthic invertebrates, most abundant of them are polychaetes *P. elegans* and *M. neglecta*. Patches of very coarse sand and gravel may occur on sites. The habitat stretches along the exposed Latvian and Lithuanian coastlines in depths from 2 up to 26 meters, however typical depth range does not extend below 10-12 m. In shallow areas the habitat is differentiated from exposed soft bottom with *Macoma balthica* only after analysis of quantitative benthic macrofauna samples.

Instability of the substrate prevents formation of established benthic communities: approximately 18 macro-invertebrate species are recorded in the habitat with the average of 5±2 species per sample. These species are either burrowing infaunal (*M. neglecta, P. elegans, M. baltica*) or actively swimming nectobenthic (*Bathyporeia pilosa, Crangon crangon*) forms adapted to the active hydrodynamic conditions of the exposed sandy coast. Macro-invertebrate density and biomass varies in range of 70 - 11340 ind m^{-2} and 0.03 - 100 g m^{-2} respectively.

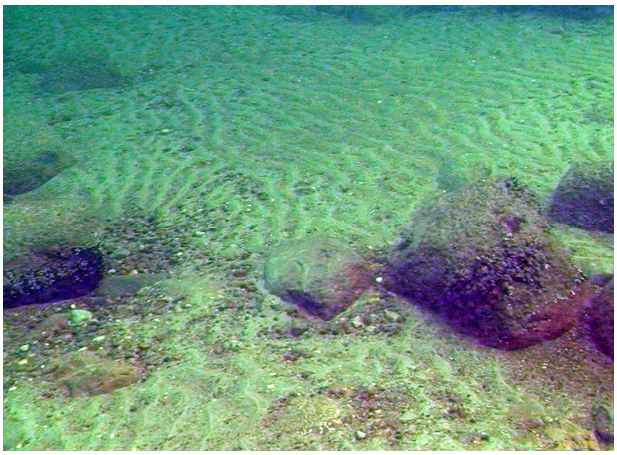
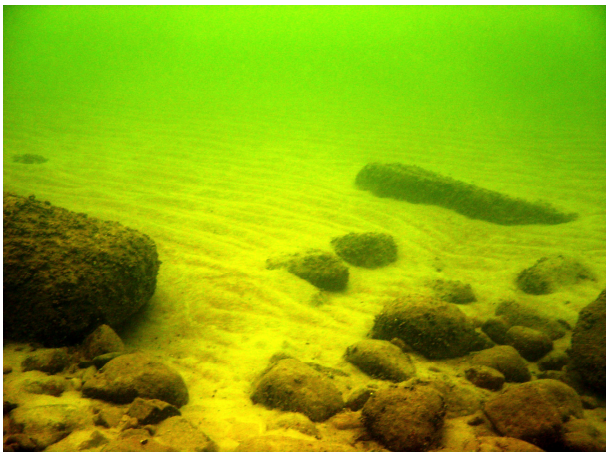
Habitat usually is devoid of attached algae. Perennial *Furcellaria lumbricalis* and annual algae *Pilayella*, *Ectocarpus* and *Ceramium* temporally can form drifting mats.

Functions: The habitat is characterised by relatively low benthic macro-invertebrate species diversity and biomass. The habitat is preferred by deposit-feeders polychaetes *P. elegans*, *M. neglecta* and *Hediste diversicolor*.

Conservation value: Habitat is relatively tolerant to changes in hydrodynamic regime and sediment transport. Dominant polychaete species are resistant to eutrophication and have high recovery rates after impacts.

Species list (algae and plants):	**Species list (invertebrates):**
1. *Ceramium tenuicorne* 2. *Ceramium virgatum* 3. *Ceramium siliquosum.* 4. *Cladophora glomerata* 5. *Cladophora rupestris* 6. *Ectocarpus siliculosus* 7. *Polysiphonia fibrillosa* 8. *Polysiphonia fucoides* 9. *Pilayella littoralis* 10. *Rhodomela confervoides*	1. *Bathyporeia pilosa* 2. *Calliopius laeviusculus* 3. *Cerastoderma glaucum* 4. *Corophium lacustre* 5. *Corophium multisetosum* 6. *Corophium volutator* 7. *Fabricia sabella* 8. *Harmothoe sarsi* 9. *Hediste diversicolor* 10. *Hydrobia spp.* 11. *Leptocheirus pilosus* 12. *Macoma balthica* 13. *Marenzelleria neglecta* 14. *Mya arenaria* 15. *Potamopyrgus antipodarum* 16. *Pygospio elegans* 17. *Saduria entomon* 18. *Streblospio shrubsoli*

25. Exposed soft bottoms with mobile amphipods

Name: Exposed soft bottoms with mobile amphipods	**Characterising features:** High numbers of mobile amphipods on sandy bottoms
Figure 1: Shallow exposed bottoms with scarce epibenthic community on individual stones. 	**Figure 2:** Shallow exposed bottoms with scarce epibenthic community on individual stones. 

Description of the habitat: The habitat comprises shallow sandy areas with scarce infaunal community and relatively dense mobile amphipods such as *Bathyporeia pilosa*. In presence of hard substrate patches, epibenthic community is relatively poor.

The habitat stretches along the exposed Latvian and Lithuanian coastlines and typically is found in shallow coastal areas in depths between 0 and 3 meters.

High mobility of the substrate and sand erosion during storms prevents establishment of stable benthic communities, therefore benthic environment is usually preferred by few small-sized infaunal organisms (e.g. *Macoma balthica*, *Marenzelleria neglecta*) and mobile crustaceans. Approximately 11 macro-invertebrate species are recorded in the habitat with the average of 3±1 species per sample. Due to substrate patchiness the density and biomass of benthic invertebrates are highly variable in space (350 – 11 100 ind m^{-2} and 0.03 - 7 g m^{-2} respectively), whereas seasonal shifts are driven by effects of ice scouring and temperature changes.

The habitat is devoid of attached macroalgae species, except in cases of hard substrate presence. Perennial *Furcellaria lumbricalis* and annual algae's *Pilayella*, *Ectocarpus* and *Ceramium* can form drifting mats, which are washed ashore during storms.

Functions: The habitat is characterised by relatively low species diversity of benthic organisms. The habitat is preferred by amphipods (*B. pilosa*, *Gammarus* spp.) and nectobenthic crustacean species such as mysid *Neomysis integer*. The habitat provides feeding ground of fish fry and birds.

Conservation value: The habitat of mobile crustaceans is particularly vulnerable to oil spills, however due to wave impact and active sediment transport high potential of recovery was observed (e.g. after the accident of the tanker "Globe Assimi" in 1981 in the Port of Klaipeda).

Species list (algae and plants):	**Species list (invertebrates):**
1. *Ceramium tenuicorne* 2. *Ceramium virgatum* 3. *Ceramium siliquosum* 4. *Cladophora glomerata* 5. *Cladophora rupestris* 6. *Ectocarpus siliculosus* 7. *Polysiphonia fibrillosa* 8. *Polysiphonia fucoides* 9. *Pilayella littoralis* 10. *Rhodomela confervoides*	1. *Bathyporeia pilosa* 2. *Cerastoderma glaucum* 3. *Corophium volutator* 4. *Crangon crangon* 5. *Hediste diversicolor* 6. *Macoma balthica* 7. *Marenzelleria neglecta* 8. *Mya arenaria* 9. *Neomysis integer* 10. *Pygospio elegans* 11. *Streblospio shrubsoli*

References:

Bubinas, A. 1984. The influence of black oil spill on the biota. Macrozoobenthos. In: O. Pustelnikov Ed., Environmental influence of a black oil spill in the Baltic Sea. Biogeochemistry, Geology and Paleogeography of the Baltic Sea, vol. 2, Vilnius, 92-104 (In Russian).

Lagzdins, G. 1990. Zoobenthos in the coastal zone. (Zoobentos priurezovoj zoni). In: A. I. Simonov (Ed.) (Katastrofa tankera “Globe Assimi” v portu Klaipeda i ejo ekologicheskie posledstvija). Gydrometeoizdat. Moscow 174-176 (In Russian).

4. Distribution of habitats and species in project areas

1EST East Gulf of Finland

General description of a project area:

The East Gulf of Finland project area is located on the northern coast of Estonia along the Gulf of Finland. The western edge of the project site is Prangli pSCI, northeast of Tallinn, and area stretches along the Estonian coastline and Gulf of Finland to Lahemaa National Park to the east, near Vainupea. Total project site area is 185117 ha.

The average depth of Gulf of Finland is 37 m and the maximum depth 123 m. Slope is quite steep and depths reach over 30 m in all bays of the project area. Sand, silt or sandy clay bottoms dominate in deeper areas, boulders and stones prevail near the coast. Coastline is diverse and disjuncted by peninsulas, many small islands occur in the area. The Eastern Gulf of Finland receives fresh water from a huge drainage area and the Western Gulf is a direct continuation of the Baltic Sea proper, therefore the gulf has a permanent east–west gradient of salinity. The salinity range of project area is 4.5-6.2 psu.

Existing Natura areas:

Name	Area	Natura code
Lahemaa SPA/pSCI	72670 ha	EE0010173
Prangli pSCI	1306 ha	EE0010126
Kolga laht pSCI	1924 ha	EE0010128
Kolga laht SPA	2435 ha	EE0010171

Pressures: The area is influenced by diffuse and point source nutrient loads. Average nutrient loads per year are 2566.4 tons of total nitrogen and 89.7 tons of total phosphorus. Proportion of local transportation is small and has mainly recreation purposes.

Habitats: Three different Natura 2000 habitat types are found in the area: sandbanks, reefs and mudflats. Out of these habitat types sandbanks are most dominant comprising approximately 10% of the area. Mudflats and sandflats are found in shallow sheltered coastal areas in total about 1% of the project area. Reefs are found in moderately exposed areas and consist mainly of boulders, cobbles and stones. Reefs are mostly characterized by presence of perennial macroalgal species such as *Fucus vseiculosus* and *Furcellaria lumbricalis*, in deeper areas the reefs are dominated by bivalve *Mytilus trossulus*.

Table 1. List of Natura 2000 habitat types in the East Gulf of Finland project area.

Code	Name	Area ha	% of project area
1170	Reefs	4526.78	2.99
1110	Sandbanks which are slightly covered by sea water all the time	18274.51	12.08
1140	Mudflats and sandflats not covered by seawater at low tide	1095.79	0.72

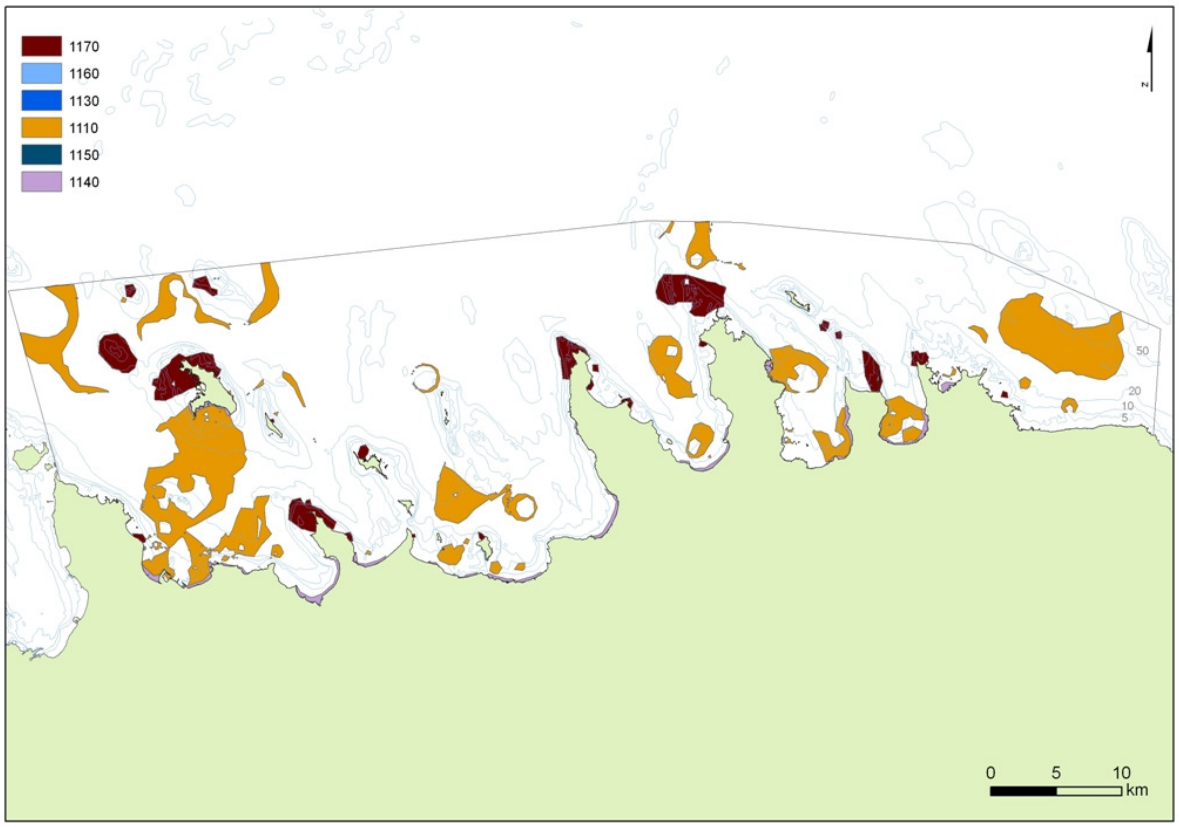


Figure 1. Map of Natura 2000 habitat types in in the East Gulf of Finland project area.

According to EBHAB classification the most prevailing habitats comprising over 60% of the area are moderately exposed soft bottoms with no particular species dominance. Moderately exposed and sheltered soft bottoms with bivalves are also well distributed. Hard substrate mainly consisting of boulders and stones is found in shallow waters near the coast.

Table 2. List of habitat types by the EBHAB classification in the East Gulf of Finland project area.

Code	Name	Area ha	% of project area
1	Sheltered hard bottoms with *Fucus vesiculosus*	364.34	0.24
3	Sheltered hard bottoms with no particular species dominance	60.43	0.04
4	Sheltered soft bottoms with higher plants	787.29	0.52
5	Sheltered soft bottoms with charophytes	936.17	0.62
6	Sheltered soft bottoms with bivalves	2108.49	1.39
7	Sheltered soft bottoms with no particular species dominance	12497.12	8.26
8	Moderately exposed hard bottoms with *Fucus vesiculosus*	1680.15	1.11
9	Moderately exposed hard bottoms with F*urcellaria lumbricalis*	169.53	0.11

10	Moderately exposed hard bottoms with bivalves and *Balanus improvisus*	2318.34	1.53
11	Moderately exposed hard bottoms with no particular species dominance, <20m	586.05	0.39
12	Moderately exposed hard bottoms with no particular species dominance, >=20m	913.05	0.60
13	Moderately exposed soft bottoms with *Zostera marina*	9.24	0.01
14	Moderately exposed soft bottoms with higher plants excluding *Zostera marina.*	535.01	0.35
16	Moderately exposed soft bottoms with *Furcellaria lumbricalis*	226.22	0.15
17	Moderately exposed soft bottoms with bivalves	24271.84	16.04
18	Moderately exposed soft bottoms with no particular species dominance	103874.19	68.64

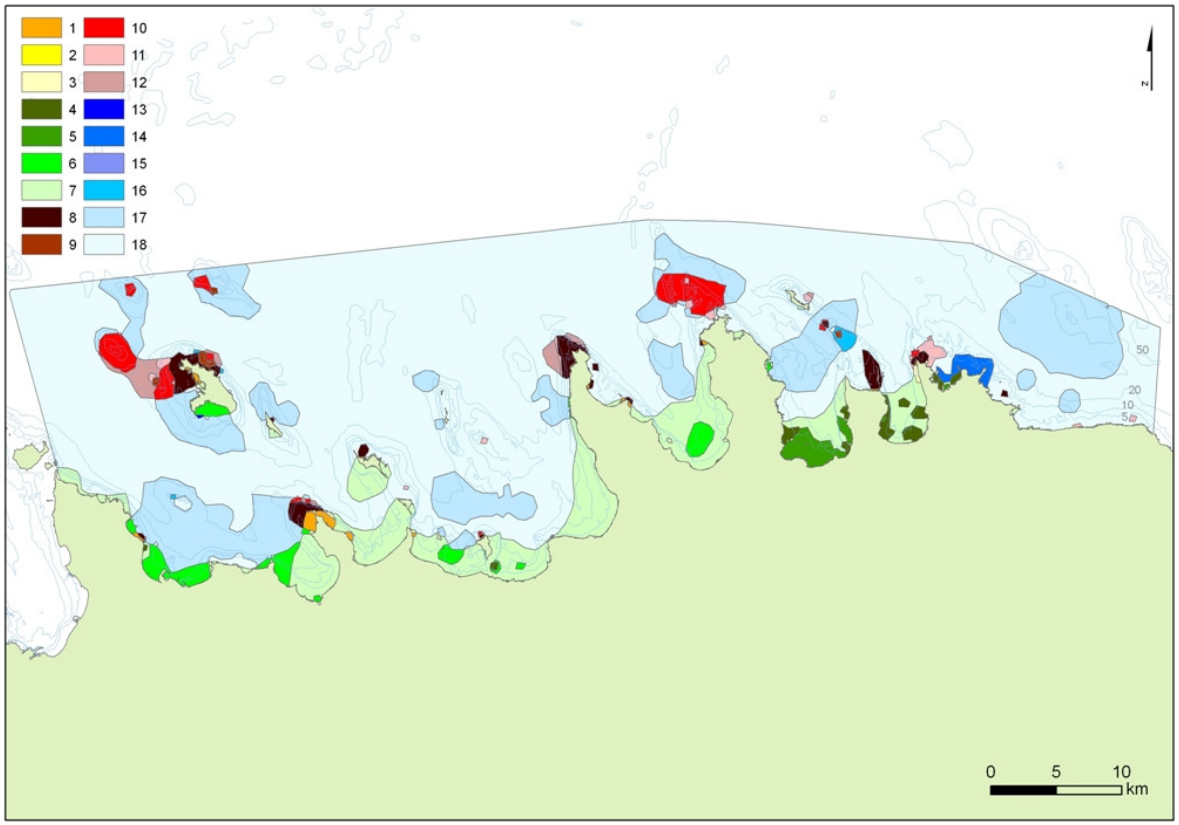


Figure 2. Map of habitat types by the EBHAB classification in the East Gulf of Finland project area.

Species: Due to decreasing salinity conditions from west to east, this is the easternmost distribution area for eelgrass *Zostera marina*, which is regarded as one of the keyspecies of this habitat type. Overall, due to higher exposure, lower salinity and dominance of sand eastwards, in this project area we see the distributional extent of most perennial macroalgal species and accompanying invertebrates. Characteristic substrate of reefs are boulders which

in shallow coastal areas are dominated by *Fucus vesiculosus* communities, as for deeper areas and shoals the dominate species are *Mytilus trossulus* and *Balanus improvisus.*

Table 3. Species depth distribution and biomass in the East Gulf of Finland project area.

		Depth m		Biomass dw g m^{-2}			
	Species	**Min**	**Max**	**Min**	**Max**	**Mean**	**StDev**
1	*Ceramium tenuicorne*	0.2	20.6	0.00	35.50	1.59	4.01
2	*Ceramium virgatum*	3.7	23.5	0.00	35.50	5.02	10.45
3	*Chaetomorpha linum*	4.2	4.2	1.47	1.47	1.47	
4	*Chara aspera*	0.3	0.5	0.15	46.10	17.92	24.68
5	*Chorda filum*	0.7	5.4	0.05	26.41	3.67	8.58
6	*Cladophora glomerata*	0.2	15	0.00	174.10	15.34	31.85
7	*Cladophora rupestris*	0.2	17.5	0.00	455.95	16.75	65.74
8	*Coccotylus truncatus*	1	10.5	0.10	4.20	2.15	2.89
9	*Cyanophyta*	5	5	0.00	0.00	0.00	
10	*Dictyosiphon foeniculaceus*	0.2	5	0.00	124.28	15.53	24.00
11	*Ectocarpus siliculosus*	2	2	1.33	1.33	1.33	
12	*Elachista fucicola*	0.5	4	0.05	10.96	2.46	3.56
13	*Eudesme virescens*	0.2	3	0.03	0.03	0.03	0.00
14	*Fucus vesiculosus*	0.3	7.5	0.21	3034.46	565.48	633.41
15	*Furcellaria lumbricalis*	0.5	17.5	0.00	217.22	25.13	42.54
16	*Leathesia difformis*	0.7	0.7	0.11	0.11	0.11	
17	*Myriophyllum spicatum*	3.9	18	0.42	1.47	0.94	0.74
18	*Pilayella littoralis*	0.2	20.6	0.00	505.87	33.21	71.84
19	*Pilayella/Ectocarpus*	0.2	9.2	0.01	174.43	17.40	32.24
20	*Polysiphonia fibrillosa*	0.3	10	0.00	8.88	1.51	2.09
21	*Polysiphonia fucoides*	0.2	30	0.00	133.03	8.93	18.19
22	*Potamogeton pectinatus*	0.5	5.2	0.03	53.01	9.15	18.26
23	*Potamogeton perfoliatus*	4.3	5.2	0.14	5.47	2.30	2.10
24	*Rhizoclonium riparium*	10	10	0.00	0.00	0.00	
25	*Rhodomela confervoides*	1	23.5	0.01	11.21	2.02	3.65
26	*Ruppia maritima*	0.5	1.4	1.21	90.25	38.24	46.37
27	*Sphacelaria arctica*	0.2	20	0.00	122.38	8.71	17.45
28	*Stictyosiphon tortilis*	1	5.5	0.11	1.29	0.57	0.57
29	*Zannichellia palustris*	0.3	2.1	0.04	20.05	4.19	6.58
30	*Zostera marina*	2.8	5.4	0.31	66.86	11.13	21.27
31	*Tolypella nidifica*	1.4	4.3	0.67	5.15	2.91	3.16
32	*Ulva intestinalis*	0.5	2.9	0.00	0.22	0.07	0.09
33	*Alderia modesta*	0.5	10	0.01	0.32	0.11	0.14
34	*Argulus* sp	3	4	0.01	0.02	0.01	0.01
35	*Balanus improvisus*	0.5	30	0.00	110.53	10.78	18.68
36	*Bathyporeia pilosa*	1.2	25.4	0.00	1.35	0.26	0.33
37	*Bithynia tentaculata*	3.1	8.4	0.08	1.45	0.65	0.69
38	*Bylgides sarsi*	50	50	0.01	0.01	0.01	
39	*Cerastoderma glaucum*	0.5	20	0.01	43.78	9.43	11.19
40	*Chironomidae*	0.2	50	0.00	1.21	0.07	0.13
41	*Coleoptera*	39	39	0.00	0.00	0.00	
42	*Cordylophora caspia*	7.5	20.6	0.04	0.28	0.14	0.13
43	*Corophium volutator*	0.5	20.6	0.00	1.50	0.11	0.23
44	*Crangon crangon*	12	12	8.05	8.05	8.05	
45	*Cyanophthalma obscura*	0.5	10.5	0.00	1.86	0.18	0.41
46	*Diptera*	3	3	0.41	0.41	0.41	

47	*Gammarus juv*	0.2	32	0.00	7.69	0.33	0.76
48	*Gammarus locusta*	4.3	4.3	0.24	0.24	0.24	
49	*Gammarus oceanicus*	0.2	16	0.01	34.64	2.39	4.60
50	*Gammarus salinus*	0.2	20	0.00	4.25	0.19	0.37
51	*Gammarus* sp	12	12	0.16	0.16	0.16	
52	*Gammarus zaddachi*	0.2	10	0.00	3.78	0.33	0.55
53	*Gammarus tigrinus*	3.7	3.7	0.03	0.03	0.03	
54	*Gonothyraea loveni*	11.3	11.3	0.04	0.04	0.04	
55	*Halicryptus spinulosus*	7	50	0.00	1.05	0.22	0.25
56	*Hediste diversicolor*	0.5	45	0.00	9.69	0.30	1.02
57	*Hydracarina*	3	3	0.02	0.02	0.02	
58	*Hydrobia* sp	0.5	0.5	0.16	0.16	0.16	
59	*Hydrobia ulvae*	0.2	20.6	0.00	7.38	0.80	1.18
60	*Hydrobia ventrosa*	3.9	18	0.02	0.67	0.12	0.21
61	*Idotea balthica*	0.2	30	0.00	4.80	0.62	0.70
62	*Idotea chelipes*	0.2	8.5	0.00	15.07	0.35	1.46
63	*Idotea* sp	0.5	0.5	0.10	0.10	0.10	
64	*Jaera albifrons*	0.2	13.6	0.00	1.41	0.07	0.17
65	*Laomedea flexuosa*	8.5	8.5	0.01	0.01	0.01	
66	*Lymnaea peregra*	0.2	10	0.01	5.99	0.91	1.18
67	*Lymnaea* sp	0.3	2	1.02	2.38	1.75	0.69
68	*Macoma balthica*	0.5	52	0.00	333.31	35.46	48.32
69	*Marenzelleria neglecta*	3.5	55	0.00	0.48	0.08	0.11
70	*Monoporeia affinis*	4.3	50	0.00	1.86	0.18	0.26
71	*Mya arenaria*	2.4	40	0.04	114.98	6.74	17.47
72	*Mysis mixta*	2.5	5.8	0.01	0.10	0.04	0.04
73	*Mytilus trossulus*	0.5	45	0.00	634.40	18.52	50.36
74	*Oligochaeta*	0.5	55	0.00	2.01	0.05	0.20
75	*Piscicola geometra*	2	10	0.00	0.08	0.02	0.03
76	*Planorbis* sp	0.5	0.5	0.26	0.26	0.26	
77	*Pontoporeia femorata*	42	42	0.01	0.01	0.01	
78	*Potamopyrgus antipodarum*	5	20	0.08	4.70	0.73	1.28
79	*Praunus inermis*	2.5	2.5	0.02	0.02	0.02	
80	*Saduria entomon*	3.7	50	0.00	14.77	3.45	3.98
81	*Tenellia adspersa*	5.5	5.5	0.03	0.03	0.03	
82	*Theodoxus fluviatilis*	0.2	13.6	0.00	73.18	7.56	10.72
83	*Trichoptera*	5	5	0.18	0.18	0.18	

2EST West Gulf of Finland

General description of a project area:

The West Gulf of Finland project area is located on the northern coast of Estonia along the Gulf of Finland. The western edge of the project site is Kolviku cape and area stretches along the Estonian coastline and Gulf of Finland to Suurupi peninsula to the east, near Tallinn. Total project site area is 53413 ha.

The average depth of Gulf is 37 m and the maximum depth is 123 m. Shallow marine area (depth under 10 m) is about 1/3 of the project area, found mostly in between Pakri islands and mainland. Sand, silt or sandy clay bottoms dominate in the whole depth range, rock, boulders and stones are found in exposed areas near the coast. Coastline is diverse and disjuncted by peninsulas and Pakri islands in the western part of project area. The Western Gulf of Finland is direct extension of the Baltic Proper and freshwater inflow is small, thus the salinity conditions in the region are quite stable. Anyhow, there exists a permanent west–east gradient of salinity. The salinity in the project area is around 6 psu.

Existing Natura areas:

Name	Area	Natura code
Pakri SPA/pSCI	16757 ha	EE001072

Pressures: The area is influenced by diffuse and point source nutrient loads, nevertheless, the human impact on the area is small. Average nutrient loads per year are 1493.1 tons of total nitrogen and 32.9 tons of total phosphorus. Proportion of local transportation is rather small and mainly has recreation purposes. Paldiski South harbour is one f the biggest harbours in the area, core activity of the harbour is focused on the handling of Estonian export and import cargo and transit cargo. Mainly ro-ro cargo, scrap metal, timber, peat and oil products are handled. Developing fields of activity include transit of new cars for neighbouring markets and pre-sale service.

Habitats: Three different Natura 2000 habitat types are found in the area: sandbanks, reefs and mudflats. Out of these habitat types sandbanks are most prevailing comprising approx 10% in this area. Reefs are found in the north of islands and peninsulas and mainly consist of rock, boulders and stones are rare. Mudflats extend along the coastline in sheltered areas.

Table 1. List of Natura 2000 habitat types in the West Gulf of Finland project area.

Code	Name	Area ha	% of project area
1170	Reefs	1857.73	2.98
1110	Sandbanks which are slightly covered by sea water all the time	8912.10	14.29
1140	Mudflats and sandflats not covered by seawater at low tide	1310.07	2.10

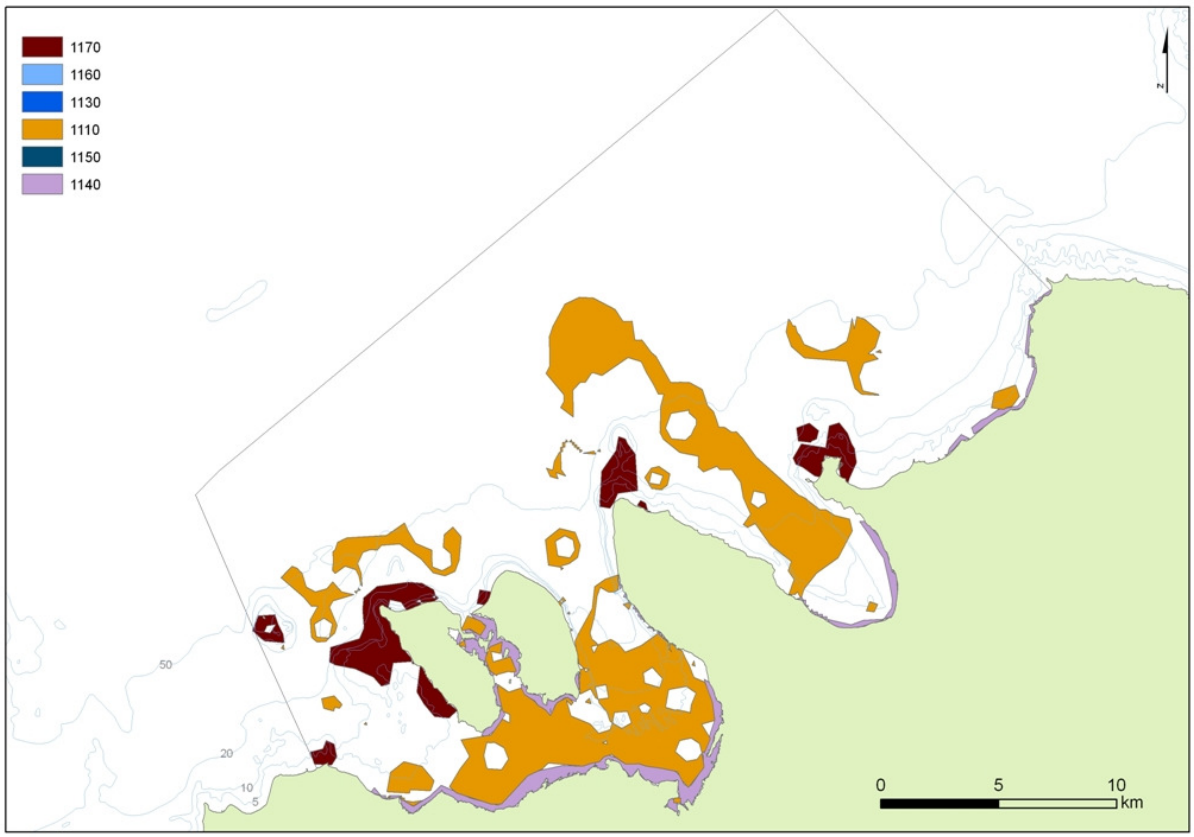


Figure 1. Map of Natura 2000 habitat types in in the West Gulf of Finland project area.

According to EBHAB classification the prevailing habitat types are moderately exposed soft bottoms with no particular species dominance. The sheltered area between islands and mainland with sandy substrates offers good habitat for higher plants and bivalves.

Table 2. List of habitat types by the EBHAB classification in the West Gulf of Finland project area.

Code	Name	Area ha	% of project area
1	Sheltered hard bottoms with *Fucus vesiculosus*	58.81	0.09
2	Sheltered hard bottoms with bivalves and *Balanus improvisus*	3.37	0.01
3	Sheltered hard bottoms with no particular species dominance	14.14	0.02
4	Sheltered soft bottoms with higher plants	2144.14	3.44
5	Sheltered soft bottoms with charophytes	277.49	0.44
6	Sheltered soft bottoms with bivalves	2265.55	3.63
7	Sheltered soft bottoms with no particular species dominance	2586.79	4.15
8	Moderately exposed hard bottoms with *Fucus vesiculosus*	681.13	1.09

10	Moderately exposed hard bottoms with bivalves and *Balanus improvisus*	1121.16	1.80
11	Moderately exposed hard bottoms with no particular species dominance, <20m	717.08	1.15
12	Moderately exposed hard bottoms with no particular species dominance, >=20m	178.25	0.29
13	Moderately exposed soft bottoms with *Zostera marina*	259.35	0.42
14	Moderately exposed soft bottoms with higher plants excluding *Zostera marina.*	597.48	0.96
15	Moderately exposed soft bottoms with charophytes	4.00	0.01
16	Moderately exposed soft bottoms with *Furcellaria lumbricalis*	21.81	0.03
17	Moderately exposed soft bottoms with bivalves	10225.54	16.40
18	Moderately exposed soft bottoms with no particular species dominance	41213.28	66.08

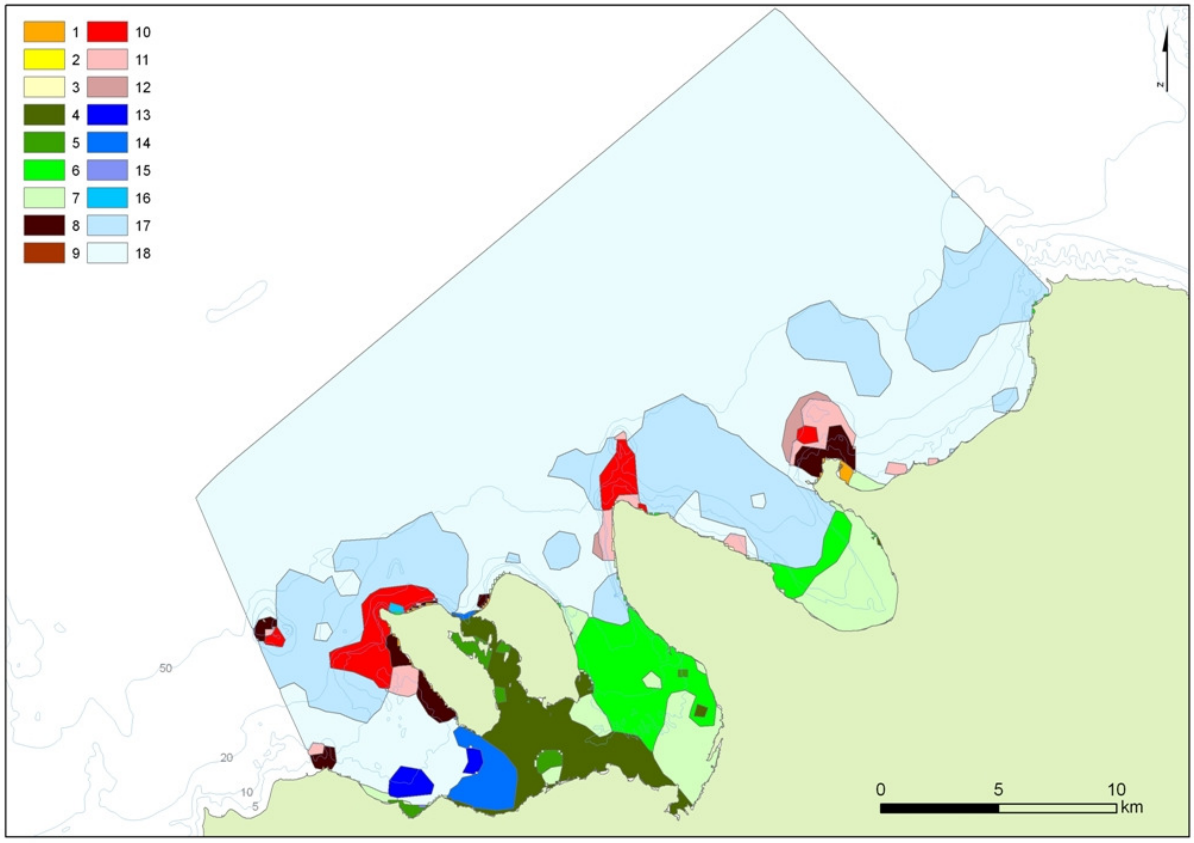


Figure 2. Map of habitat types by the EBHAB classification in the East Gulf of Finland project area.

Species: Sheltered area with sandy substrate between Pakri islands and mainland offers good environment for higher plants – e.g. *Zannichellia palustris, Potamogeton pectinatus* and *Zostera marina.* Characteristic substrate of reefs is rock which in shallow coastal areas are dominated by *Fucus vesiculosus* communities, as for deeper areas and shoals the dominate species are *Mytilus trossulus* and *Balanus improvisus.*

Table 3. Species depth distribution and biomass in the East Gulf of Finland project area.

		Depth m		Biomass dw g m^{-2}			
	Species	**Min**	**Max**	**Min**	**Max**	**Mean**	**StDev**
1	*Ceramium tenuicorne*	0.4	27.7	0.00	122.97	9.14	21.52
2	*Ceramium virgatum*	5.7	11.4	0.02	42.65	12.53	20.34
3	*Ceratophyllum demersum*	1.5	2	116.47	293.65	205.06	125.28
4	*Chaetomorpha linum*	1.3	1.3	1.83	1.83	1.83	
5	*Chara aspera*	0.4	1.2	0.00	133.04	28.02	42.68
6	*Chara baltica*	0.6	1.2	0.22	20.34	10.28	14.23
7	*Chara canescens*	0.4	1.3	0.50	31.96	4.46	9.72
8	*Chara connivens*	0.7	2	13.19	34.10	23.65	14.79
9	*Chorda filum*	0.6	6.2	0.01	32.59	3.75	7.39
10	*Cladophora glomerata*	0.4	12.8	0.00	455.98	19.75	55.30
11	*Cyanophyta*	1.4	1.4	0.03	0.03	0.03	
12	*Dictyosiphon foeniculaceus*	0.4	11.4	0.00	13.76	1.90	3.60
13	*Ectocarpus siliculosus*	0.4	9.6	0.63	92.92	31.14	34.49
14	*Elachista fucicola*	0.4	3	0.45	228.69	114.57	161.39
15	*Eudesme virescens*	0.4	3.8	0.00	18.92	6.18	6.80
16	*Fucus radicans*	1.2	1.2	2.15	2.15	2.15	
17	*Fucus vesiculosus*	0.4	11.4	0.13	2183.58	285.34	490.62
18	*Furcellaria lumbricalis*	1	22	0.02	66.03	12.53	20.02
19	*Halosiphon tomentosus*	0.4	9.6	0.00	2.95	0.44	0.86
20	*Leathesia difformis*	1	1	1.79	1.82	1.80	0.02
21	*Monostroma balticum*	6	6	0.02	0.15	0.05	0.06
22	*Myriophyllum spicatum*	0.5	3.8	0.02	46.73	8.28	13.01
23	*Pilayella littoralis*	0.4	14	0.00	494.81	53.01	86.68
24	*Polysiphonia fibrillosa*	1	4	0.00	1.12	0.38	0.64
25	*Polysiphonia fucoides*	0.5	26	0.00	77.02	5.68	15.47
26	*Potamogeton pectinatus*	0.6	4	0.01	150.07	21.13	37.90
27	*Potamogeton perfoliatus*	0.8	3.8	0.19	15.69	4.96	5.71
28	*Rhizoclonium riparium*	0.4	0.4	0.34	0.34	0.34	
29	*Rhodomela confervoides*	0.5	20	0.01	59.97	6.28	14.95
30	*Ruppia maritima*	0.6	1	0.05	23.87	8.01	13.73
31	*Sphacelaria arctica*	0.7	14	0.01	28.38	3.08	6.09
32	*Stictyosiphon tortilis*	0.7	20	0.00	1.16	0.26	0.34
33	*Zannichellia palustris*	0.4	3.4	0.01	24.10	6.98	7.73
34	*Zostera marina*	0.6	4	0.03	49.63	12.14	15.14
35	*Tolypella nidifica*	0.4	7	0.03	18.50	2.60	3.97
36	*Ulothrix flacca*	0.4	0.4	2.05	2.05	2.05	
37	*Ulothrix sp*	1.4	6.5	0.06	7.70	2.13	3.72
38	*Ulva intestinalis*	0.4	11.4	0.01	12.51	2.21	3.29
39	*Urospora penicilliformis*	0.4	0.4	1.02	1.02	1.02	
40	*Alderia modesta*	0.6	11.4	0.01	0.06	0.03	0.03
41	*Asellus aquaticus*	1.4	8.5	0.01	1.06	0.23	0.32
42	*Balanus improvisus*	0.4	37	0.10	163.15	19.30	35.03
43	*Bathyporeia pilosa*	0.5	30	0.01	0.84	0.16	0.17
44	*Bithynia tentaculata*	1.5	5.7	0.86	15.16	7.22	7.28

45	*Bylgides sarsi*	20	35	0.00	0.18	0.06	0.10
46	*Cerastoderma glaucum*	0.4	26	0.04	78.39	12.24	14.96
47	*Chironomidae*	0.4	30	0.00	2.02	0.13	0.29
48	*Coleoptera*	0.6	2.8	0.11	0.74	0.43	0.32
49	*Corophium volutator*	2.8	37	0.00	0.19	0.05	0.05
50	*Crangon crangon*	0.7	0.7	1.98	1.98	1.98	
51	*Cyanophthalma obscura*	0.6	12.8	0.00	0.15	0.04	0.04
52	*Diptera*	0.6	0.6	0.28	0.28	0.28	
53	*Echinogammarus stoerensis*	1.5	1.5	0.02	0.02	0.02	
54	*Electra crustulenta*	8.2	17	0.00	0.00	0.00	0.00
55	*Gammarus juv*	0.4	17	0.00	2.51	0.17	0.38
56	*Gammarus oceanicus*	0.4	11.4	0.05	1.33	0.49	0.35
57	*Gammarus salinus*	0.4	22	0.01	5.19	0.32	0.68
58	*Gammarus zaddachi*	0.4	17	0.01	3.99	0.51	0.82
59	*Gammarus tigrinus*	0.4	2	0.08	1.50	0.59	0.53
60	*Gonothyraea loveni*	3.8	36	0.03	2.04	0.72	1.15
61	*Halicryptus spinulosus*	16.2	37	0.00	1.48	0.31	0.37
62	*Hediste diversicolor*	0.4	30.4	0.00	3.87	0.34	0.77
63	*Hydrobia ulvae*	0.4	30	0.00	22.02	2.01	3.78
64	*Hydrobia ventrosa*	0.4	1.8	0.01	0.27	0.13	0.11
65	*Idotea balthica*	0.4	8.5	0.00	5.85	0.57	0.97
66	*Idotea chelipes*	0.4	8.5	0.00	25.99	0.66	3.55
67	*Jaera albifrons*	0.4	22	0.00	0.47	0.06	0.10
68	*Laomedea flexuosa*	5.7	9.6	0.00	0.15	0.08	0.10
69	*Leptocheirus pilosus*	0.8	4	0.00	0.12	0.04	0.04
70	*Lymnaea peregra*	0.4	5	0.09	5.26	1.21	1.47
71	*Macoma balthica*	0.5	37	0.02	184.87	24.12	32.62
72	*Marenzelleria neglecta*	11.4	37	0.00	0.31	0.06	0.10
73	*Monoporeia affinis*	20	37	0.02	0.56	0.26	0.18
74	*Mya arenaria*	0.5	30	0.00	28.54	2.88	4.27
75	*Mytilus trossulus*	0.4	37	0.02	13951.35	209.96	1118.44
76	*Odonata*	0.5	2	0.02	1.80	1.05	0.79
77	*Oligochaeta*	0.4	36	0.00	2.02	0.08	0.25
78	*Palaemon adspersus*	1.3	1.3	3.43	3.43	3.43	
79	*Piscicola geometra*	2	2	0.02	0.02	0.02	
80	*Potamopyrgus antipodarum*	0.8	23	0.03	0.20	0.11	0.09
81	*Saduria entomon*	3	37	0.00	59.79	6.87	18.66
82	*Stagnicola palustris*	9	9	0.18	0.18	0.18	
83	*Theodoxus fluviatilis*	0.4	14	0.00	54.54	4.34	8.10
84	*Trichoptera*	0.5	3.8	0.03	0.62	0.21	0.20

3EST Väinameri

General description of a project area:

The Väinameri project site is located in Lääne, Saare, Hiiu and Pärnu counties in western Estonia. The area is a large wetland and sea complex comprised mostly of shallow sea bays with many small islets and salt marshes. Haapsalu and Matsalu Bays along the mainland coast are the main features in the eastern area and are among the most eutrophied bays in the entire coastal zone. The Kasari River flows into Matsalu Bay, and is the only significant river feeding into the Väinameri system, although numerous smaller rivers and streams empty into the area. Many of the lagoons act as a sediment trap for these waters, which are rich in biogenic materials. Salinity varies from 0-7 psu. 20m of depth is reached only in the north of the project area in the vicinity of Vormsi island. Soft substrates prevail.

Total project site area is 302619 ha. The West Estonian Archipelago Sea contributes most to the project area with 224300 ha surface area. Sea is shallow and the depth remains below 10m. Salinity varies between 6 and 7 psu. Temperature conditions resemble that of the Gulf of Riga. The region is periodically influenced by the nutrient rich water of the Gulf of Riga and the state of the Gulf of Riga has a significant role in the development of benthic communities in the West Estonian Archipelago Sea. The bottom relief of the area is flat, with gentle slopes towards deeps. The whole water basin is semi-exposed. Sand and sandy clay substrates prevail. Due to shallowness and clayey sediments already moderate winds result in strong resuspension of bottom sediments and poor underwater light conditions.

Existing Natura areas:

Name	Area ha	Natura code
Väinameri pSCI	221848	EE0040002
Väinameri SPA	209243	EE0040001

Pressures: The area is influenced by diffuse and point source nutrient loads. Shipping is local, mostly transportation between islands and mainland or of recreational nature.

Habitats: Six different Natura 2000 habitat types are found in the area: sandbanks, reefs, large inlets, estuary, lagoons and mudflats – all occur in the extent of studied area. Out of these habitat types sandbanks are most dominant comprising approximately 1/3 in this area. These sandbanks are unique as they support the community of loose *Furcellaria lumbricalis,* which nowadays is found only in Kassary Bay and is exceptional in global scale. The only recognized estuary in Estonia – Matsalu bay – is located here as well. Mudflats are quite equally distributed along the coastline and often found together with large shallow inlets and bays. Reefs are rare and mostly found in the southern area where boulders dominate as substrate and northwest of Vormsi where rock is the prevailing substrate.

Table 1. List of Natura 2000 habitat types in the Väinameri and project area.

Code	Name	Area ha	% of project area
1170	Reefs	4456.80	1.75
1160	Large shallow inlets and bays	10332.85	4.06
1130	Estuaries	9389.81	3.69
1110	Sandbanks which are slightly covered by sea water all the time	95674.63	37.61

1150	* Coastal lagoons	1853.12	0.73
1140	Mudflats and sandflats not covered by seawater at low tide	17636.09	6.93

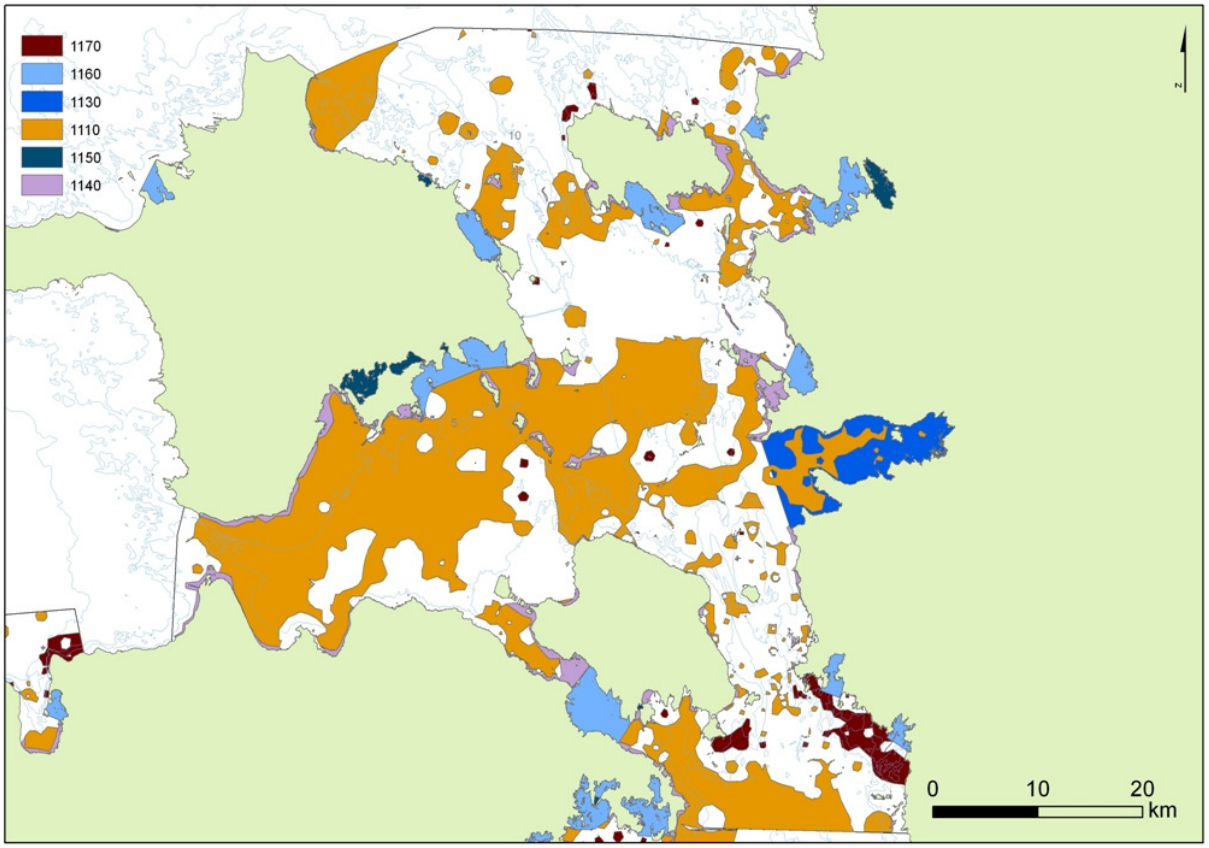


Figure 1. Map of Natura 2000 habitat types in the Väinameri project area.

According to EBHAB classification the prevailing habitat types are sheltered and moderately exposed soft bottoms with different characteristic features. The shallowness and shelterness together with sandy substrates offer good habitat for higher plants and bivalves.

Table 2. List of habitat types by the EBHAB classification in the Väinameri project area.

Code	Name	Area ha	% of project area
1	Sheltered hard bottoms with *Fucus vesiculosus*	148.50	0.06
2	Sheltered hard bottoms with bivalves and *Balanus improvisus*	376.18	0.15
3	Sheltered hard bottoms with no particular species dominance	226.17	0.09
4	Sheltered soft bottoms with higher plants	24982.77	9.82
5	Sheltered soft bottoms with charophytes	14534.91	5.71
6	Sheltered soft bottoms with bivalves	30302.83	11.91
7	Sheltered soft bottoms with no particular species dominance	18123.87	7.12

8	Moderately exposed hard bottoms with *Fucus vesiculosus*	606.85	0.24
9	Moderately exposed hard bottoms with F*urcellaria lumbricalis*	1920.11	0.75
10	Moderately exposed hard bottoms with bivalves and *Balanus improvisus*	1412.78	0.56
11	Moderately exposed hard bottoms with no particular species dominance, <20m	946.72	0.37
13	Moderately exposed soft bottoms with *Zostera marina*	13420.45	5.28
14	Moderately exposed soft bottoms with higher plants excluding *Zostera marina.*	10558.04	4.15
15	Moderately exposed soft bottoms with charophytes	2604.90	1.02
16	Moderately exposed soft bottoms with *Furcellaria lumbricalis*	31860.95	12.52
17	Moderately exposed soft bottoms with bivalves	39581.41	15.56
18	Moderately exposed soft bottoms with no particular species dominance	62807.41	24.69

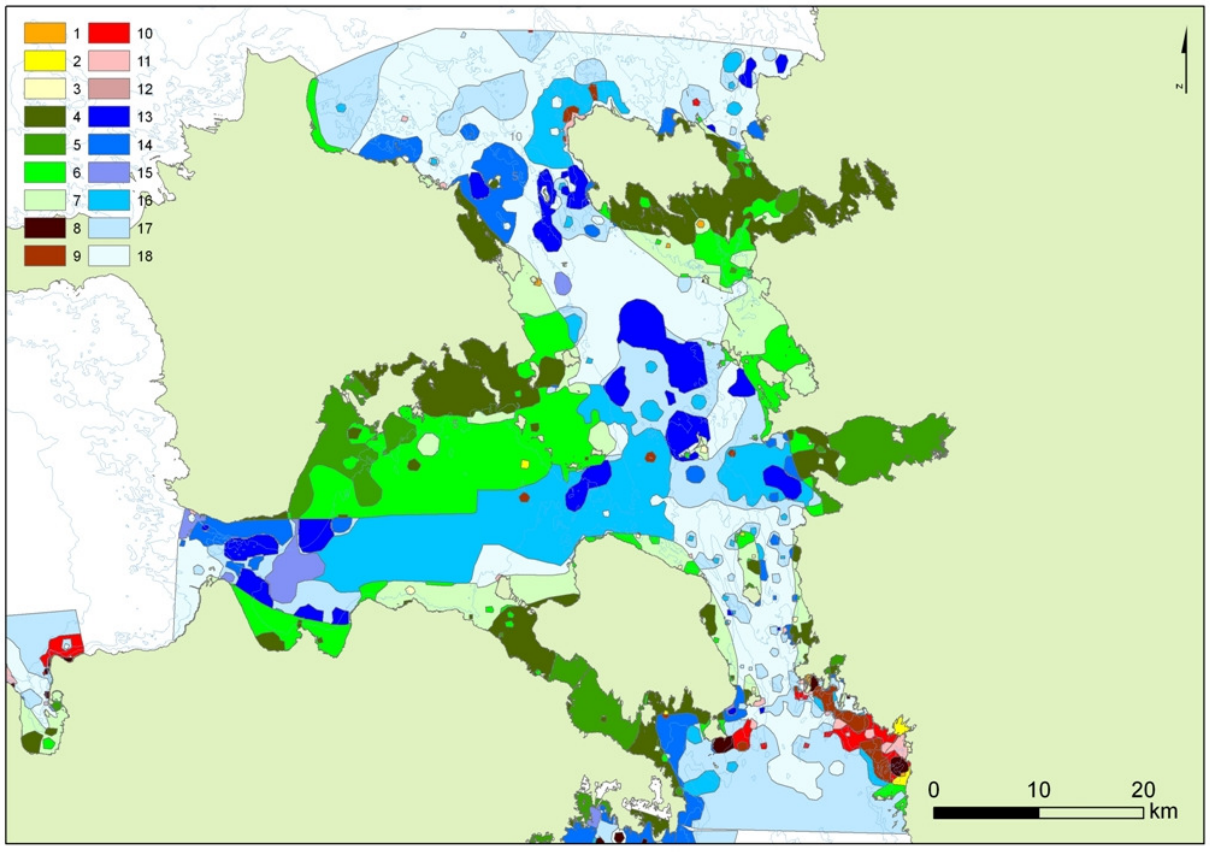


Figure 2. Map of habitat types by the EBHAB classification in the Väinameri project area.

Species: The West Estonian Archipelago Sea hosts the drifting red macroalgal community dominated by *Furcellaria lumbricalis* and *Coccotylus truncatus*. The community covers up to 200 km^2 with more than 200 000 tons of wet biomass. *F. lumbricalis* is the only economically important algal species in the Baltic Sea and is exploited in the area since the 1960s. The drifting red algal community is confined to habitats characterized by a weak topographic depression, soft bottoms, high sediment load, and poor light conditions. Due to the loose-lying nature, the spatial patterns of the drifting red algae are mainly due to the basin-scale hydrodynamic (light) regime and partly due to the competitive interactions among other species within the drifting macroalgal community. As soft substrates prevail, also higher plants and infauna dominate in the area.

Table 3. Species depth distribution and biomass in the Väinameri project area.

		Depth m		Biomass dw g m^{-2}			
	Species	**Min**	**Max**	**Min**	**Max**	**Mean**	**StDev**
1	*Aglaothamnion roseum*	1.9	7.8	0.00	1.96	0.22	0.58
2	*Ceramium tenuicorne*	0.2	14.8	0.00	207.96	1.76	13.65
3	*Ceramium virgatum*	1	7.5	0.00	0.68	0.15	0.20
4	*Ceratophyllum demersum*	1.3	1.5	0.41	2.70	1.42	1.17
5	*Chaetomorpha linum*	0.1	13	0.00	62.03	1.49	5.64
6	*Chara aspera*	0.1	4.5	0.02	201.42	40.50	50.32
7	*Chara baltica*	0.2	3	0.04	160.66	14.43	26.20
8	*Chara canescens*	0.2	3	0.09	37.05	4.18	6.21
9	*Chara connivens*	0.1	4	0.01	149.65	11.99	24.07
10	*Chara sp*	0.2	2.3	0.13	46.77	8.57	18.74
11	*Chara tomentosa*	0.5	2.4	0.05	780.41	138.42	250.09
12	*Chorda filum*	0.5	7	0.01	69.74	8.16	21.44
13	*Cladophora glomerata*	0.1	12	0.00	758.23	23.64	66.34
14	*Cladophora rupestris*	0.1	9	0.00	40.82	2.09	6.83
15	*Coccotylus truncatus*	0.2	23	0.00	209.10	7.88	23.84
16	*Cyanophyta*	1	5.1	0.00	3.96	0.44	1.06
17	*Dictyosiphon foeniculaceus*	0.2	9	0.01	281.33	8.28	36.61
18	*Elachista fucicola*	3	3	0.02	0.02	0.02	
19	*Fontinalis*	0.7	2	0.00	1.35	0.26	0.46
20	*Fucus radicans*	0.2	3	0.09	615.09	240.54	222.13
21	*Fucus vesiculosus*	0.1	10.6	0.01	1090.14	126.30	211.46
22	*Fucus vesiculosus loose*	3	3	5.60	10.68	8.14	3.59
23	*Furcellaria lumbricalis*	0.1	23	0.00	947.39	27.00	78.20
24	*Furcellaria lumbricalis loose*	1	8.5	0.33	568.58	210.02	124.15
25	*Halosiphon tomentosus*	18	18	1.50	1.50	1.50	
26	*Leathesia difformis*	2.5	2.5	0.20	0.20	0.20	
27	*Lemna trisulca*	0.8	1.5	0.06	0.24	0.11	0.09
28	*Microcoleus chthonoplastes*	1.2	4	0.00	0.12	0.04	0.05
29	*Monostroma balticum*	1	4	0.11	53.09	10.52	17.85
30	*Myriophyllum spicatum*	0.2	5.9	0.00	540.05	31.87	71.65
31	*Najas marina*	0.5	2.5	0.00	5.10	1.05	1.43
32	*Percursaria percursa*	1	1	0.00	1.61	0.81	1.14
33	*Pilayella littoralis*	0.2	17	0.00	1773.51	47.51	130.98
34	*Pilayella/Ectocarpus*	0.1	5.2	0.04	506.78	50.41	82.16
35	*Polysiphonia fibrillosa*	0.5	8	0.00	22.81	1.38	3.88
36	*Polysiphonia fucoides*	0.2	23	0.00	290.08	8.80	21.15
37	*Potamogeton pectinatus*	0.2	11	0.00	399.22	23.94	42.53
38	*Potamogeton perfoliatus*	0.5	7.6	0.08	108.47	15.42	18.58

39	*Ranunculus baudotii*	1	1	16.29	16.29	16.29	
40	*Ranunculus circinatus*	3	3	13.04	13.04	13.04	
41	*Rhizoclonium riparium*	0.5	7.7	0.00	149.67	8.77	25.50
42	*Rhodochorton purpureum*	3	3	0.07	0.07	0.07	
43	*Rhodomela confervoides*	0.5	11	0.00	13.02	2.23	3.94
44	*Ruppia cirrhosa*	1	2.1	0.88	60.19	30.53	41.94
45	*Ruppia maritima*	0.2	12	0.05	207.89	21.59	35.94
46	*Sphacelaria arctica*	0.4	23	0.00	80.77	3.60	9.45
47	*Stictyosiphon tortilis*	0.3	5.2	0.00	44.37	8.15	17.04
48	*Zannichellia palustris*	0.1	6	0.01	529.00	13.94	51.43
49	*Zostera marina*	0.2	7.4	0.02	123.98	15.01	23.67
50	*Tolypella nidifica*	0.2	7	0.00	46.84	2.59	6.59
51	*Ulothrix flacca*	0.2	2.4	0.00	100.77	14.68	30.17
52	*Ulothrix sp*	0.5	6	0.00	94.91	5.71	20.28
53	*Ulva intestinalis*	0.2	10.5	0.00	168.50	6.71	22.37
54	*Urospora penicilliformis*	0.8	7.8	0.00	15.44	0.92	3.53
55	*Alderia modesta*	2.5	9	0.01	0.05	0.02	0.02
56	*Argulus sp*	2.3	2.3	0.00	0.00	0.00	
57	*Asellus aquaticus*	0.5	7.8	0.00	1.89	0.22	0.32
58	*Balanus improvisus*	1	20	0.18	46.90	5.70	8.76
59	*Bathyporeia pilosa*	1.5	13.2	0.00	16.32	0.75	3.18
60	*Bithynia tentaculata*	0.6	5	0.07	80.72	10.17	16.68
61	*Cerastoderma glaucum*	0.2	20	0.00	221.17	13.53	20.42
62	*Ceratopogonidae*	0.4	0.8	0.00	0.01	0.01	0.01
63	*Chironomidae*	0.1	20	0.00	7.70	0.23	0.66
64	*Coleoptera*	0.4	5.1	0.00	0.33	0.10	0.10
65	*Cordylophora caspia*	1	2	0.03	1.23	0.29	0.53
66	*Corophium volutator*	0.5	23	0.00	6.76	0.25	0.60
67	*Crangon crangon*	3.4	3.4	5.01	5.01	5.01	
68	*Cyanophthalma obscura*	0.5	8	0.00	0.26	0.04	0.05
70	*Diptera*	0.5	3	0.00	0.93	0.33	0.33
71	*Dreissena polymorpha*	7.5	7.5	7.19	7.19	7.19	
72	*Electra crustulenta*	1	16	0.00	0.01	0.00	0.00
73	*Ephemeroptera*	1	1.8	0.02	0.03	0.02	0.00
74	*Erpobdella octoculata*	0.7	1	0.42	0.81	0.61	0.28
75	*Gammarus juv*	0.2	23	0.00	6.85	0.11	0.44
76	*Gammarus locusta*	0.5	8	0.02	0.38	0.08	0.08
77	*Gammarus oceanicus*	0.2	8	0.00	3.78	0.24	0.43
78	*Gammarus salinus*	0.2	11	0.00	29.83	0.28	1.62
79	*Gammarus zaddachi*	0.2	10.5	0.01	2.09	0.30	0.38
80	*Gammarus tigrinus*	0.2	5.5	0.01	4.98	0.57	0.96
81	*Gonothyraea loveni*	1	18	0.00	4.00	0.27	0.67
82	*Halicryptus spinulosus*	2.7	19	0.01	0.16	0.06	0.07
83	*Hediste diversicolor*	0.2	23	0.00	155.56	0.88	6.21
84	*Hirudinea sp*	1.5	3	0.02	0.06	0.04	0.02
85	*Hydrobia sp*	0.2	4	0.05	1.12	0.36	0.39
86	*Hydrobia ulvae*	0.2	23	0.00	25.92	2.01	3.18
87	*Hydrobia ventrosa*	0.5	6	0.01	2.38	0.77	0.76
88	*Idotea balthica*	0.2	11	0.00	8.40	0.34	0.92
89	*Idotea chelipes*	0.2	7.3	0.00	7.17	0.17	0.52
90	*Idotea granulosa*	1	1	0.27	0.27	0.27	
91	*Jaera albifrons*	0.2	20	0.00	0.28	0.03	0.04
92	*Laomedea flexuosa*	1.5	3.1	0.01	0.29	0.07	0.11
93	*Lepidoptera*	0.5	2.1	0.00	0.29	0.05	0.09

94	*Leptocheirus pilosus*	0.2	13	0.00	0.92	0.07	0.15
95	*Lymnaea peregra*	0.2	6.3	0.01	62.72	2.21	5.56
96	*Lymnaea sp*	1	1	0.67	0.67	0.67	
97	*Lymnaea spx*	0.4	3.8	0.03	0.65	0.34	0.44
98	*Lymnaea stagnalis*	2.4	5	2.29	5.06	3.47	1.31
99	*Macoma balthica*	0.2	23	0.01	442.30	18.65	26.71
100	*Marenzelleria neglecta*	0.5	20	0.00	0.44	0.07	0.09
101	*Melita palmata*	1.9	3	0.01	0.03	0.02	0.01
102	*Monoporeia affinis*	1	20	0.00	0.88	0.20	0.23
103	*Mya arenaria*	0.2	23	0.00	210.10	13.28	22.90
104	*Mysis mixta*	0.5	5.7	0.00	0.03	0.02	0.01
105	*Mytilus trossulus*	0.2	20	0.00	2605.22	24.38	125.21
106	*Neomysis integer*	2	3.5	0.03	0.07	0.05	0.02
107	*Odonata*	0.1	3	0.01	8.26	0.92	1.47
108	*Oligochaeta*	0.2	23	0.00	30.95	0.24	1.81
109	*Palaemon adspersus*	1	5.7	4.59	7.88	6.47	1.69
110	*Piscicola geometra*	1.5	11	0.01	0.17	0.04	0.06
111	*Potamopyrgus antipodarum*	0.5	3	0.02	1.38	0.45	0.63
112	*Praunus flexuosus*	2	4	0.01	0.02	0.01	0.01
113	*Praunus inermis*	0.5	1.7	0.03	0.09	0.06	0.04
114	*Saduria entomon*	1.5	23	0.00	41.61	6.93	9.48
115	*Tenellia adspersa*	1	3.8	0.09	0.23	0.16	0.10
116	*Theodoxus fluviatilis*	0.2	20	0.00	35.78	3.71	5.13
117	*Trichoptera*	0.2	3.5	0.01	2.70	0.29	0.54

4EST West Saaremaa

General description of a project area:

The West Saaremaa project site is located in the sea area adjacent to western Saaremaa island from the nearby village of Karala and then northeast along the coastline to Panga pank and the village of Panga. This area is noted for its important habitat for the wintering *Polysticta stelleri*. Total project area is 70707 ha.

Küdema laht is located on the northern coast of Saaremaa island, north of the village of Mustjala. Küdema laht is a sea bay with a depth of up to 20 m, however many small islets are also found here. Tagamõisa poolsaar is located at the tip of Tagamõisa peninsula on the northwestern coast of Saaremaa island, west Estonia. The peninsula is surrounded by a sea with a depth up to 20 m and with numerous small shallow (< 4 m) bays, and seashore lakes. Main habitats are marine sea, wetland, and coastal meadow. Vilsandi SPA/pSCI is located in Saare County in western Saaremaa Island, 35 km west-northwest of the town of Kuressaare. Vilsandi is entirely within the boundaries of Vilsandi National Park. The Vilsandi archipelago is comprised of a large complex of shallow (< 5 m) bays with many small islets and some lakes. Over 160 islands and islets can be found within this SPA/pSCI. Base rock is bihorm, a firm limestone, while offshore islets consist of dolomite banks belonging to the skerry type of islands which are rare for Estonia. Climate is considered maritime and storms occur nearly 60 days every year. Koorunõmme is located north and east of Vilsandi NP along the Saaremaa coastline in west Estonia. This is a complex of shallow bays and seas and is adjacent to Küdema laht.

Existing Natura areas:

Name	Area ha	Natura code
Küdema laht SPA/pSCI	4503	E0040432
Tagamõisa poolsaar SPA	1106	EE0040476
Tagamõisa pSCI	1312	EE0040475
Vilsandi SPA/pSCI	1823	EE0040496
Koorunõmme SPA	221	EE0040428

Pressures: The influence from by diffuse and point source nutrient loads is small. Tamme harbour is located in Küdema Bay serving cruise ships mostly in summertime. Other harbours in the area are small and have local importance.

Habitats: Five different Natura 2000 habitat types are found in the area: sandbanks, reefs, large inlets, lagoons and mudflats. Out of these habitat types reefs are most dominant and are found afar off the coast as well. Shallow inlets and bays and mudflats are located mostly in the Küdema Bay and southeast of Vilsandi island.

Table 1. List of Natura 2000 habitat types in the West Saaremaa project area.

Code	Name	Area ha	% of project area
1170	Reefs	12548.04	16.54
1160	Large shallow inlets and bays	1555.57	2.05
1110	Sandbanks which are slightly covered by sea water all the time	6779.62	8.94
1150	* Coastal lagoons	61.01	0.08

1140	Mudflats and sandflats not covered by seawater at low tide	2169.58	2.86

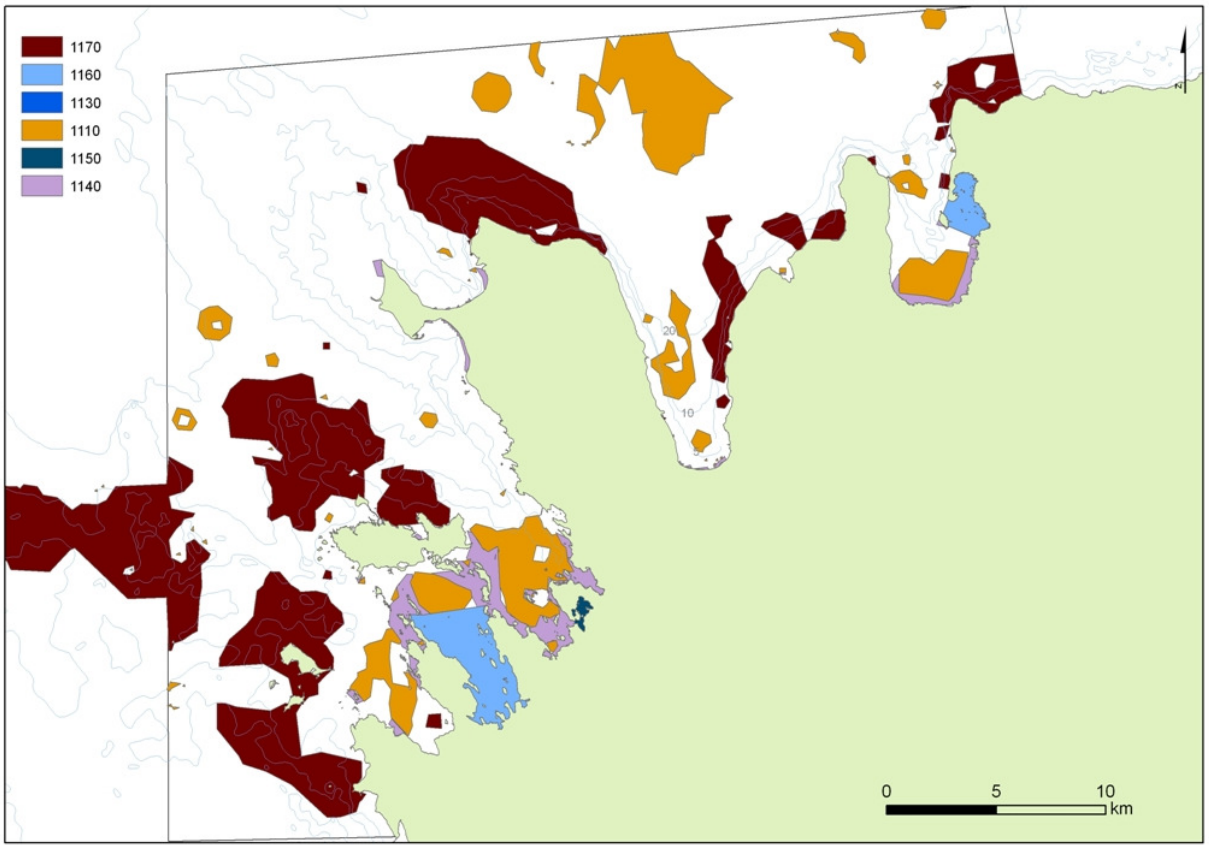


Figure 1. Map of Natura 2000 habitat types in the West Saaremaa project area.

Based on EBHAB classification moderately exposed soft bottoms with bivalves or no particular species dominance prevail. Hard bottoms with mussels or algae are widely distributed along the coastline.

Table 2. List of habitat types by the EBHAB classification in the West Saaremaa project area.

Code	Name	Area ha	% of project area
1	Sheltered hard bottoms with *Fucus vesiculosus*	42.36	0.06
2	Sheltered hard bottoms with bivalves and *Balanus improvisus*	31.10	0.04
3	Sheltered hard bottoms with no particular species dominance	26.93	0.04
4	Sheltered soft bottoms with higher plants	2035.20	2.68
5	Sheltered soft bottoms with charophytes	1730.28	2.28
6	Sheltered soft bottoms with bivalves	241.59	0.32
7	Sheltered soft bottoms with no particular species dominance	1809.04	2.38

8	Moderately exposed hard bottoms with *Fucus vesiculosus*	1533.46	2.02
9	Moderately exposed hard bottoms with F*urcellaria lumbricalis*	2673.39	3.52
10	Moderately exposed hard bottoms with bivalves and *Balanus improvisus*	8280.42	10.92
11	Moderately exposed hard bottoms with no particular species dominance, <20m	4763.54	6.28
12	Moderately exposed hard bottoms with no particular species dominance, >=20m	450.48	0.59
13	Moderately exposed soft bottoms with *Zostera marina*	201.81	0.27
14	Moderately exposed soft bottoms with higher plants excluding *Zostera marina.*	1927.98	2.54
15	Moderately exposed soft bottoms with charophytes	1241.86	1.64
16	Moderately exposed soft bottoms with *Furcellaria lumbricalis*	1382.56	1.82
17	Moderately exposed soft bottoms with bivalves	23980.77	31.61
18	Moderately exposed soft bottoms with no particular species dominance	23505.77	30.99

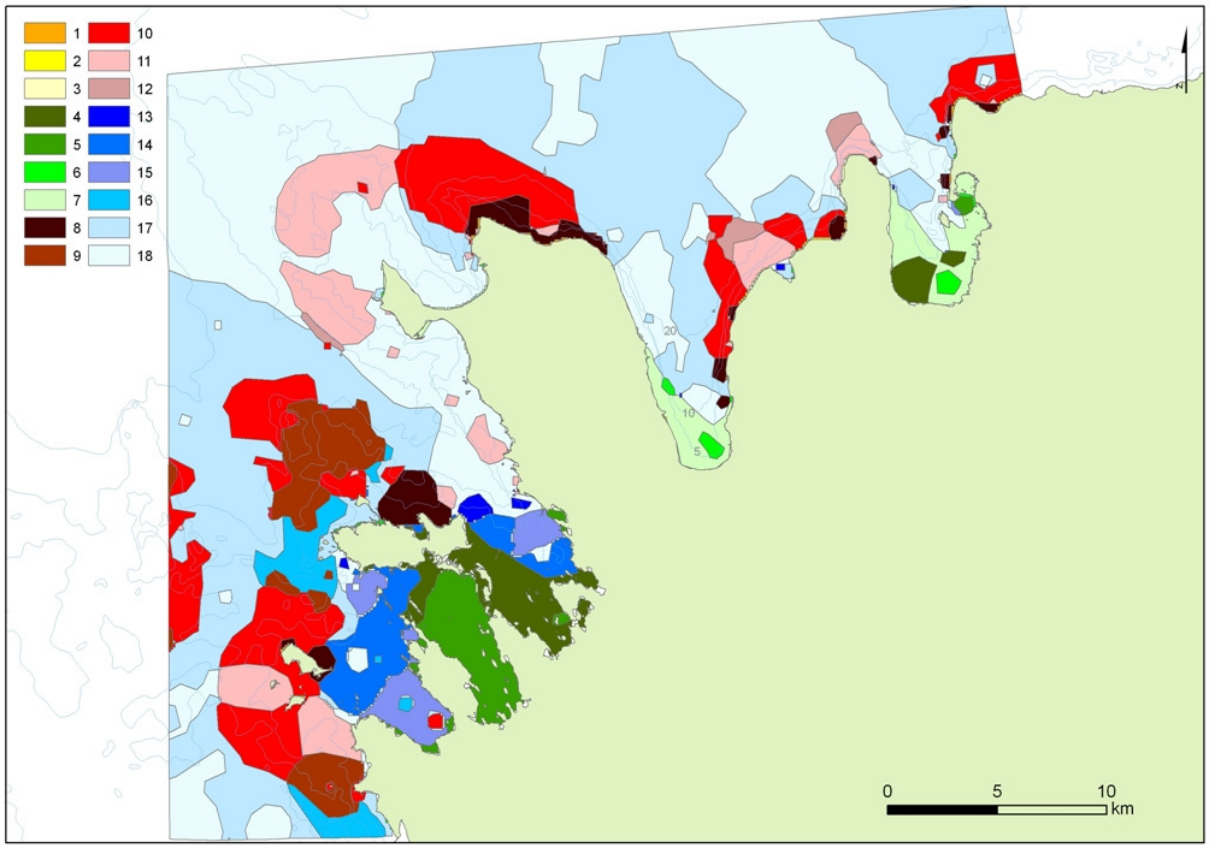


Figure 2. Map of habitat types by the EBHAB classification in the West Saaremaa project area.

Species: Occurance of hard bottoms in exposed areas off the coast offers attachment and thus habitat for numerous filamentous algae. Higher salinity and good transparency of the Baltic Proper waters invading to this this area together with occurance of hard bottoms in exposed areas off the coast offers unique conditions which reflects in the utmost species composition. Marine species prosper, freshwater origin species are rare and found only in near-coast sheltered areas. Some algal species such as *Pilayella littoralis, Furcellaria lumbricalis, Stictyosiphon foeniculaceus* and *Ceramium tenuicorne* can be found in depths up to 25 m.

Table 3. Species depth distribution and biomass in the West Saaremaa project area.

		Depth m		Biomass dw g m^{-2}			
	Species	**Min**	**Max**	**Min**	**Max**	**Mean**	**StDev**
1	*Aglaothamnion roseum*	9	9	0.01	0.01	0.01	
2	*Ceramium tenuicorne*	0.2	23.3	0.00	161.48	5.42	17.94
3	*Ceramium virgatum*	0.2	14	0.00	122.97	7.85	17.58
4	*Chaetomorpha linum*	0.7	13.3	0.00	81.21	6.03	16.58
5	*Chara aspera*	0.5	4	0.71	415.58	86.53	110.97
6	*Chara baltica*	0.6	2.75	0.40	203.38	47.79	62.81
7	*Chara canescens*	0.5	2.75	0.14	36.26	7.31	11.74
8	*Chara connivens*	1.3	3.3	0.26	85.05	13.99	26.37
9	*Chara horrida*	1.2	1.2	0.75	0.75	0.75	
10	*Chara tomentosa*	1.2	2.75	4.16	496.11	191.34	200.54
11	*Chorda filum*	0.2	13.5	0.00	46.61	5.45	10.36
12	*Cladophora glomerata*	0.2	16.4	0.00	227.15	12.40	27.62
13	*Cladophora rupestris*	0.2	12	0.00	3.79	0.62	1.20
14	*Coccotylus truncatus*	3	24	0.01	43.61	1.52	6.17
15	*Cyanophyta*	1	3	0.00	0.63	0.24	0.34
16	*Dictyosiphon foeniculaceus*	0.2	12	0.00	141.31	6.50	16.68
17	*Ectocarpus siliculosus*	4.8	9.3	0.03	1.35	0.69	0.93
18	*Elachista fucicola*	2.5	5.1	0.11	7.55	2.19	3.59
19	*Eudesme virescens*	3.2	3.2	0.40	0.40	0.40	
20	*Fontinalis*	0.3	1.9	0.06	2.35	1.20	1.62
21	*Fucus vesiculosus*	0.2	12	0.12	1166.45	221.34	294.24
22	*Furcellaria lumbricalis*	0.4	24	0.00	3149.00	51.22	246.92
23	*Leathesia difformis*	0.7	1	0.13	20.11	8.43	10.41
24	*Monostroma balticum*	1.7	13.1	0.09	1.88	0.77	0.86
25	*Myriophyllum spicatum*	0.5	7.5	0.02	49.24	9.79	15.89
26	*Pilayella littoralis*	0.2	20	0.00	526.70	38.43	73.09
27	*Pilayella/Ectocarpus*	0.2	9.5	0.03	216.24	30.46	49.64
28	*Polysiphonia fibrillosa*	0.2	8.7	0.00	3.86	0.40	0.97
29	*Polysiphonia fucoides*	0.2	23.3	0.00	376.28	11.45	35.06
30	*Potamogeton pectinatus*	0.5	13.1	0.00	319.48	48.44	79.15
31	*Potamogeton perfoliatus*	1.1	1.1	73.24	73.24	73.24	
32	*Rhizoclonium riparium*	0.3	8.4	0.00	7.83	1.04	2.75
33	*Rhodomela confervoides*	0.8	13.1	0.00	29.63	3.38	6.76
34	*Ruppia maritima*	0.3	3.8	0.04	290.08	50.53	102.60
35	*Sphacelaria arctica*	0.5	17.2	0.00	12.39	1.40	2.57
36	*Stictyosiphon tortilis*	0.5	24	0.00	21.05	1.46	4.24
37	*Zannichellia palustris*	0.2	12	0.01	71.33	11.16	19.27
38	*Zostera marina*	0.8	5.9	0.04	280.06	43.11	61.73
39	*Tolypella nidifica*	1.8	8	0.01	0.92	0.24	0.30
40	*Ulothrix flacca*	1	1	0.00	0.00	0.00	
41	*Ulothrix sp*	0.3	4.8	0.00	15.65	5.35	8.92
42	*Ulva intestinalis*	0.2	13.2	0.00	242.78	10.55	38.46

43	*Urospora penicilliformis*	3	3	0.00	0.00	0.00	
44	*Alderia modesta*	9	9	0.00	0.01	0.00	0.00
45	*Asellus aquaticus*	0.5	13.1	0.00	0.59	0.09	0.13
46	*Balanus improvisus*	0.4	21.5	0.08	13.57	2.88	3.28
47	*Bathyporeia pilosa*	0.8	6.8	0.00	0.50	0.16	0.14
48	*Bithynia tentaculata*	0.7	1.1	0.40	1.57	0.99	0.83
49	*Bylgides sarsi*	8.4	11.8	0.16	0.25	0.20	0.07
50	*Calliopius laeviusculus*	0.5	11.7	0.00	0.07	0.02	0.02
51	*Cerastoderma glaucum*	0.2	23.3	0.00	142.37	9.41	18.27
52	*Chironomidae*	0.2	14	0.00	4.92	0.18	0.47
53	*Coleoptera*	0.5	0.5	0.03	0.08	0.05	0.03
54	*Cordylophora caspia*	1.3	1.3	0.08	0.08	0.08	
55	*Corophium volutator*	1	24	0.00	0.88	0.08	0.18
56	*Crangon crangon*	0.5	11.5	1.01	7.32	3.73	2.64
57	*Cyanophthalma obscura*	0.2	9.5	0.00	1.44	0.09	0.23
58	*Diptera*	0.5	1	0.18	0.39	0.29	0.15
59	*Echinogammarus stoerensis*	3.2	5	0.06	0.12	0.09	0.04
60	*Electra crustulenta*	8	21.5	0.00	0.01	0.00	0.00
61	*Gammarus duebeni*	0.4	5.5	0.04	0.50	0.29	0.23
62	*Gammarus juv*	0.2	20	0.00	9.09	0.26	0.73
63	*Gammarus locusta*	0.5	13.3	0.00	2.29	0.34	0.51
64	*Gammarus oceanicus*	0.2	13.1	0.01	6.62	0.55	0.86
65	*Gammarus salinus*	0.2	14	0.00	24.89	0.51	1.99
66	*Gammarus zaddachi*	0.2	13.5	0.01	10.37	0.46	1.07
67	*Gammarus tigrinus*	1	5.6	0.03	0.46	0.18	0.18
68	*Gonothyraea loveni*	5.8	21.5	0.00	0.17	0.05	0.07
69	*Halicryptus spinulosus*	21	35	0.19	0.22	0.20	0.02
70	*Hediste diversicolor*	0.2	35	0.00	8.89	0.35	0.76
71	*Hydracarina*	7.5	7.5	0.22	0.22	0.22	
72	*Hydrobia sp*	0.2	13.1	0.03	7.76	1.54	2.04
73	*Hydrobia ulvae*	0.2	23.3	0.00	57.89	2.70	5.77
74	*Hydrobia ventrosa*	0.5	9.3	0.00	1.90	0.21	0.45
75	*Idotea balthica*	0.2	14	0.00	489.70	3.41	38.09
76	*Idotea chelipes*	0.2	12	0.00	1.82	0.17	0.23
77	*Idotea granulosa*	3	3	0.28	0.28	0.28	
78	*Jaera albifrons*	0.4	14	0.00	1.69	0.07	0.18
79	*Laomedea flexuosa*	6.3	12	0.01	0.10	0.03	0.04
80	*Lepidoptera*	0.5	2.7	0.11	0.42	0.30	0.17
81	*Leptocheirus pilosus*	0.5	11.7	0.00	0.03	0.01	0.01
82	*Lymnaea peregra*	0.2	14	0.01	31.05	2.73	4.81
83	*Lymnaea sp*	0.9	8.1	0.09	3.38	1.73	2.33
84	*Macoma balthica*	0.4	35	0.01	85.82	10.07	14.63
85	*Marenzelleria neglecta*	2	12.5	0.00	0.05	0.02	0.02
86	*Melita palmata*	0.5	5.5	0.00	0.09	0.04	0.03
87	*Monoporeia affinis*	0.4	0.4	0.03	0.03	0.03	
88	*Mya arenaria*	0.4	23.3	0.00	89.74	6.34	12.61
89	*Mysis mixta*	5	5	0.32	0.32	0.32	
90	*Mytilus trossulus*	0.2	24	0.00	1033.42	113.86	191.80
91	*Neomysis integer*	1.9	3.8	0.02	0.08	0.05	0.05
92	*Odonata*	0.9	2.7	0.04	3.44	1.13	1.19
93	*Oligochaeta*	0.2	23.3	0.00	1.13	0.05	0.13
94	*Palaemon adspersus*	0.5	11	0.00	1.38	0.52	0.75
95	*Piscicola geometra*	2.2	9	0.00	0.04	0.01	0.01
96	*Praunus flexuosus*	1.8	11.7	0.02	0.16	0.06	0.06

97	*Praunus inermis*	3.6	11	0.01	0.06	0.02	0.02
98	*Praunus sp*	5.2	7.2	0.00	0.01	0.01	0.00
99	*Saduria entomon*	2.7	35	0.03	2.65	0.50	0.84
100	*Theodoxus fluviatilis*	0.2	13.5	0.01	56.41	4.85	7.52
101	*Trichoptera*	0.5	8.7	0.04	0.42	0.17	0.13

5EST South Saaremaa

General description of a project area:

The South Saaremaa project site is located in the Gulf of Riga and encompasses the coastal sea area of southern and southeastern Saaremaa island. It extends from Kübassaare peninsula to Kasti Bay and Vätta peninsula. Total project area is 63549 ha. The coastline is extremely disjuncted with many small bays invading to the land. Area is rather shallow, depths over 20 m are reached in 10 km distance from the coast.

The Gulf of Riga is a wide, shallow, semi-enclosed brackish water ecosystem of the Baltic Sea. The Gulf receives freshwater from a large drainage area (134 000 km^2), primarily entering the southern part of the basin. The average salinity varies from 0.5–2.0 psu in surface layers in its southern and northeastern areas to 7 psu at the straits. In most parts, however, the salinity is 5.0–6.5 psu with the absence of a permanent halocline. Due to its shallowness, the dynamics of both surface and deep water temperatures are directly coupled with air temperatures. The oxygen regime is relatively good due to strong vertical mixing. In most areas, oxygen concentrations are higher than 5 ml l^{-1}.

Existing Natura areas:

Name	Area ha	Natura code
Kasti laht SPA	3685	EE0040418
Kasti laht pSCI	3895	EE0040417
Sutu laht SPA	2129	EE0040472
Sutu pSCI	2161	EE0040471
Siiksaare-Oessaare SPA/pSCI	3892	EE0040469
Kahtla-Kübassaare SPA	13232	EE0040412
Kahtla-Kübassaare pSCI	13165	EE0040411

Pressures: In consequence of limited water exchange, the Gulf is more eutrophicated than the Baltic Proper, and the outflow of nutrients through the straits is higher than the inflow. The riverine loading is the most important pathway of nutrients into the Gulf of Riga and exceeds the combined contribution from atmospheric deposition, point emission from cities and industries along the coast, and nitrogen fixation by marine organisms.

Habitats: Six different Natura 2000 habitat types are found in the area: sandbanks, reefs, large inlets, lagoons and mudflats. Out of these habitat types sandbanks are most dominant and are found afar off the coast as well. Shallow inlets and bays and mudflats are located mostly in the eastern side of the project area. Reefs are small, mainly formed by boulders and stones and are found sparsely near the coast.

Table 1. List of Natura 2000 habitat types in the West Saaremaa project area.

Code	Name	Area ha	% of project area
1170	Reefs	1947.08	3.49
1160	Large shallow inlets and bays	2166.05	3.88
1110	Sandbanks which are slightly covered by sea water all the time	14955.27	26.80
1150	* Coastal lagoons	327.89	0.59

1140	Mudflats and sandflats not covered by seawater at low tide	2216.83	3.97

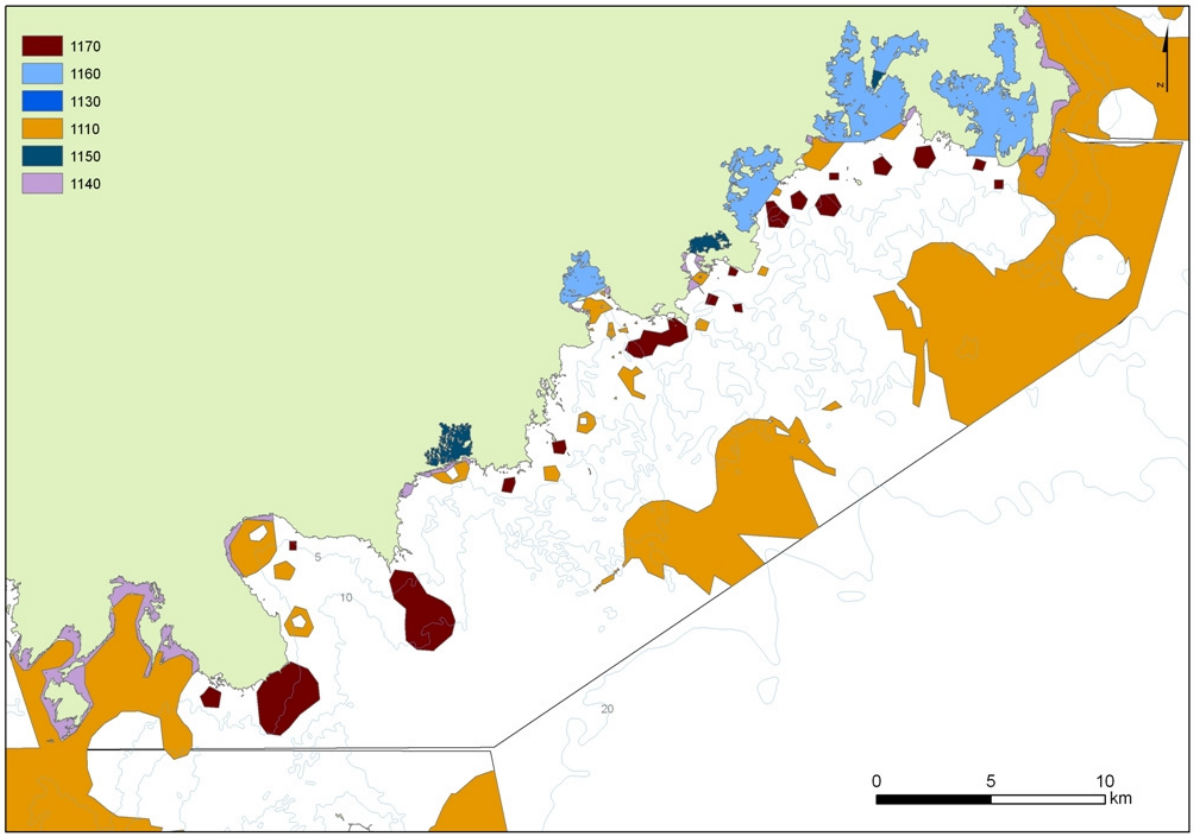


Figure 1. Map of Natura 2000 habitat types in the West Saaremaa project area.

Based on EBHAB classification moderately exposed soft bottoms with bivalves or no particular species dominance prevail. Hard bottoms with mussels or algae are distributed sparsely along the coast.

Table 2. List of habitat types by the EBHAB classification in the West Saaremaa project area.

Code	Name	Area ha	% of project area
4	Sheltered soft bottoms with higher plants	1478.58	2.65
5	Sheltered soft bottoms with charophytes	982.32	1.76
6	Sheltered soft bottoms with bivalves	103.36	0.19
7	Sheltered soft bottoms with no particular species dominance	15.31	0.03
8	Moderately exposed hard bottoms with *Fucus vesiculosus*	189.52	0.34
9	Moderately exposed hard bottoms with F*urcellaria lumbricalis*	1139.93	2.04

10	Moderately exposed hard bottoms with bivalves and *Balanus improvisus*	618.74	1.11
11	Moderately exposed hard bottoms with no particular species dominance, <20m	40.87	0.07
13	Moderately exposed soft bottoms with *Zostera marina*	533.79	0.96
14	Moderately exposed soft bottoms with higher plants excluding *Zostera marina.*	6190.33	11.09
15	Moderately exposed soft bottoms with charophytes	373.03	0.67
16	Moderately exposed soft bottoms with *Furcellaria lumbricalis*	12223.98	21.90
17	Moderately exposed soft bottoms with bivalves	21277.86	38.13
18	Moderately exposed soft bottoms with no particular species dominance	10637.78	19.06

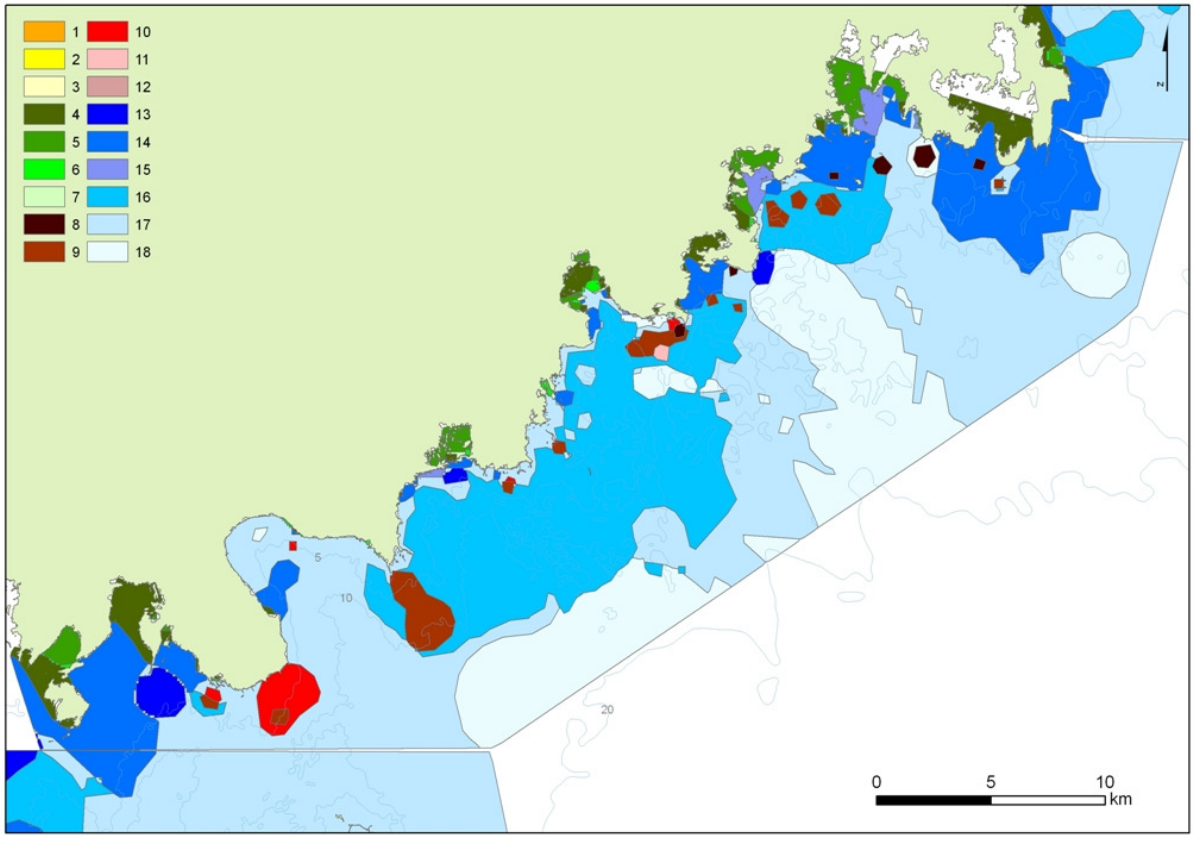


Figure 2. Map of habitat types by the EBHAB classification in the West Saaremaa project area.

Species: Sheltered and shallow bays offer great habitat for a variaty of marine and freshwater origin species. Charophytes and higher plants occur widely in the area.

Table 3. Species depth distribution and biomass in the West Saaremaa project area.

	Species	Depth m		Biomass dw g m^{-2}			
		Min	Max	Min	Max	Mean	StDev
1	*Aglaothamnion roseum*	6	9.2	0.03	0.94	0.33	0.52
2	*Ceramium tenuicorne*	0.5	10	0.00	83.06	1.81	6.02
3	*Ceramium virgatum*	1	2	0.01	0.24	0.12	0.16
4	*Ceratophyllum demersum*	0.5	5,5	0.06	34.67	6.62	10.63
5	*Chaetomorpha linum*	1	3	0.00	268.30	38.22	88.65
6	*Chara aspera*	0.4	5.5	0.09	1297.28	50.83	181.62
7	*Chara baltica*	0.5	0.5	25.84	25.84	25.84	
8	*Chara canescens*	0.5	3	0.10	13.41	2.55	3.48
9	*Chara connivens*	0.5	3	0.04	1042.74	126.93	309.42
10	*Chara sp*	0.3	6	0.00	305.71	76.01	131.05
11	*Chara tomentosa*	0.5	1.5	15.82	3243.26	594.84	797.78
12	*Chorda filum*	0.5	4	0.07	93.43	7.32	19.77
13	*Cladophora glomerata*	0.2	10	0.00	375.01	30.02	60.49
14	*Cladophora rupestris*	0.6	6.2	0.02	1.73	0.57	0.67
15	*Coccotylus truncatus*	0.5	8	0.00	5.40	0.71	1.24
16	*Cyanophyta*	0.7	2.7	0.00	52.30	8.78	15.92
17	*Dictyosiphon foeniculaceus*	0.2	9.2	0.00	173.65	8.01	22.84
18	*Ectocarpus siliculosus*	3	3	0.45	0.45	0.45	
19	*Elachista fucicola*	0.5	1.2	0.17	0.20	0.19	0.02
20	*Elodea canadensis*	1	1	0.11	701.01	350.56	495.61
21	*Fontinalis*	0.6	2.5	0.00	0.45	0.13	0.19
22	*Fucus vesiculosus*	0.2	6	0.19	2170.22	248.23	372.56
23	*Furcellaria lumbricalis*	0.2	9.8	0.02	944.04	32.66	83.84
24	*Monostroma balticum*	2	2	15.77	15.77	15.77	
25	*Myriophyllum spicatum*	0.5	6	0.00	363.90	24.33	56.39
26	*Najas marina*	0.3	3	0.01	130.36	16.47	37.60
27	*Pilayella littoralis*	0.5	10	0.00	628.39	23.55	67.46
28	*Pilayella/Ectocarpus*	0.2	7.2	0.08	85.65	21.47	25.61
29	*Polysiphonia fibrillosa*	0.5	9.8	0.00	34.70	2.03	6.19
30	*Polysiphonia fucoides*	0.5	10	0.00	200.05	4.46	14.24
31	*Potamogeton pectinatus*	0.2	7.2	0.01	688.96	39.57	70.79
32	*Potamogeton perfoliatus*	0.5	4	0.01	129.01	19.54	27.41
33	*Ranunculus baudotii*	1.2	1.5	28.18	73.06	50.62	31.73
34	*Rhizoclonium riparium*	0.5	6.2	0.00	65.78	7.10	16.91
35	*Rhodomela confervoides*	1	8.4	0.00	15.36	1.53	2.41
36	*Ruppia maritima*	0.5	7.2	0.00	261.33	22.94	45.01
37	*Sphacelaria arctica*	0.5	10	0.00	165.83	6.57	17.41
38	*Stictyosiphon tortilis*	0.5	9.8	0.00	462.60	13.36	51.20
39	*Zannichellia palustris*	0.2	8	0.00	202.84	11.02	29.60
40	*Zostera marina*	0.5	6	0.12	36.68	5.12	9.93
41	*Tolypella nidifica*	0.5	6.8	0.03	32.81	3.54	5.37
42	*Ulothrix sp*	0.5	2.5	0.00	3.46	0.27	0.96
43	*Ulva intestinalis*	0.4	6.5	0.00	1266.69	40.71	138.90
44	*Urospora penicilliformis*	1	1	0.00	0.49	0.07	0.18
45	*Vaucheria sp*	0.5	0.75	0.63	3.32	1.98	1.90
46	*Alderia modesta*	1	2.2	0.01	0.90	0.23	0.38
47	*Argulus sp*	4.5	4.5	0.04	0.04	0.04	
48	*Asellus aquaticus*	0.3	8	0.00	23.40	1.40	3.50
49	*Balanus improvisus*	1.5	5.5	0.26	15.97	3.89	6.81
50	*Bithynia tentaculata*	0.2	3	0.01	105.72	12.30	19.17

51	*Cerastoderma glaucum*	0.2	10	0.01	231.43	17.48	28.38
52	*Chironomidae*	0.3	11.1	0.00	17.85	0.77	2.00
53	*Coleoptera*	0.5	2	0.02	0.52	0.12	0.15
54	*Cordylophora caspia*	2.1	2.1	0.01	0.01	0.01	
55	*Corophium volutator*	0.5	10	0.00	4.32	0.22	0.52
56	*Cyanophthalma obscura*	0.2	6.5	0.00	0.65	0.05	0.09
57	*Diptera*	0.5	2.5	0.01	1.04	0.35	0.34
58	*Dreissena polymorpha*	3.5	5.5	3.10	4.02	3.53	0.46
59	*Ephemeroptera*	1	1.3	0.07	1.30	0.77	0.64
60	*Gammarus duebeni*	1	1	0.02	0.02	0.02	
61	*Gammarus juv*	0.2	9.8	0.00	32.93	0.32	2.15
62	*Gammarus lacustris*	1.5	1.5	0.21	0.21	0.21	
63	*Gammarus oceanicus*	0.2	9.8	0.02	2.75	0.37	0.47
64	*Gammarus salinus*	0.2	9.5	0.01	9.57	0.34	1.00
65	*Gammarus sp*	2	2	0.16	0.16	0.16	
66	*Gammarus zaddachi*	0.2	7.5	0.04	0.71	0.21	0.17
67	*Gammarus tigrinus*	0.2	6	0.01	7.23	0.94	1.39
68	*Gonothyraea loveni*	2.2	2.2				
69	*Hediste diversicolor*	0.4	8	0.00	46.92	1.38	3.33
70	*Hydracarina*	0.5	3	0.00	0.09	0.03	0.03
71	*Hydrobia sp*	1.5	1.5	0.76	2.04	1.40	0.91
72	*Hydrobia ulvae*	0.2	10	0.00	150.42	3.21	8.19
73	*Hydrobia ventrosa*	0.5	6	0.01	8.13	0.74	1.48
74	*Idotea balthica*	0.5	6.8	0.00	4.01	0.45	0.63
75	*Idotea chelipes*	0.5	8	0.00	18.87	0.33	1.53
76	*Idotea granulosa*	1.5	1.5	0.14	0.14	0.14	
77	*Jaera albifrons*	0.5	8	0.00	0.45	0.05	0.08
78	*Laomedea flexuosa*	1	5.2	0.06	0.42	0.20	0.19
79	*Lepidoptera*	0.5	5	0.00	1.10	0.21	0.33
80	*Leptocheirus pilosus*	0.5	7	0.01	0.25	0.05	0.06
81	*Lymnaea peregra*	0.2	9.5	0.01	27.99	2.45	3.73
82	*Lymnaea sp*	0.5	2	0.23	2.93	1.36	1.33
83	*Lymnaea spx*	0.5	2	2.34	25.53	13.17	11.67
84	*Lymnaea stagnalis*	0.5	3	0.27	44.27	9.74	15.36
85	*Macoma balthica*	0.5	11.4	0.03	86.20	18.26	18.80
86	*Marenzelleria neglecta*	2.5	5.5	0.02	0.25	0.11	0.09
87	*Monoporeia affinis*	4	10	0.00	0.82	0.25	0.34
88	*Mya arenaria*	0.5	8	0.04	160.56	10.11	20.40
89	*Mysis mixta*	2.1	2.1	0.02	0.02	0.02	
90	*Mytilus trossulus*	0.5	10	0.00	299.31	17.93	37.36
91	*Nematoda*	3.5	3.5	0.02	0.02	0.02	
92	*Neomysis integer*	1	5.5	0.03	0.20	0.13	0.07
93	*Odonata*	0.4	3.2	0.02	8.34	1.24	1.86
94	*Oligochaeta*	0.5	11.1	0.00	10.83	0.23	1.30
95	*Palaemon adspersus*	2	2	0.11	14.86	5.12	6.85
96	*Physa fontinalis*	0.75	1.5	0.10	0.94	0.41	0.32
97	*Piscicola geometra*	0.9	3.5	0.03	0.08	0.05	0.02
98	*Planorbis sp*	0.5	1	0.36	7.94	2.45	2.52
99	*Potamopyrgus antipodarum*	0.5	9.8	0.02	8.96	1.07	1.72
100	*Saduria entomon*	3	9.6	0.03	1.77	0.46	0.53
101	*Tenellia adspersa*	2.5	2.5	0.01	0.04	0.02	0.02
102	*Theodoxus fluviatilis*	0.2	8.4	0.00	147.74	10.40	18.46
103	*Trichoptera*	0.5	6	0.00	7.73	0.40	1.17

6EST Irbe Strait

General description of a project area:

The Irbe Strait project area is a trans-boundary area between Estonia and Latvia, of which the Irbe Strait is shared. The project area surrounds Sõrve peninsula in the southwestern part of Saaremaa extending from Abruka island in the Gulf of Riga to Lõu Bay in the Baltic Proper. The coastline is slightly disjuncted with some small bays and capes. Area is rather shallow, depths over 20 m are reached only in the Baltic Proper side. Salinity regime is ruled by weather conditions as watermasses from saline Baltic Proper and less saline Gulf of Riga mix in Irbe Strait area. In most parts of Gulf of Riga, however, the salinity is 5.0–6.5 psu with the absence of a permanent halocline, near the strait the salinity varies to 7 psu. Due to its shallowness, the dynamics of both surface and deep water temperatures are directly coupled with air temperatures. The oxygen regime is relatively good due to strong vertical mixing. In most areas, oxygen concentrations are higher than 5 ml l^{-1}. Total project area is 288307 ha.

On the Estonian side, the Irbe strait project area is dominated by the Kura Kurk SPA. Kura Kurk is located in Saare County at the southern end of Saaremaa island (southwest Estonia), and Kura Kurk is part of the Irbe Strait that is shared with Latvia. Kura Kurk is the sea area and seashore surrounding the Kura Kurk peninsula and also functions as a sea strait (depth up to 35 m) between Estonia (Saaremaa island) and Latvia (Kurzeme peninsula). The site includes both coastal and offshore habitats. Offshore is dominated by sandy bottoms with gravel and macrophyte vegetation down to 15 m. Benthic fauna is dominated by shellfish *Macoma*.

Existing Natura areas:

Name	Area ha	Natura code
Kura Kurk SPA	190000	EE0040434

Pressures: In consequence of limited water exchange, the Gulf of Riga is more eutrophicated than the Baltic Proper, and the outflow of nutrients through the straits is higher than the inflow. The riverine loading is the most important pathway of nutrients into the Gulf of Riga and exceeds the combined contribution from atmospheric deposition, point emission from cities and industries along the coast, and nitrogen fixation by marine organisms.

Habitats: Three different Natura 2000 habitat types are found in the area: sandbanks, reefs and mudflats. Out of these habitat types sandbanks are most dominant and are found in the Gulf of Riga area. Reefs are located on the west of Sõrve peninsula on Baltic Proper. Mudflats are mostly located on the coasts of Abruka island.

Table 1. List of Natura 2000 habitat types in the Irbe Strait project area.

Code	Name	Area ha	% of project area
1170	Reefs	6577.86	2.76
1110	Sandbanks which are slightly covered by sea water all the time	47119.47	19.74
1140	Mudflats and sandflats not covered by seawater at low tide	732.59	0.31

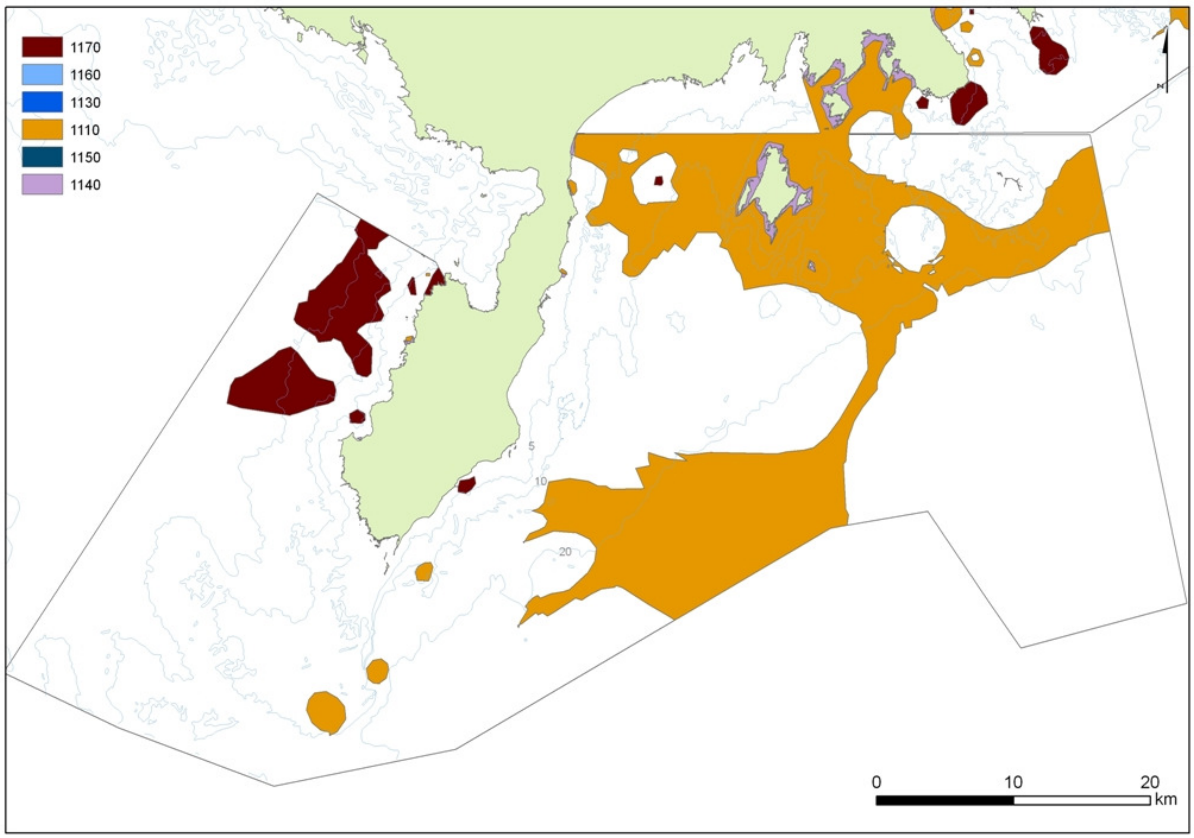


Figure 1. Map of Natura 2000 habitat types in the Irbe Strait project area.

Based on EBHAB classification moderately exposed soft bottoms with bivalves or no particular species dominance prevail. Hard bottoms with mussels or algae are distributed along the western side of Sõrve peninsula, in the Baltic Proper waters.

Table 2. List of habitat types by the EBHAB classification in the Irbe Strait project area.

Code	Name	Area ha	% of project area
2	Sheltered hard bottoms with bivalves and *Balanus improvisus*	4.14	0.00
3	Sheltered hard bottoms with no particular species dominance	29.47	0.01
4	Sheltered soft bottoms with higher plants	92.46	0.04
5	Sheltered soft bottoms with charophytes	9.15	0.00
6	Sheltered soft bottoms with bivalves	623.55	0.26
7	Sheltered soft bottoms with no particular species dominance	21.47	0.01
9	Moderately exposed hard bottoms with F*urcellaria lumbricalis*	231.72	0.10
10	Moderately exposed hard bottoms with bivalves and *Balanus improvisus*	6339.47	2.66

11	Moderately exposed hard bottoms with no particular species dominance, <20m	8086.19	3.49
12	Moderately exposed hard bottoms with no particular species dominance, >=20m	1435.51	0.60
13	Moderately exposed soft bottoms with *Zostera marina*	1120.40	0.47
14	Moderately exposed soft bottoms with higher plants excluding *Zostera marina.*	3247.97	1.36
15	Moderately exposed soft bottoms with charophytes	55.95	0.03
16	Moderately exposed soft bottoms with *Furcellaria lumbricalis*	1479.65	0.62
17	Moderately exposed soft bottoms with bivalves	128392.01	53.78
18	Moderately exposed soft bottoms with no particular species dominance	87556.30	36.68

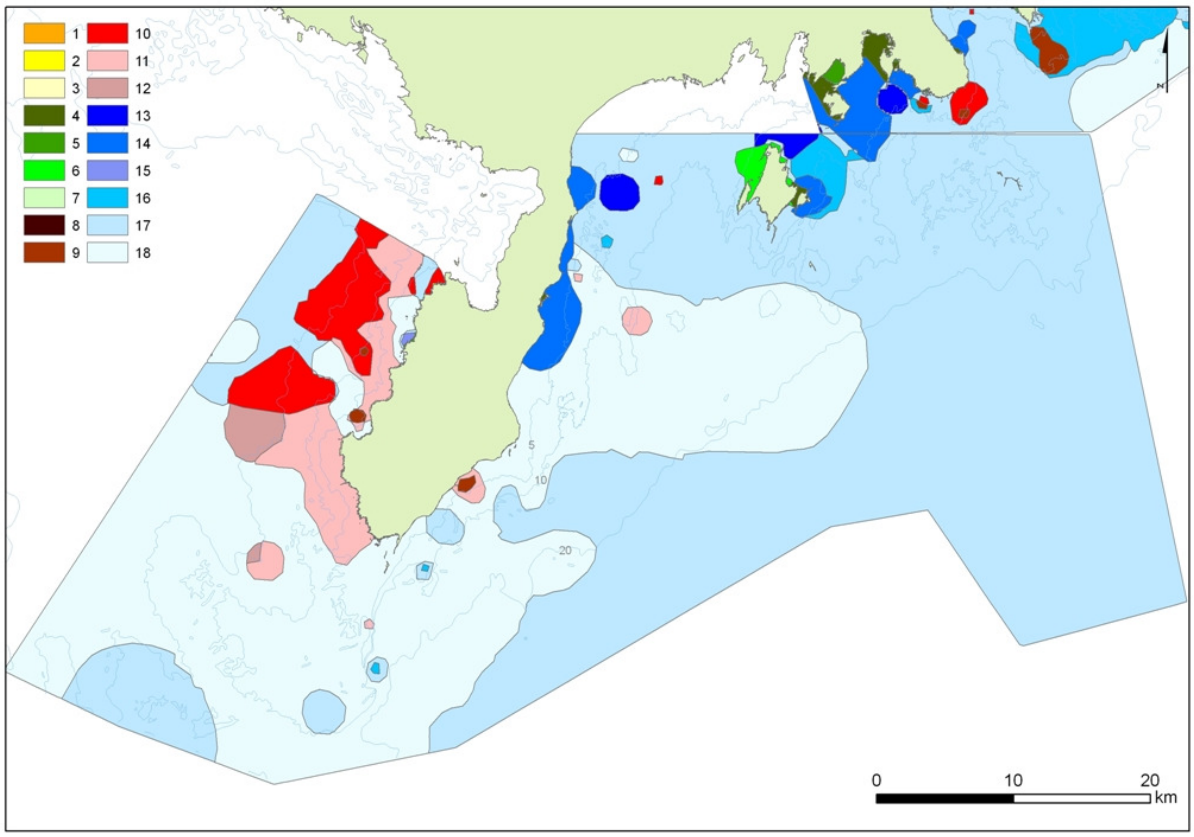


Figure 2. Map of habitat types by the EBHAB classification in the Irbe Strait project area.

Species: The total number of species found in the Irbe Strait area is relatively low compared to other studied areas. This is due to prevalence of deep and sandy habitats, near-coastal hard-substrate habitats are scarce.

Table 3. Species depth distribution and biomass in the Irbe Strait project area.

	Species	Depth m		Biomass dw g m^{-2}			
		Min	Max	Min	Max	Mean	StDev
1	*Ceramium tenuicorne*	0.2	12	0.00	8.50	0.93	1.90
2	*Ceramium virgatum*	1	6.5	0.01	1.81	0.37	0.58
3	*Chara aspera*	0.2	0.2	0.24	1.22	0.67	0.40
4	*Chara baltica*	0.2	0.2	1.43	4.86	3.14	2.42
5	*Chara canescens*	0.5	1	0.15	2.30	1.08	1.11
6	*Chara connivens*	0.5	0.5	0.62	8.75	4.68	5.75
7	*Chorda filum*	0.2	2.2	0.06	3.73	1.97	1.62
8	*Cladophora glomerata*	0.2	12	0.00	136.88	14.07	32.21
9	*Cladophora rupestris*	5	5.5	0.29	0.48	0.39	0.13
10	*Coccotylus truncatus*	2	21	0.00	1.97	0.56	0.76
11	*Dictyosiphon foeniculaceus*	0.2	6.5	0.00	37.87	3.93	7.82
12	*Elachista fucicola*	1	1	0.01	5.73	2.87	4.05
13	*Elodea canadensis*	3	3	9.53	9.53	9.53	
14	*Fontinalis*	1.2	1.2	0.00	0.00	0.00	
15	*Fucus vesiculosus*	0.2	4.5	0.98	505.03	195.59	236.82
16	*Furcellaria lumbricalis*	2	16	0.11	144.48	13.82	37.05
17	*Myriophyllum spicatum*	1	2	0.75	9.58	4.13	4.77
18	*Pilayella littoralis*	0.2	12	0.00	279.74	20.25	47.11
19	*Polysiphonia fibrillosa*	0.5	5	0.01	1.05	0.34	0.39
20	*Polysiphonia fucoides*	0.2	20	0.00	71.35	7.96	13.75
21	*Potamogeton pectinatus*	0.2	2	0.22	1.71	0.72	0.61
22	*Potamogeton perfoliatus*	6.5	6.5	0.78	0.78	0.78	
23	*Rhizoclonium riparium*	2.2	2.2	0.02	0.12	0.07	0.08
24	*Rhodomela confervoides*	1	9	0.05	28.83	10.33	10.16
25	*Ruppia maritima*	0.2	0.5	0.38	18.07	10.66	7.23
26	*Sphacelaria arctica*	0.2	21	0.00	26.60	2.11	4.67
27	*Stictyosiphon tortilis*	0.2	12	0.00	5.37	1.57	1.96
28	*Zannichellia palustris*	0.2	7	0.02	17.38	5.97	6.63
29	*Zostera marina*	4	5	0.40	68.35	34.37	48.05
30	*Tolypella nidifica*	0.5	1.2	0.10	2.97	1.43	1.44
31	*Ulva intestinalis*	4.8	5.5	0.17	0.67	0.31	0.24
32	*Balanus improvisus*	5	20	0.08	1.68	0.66	0.66
33	*Bathyporeia pilosa*	1.2	1.2	0.04	0.04	0.04	
34	*Cerastoderma glaucum*	0.2	10	0.01	29.66	3.28	6.63
35	*Chironomidae*	0.2	12	0.00	0.18	0.03	0.04
36	*Coleoptera*	0.2	0.2	0.00	0.00	0.00	0.00
37	*Cordylophora caspia*	7	7	0.01	0.01	0.01	
38	*Corophium volutator*	0.5	27	0.00	1.03	0.14	0.21
39	*Cyanophthalma obscura*	0.2	2.5	0.01	0.03	0.02	0.01
40	*Diastylis rathkei*	1.6	1.6	0.39	0.39	0.39	
41	*Gammarus juv*	0.2	27	0.00	0.37	0.06	0.08
42	*Gammarus locusta*	3.6	3.6	0.01	0.01	0.01	
43	*Gammarus oceanicus*	1	5	0.02	2.04	0.33	0.50
44	*Gammarus salinus*	0.5	27	0.00	1.66	0.24	0.35
45	*Gammarus zaddachi*	0.5	2	0.02	0.31	0.11	0.11
46	*Gammarus tigrinus*	0.2	20.5	0.03	1.08	0.41	0.46
47	*Halicryptus spinulosus*	20.5	27	0.35	0.87	0.55	0.21
48	*Hediste diversicolor*	0.2	27	0.00	3.09	0.32	0.70
49	*Hydrobia ulvae*	0.2	21	0.04	5.70	0.96	1.46

50	*Hydrobia ventrosa*	0.5	5	0.01	0.08	0.04	0.04
51	*Idotea balthica*	0.2	4.8	0.01	4.54	0.51	1.00
52	*Idotea chelipes*	0.2	6.4	0.00	3.15	0.58	0.76
53	*Jaera albifrons*	0.2	20	0.00	0.07	0.02	0.02
54	*Leptocheirus pilosus*	1	1	0.04	0.04	0.04	
55	*Lymnaea peregra*	0.2	3.6	0.03	1.42	0.33	0.51
56	*Macoma balthica*	0.2	27	0.02	100.15	17.36	22.84
57	*Marenzelleria neglecta*	9	27	0.00	0.08	0.04	0.04
58	*Monoporeia affinis*	10	27	0.01	0.48	0.10	0.12
59	*Mya arenaria*	0.2	24	0.00	8.27	1.62	2.07
60	*Mytilus trossulus*	0.2	20	0.02	184.29	14.44	32.46
61	*Neomysis integer*	0.5	0.5	0.04	0.04	0.04	
62	*Oligochaeta*	0.5	14	0.00	0.03	0.01	0.01
63	*Piscicola geometra*	4.8	4.8	0.00	0.00	0.00	
64	*Praunus flexuosus*	0.5	0.5	0.03	0.05	0.04	0.01
65	*Praunus inermis*	0.5	0.5	0.05	0.05	0.05	
66	*Saduria entomon*	5	16	0.06	4.37	1.36	1.93
67	*Theodoxus fluviatilis*	0.2	8.3	0.01	18.89	2.23	3.22

7LAT Ainaži-Tūja

General description of a project area:

The project area represents marine waters from Dzeņi to the mouth of the Gauja River with different bottom types and inflow of the relatively large Salaca River and several small ones. Sea bottom is mostly glacial deposition plain covered by pebbles, sand and stones. Bottom area includes sandy banks as well. The sounthern part of the project area is influenced by the outflow from the Daugava and Gauja Rivers. Macrofauna biomass in the early 90-ties was 0-200 g/m2. Tentatively, phytobenthic community exhibits certain variability with Rhodophyta and Phaeophyta groups of algae dominating at northern part of area, while at southern part of area equally dominant is also Chlorophyta group.

Zoobenthic community exhibits certain variability, e.g. in zones with vegetation dominant species are *Theodoxus fluviatilis, Gammarus salinus*, on hard substrate without vegetation dominant species are *Dreissena polymorpha, Mytilus trossulus*, and on sandy bottom - *Macoma baltica.* Altogether, at least ten species of phytobenthos and seventeen species of zoobenthoss were recorded previously in this area.

Since the eatern part of the Gulf of Riga is usually under ice coverage during winter time, no internationally important bird concentrations are present there in winter. However, during spring and summer seasons, there is a regular concentration of *Bucephala clangula* near the Svētupe River mouth. The Tūja offshore IBA is sheltering app. 1,000-1,200 *Gavia stellata/ arctica* (1% of northwest Europe wintering population) during winter time.

Due to rather low water salinity, fish community is dominated by freshwater and anadromous fish species, although marine fish species also occur. The main freshwater fish species are *Perca fluviatilis, Rutilus rutilus, Abramis brama*, anadromous – *Salmo salar, Salmo trutta, Vimba vimba, Stizostedion lucioperca*, marine fish species – *Clupea harengus membras*, *Zoarces viviparus* and *Pomatoschistus minutus*. The Salaca River is also a spawning area of *Lampetra fluviatilis* and rare species in Latvian waters – *Petromyzon marinus*.

Existing Natura areas:

Name	Area ha	Natura code
Ainaži-Tūja pSCI	XXX	LV0508600

Pressures: In consequence of limited water exchange, the Gulf is more eutrophicated than the Baltic Proper, and the outflow of nutrients through the straits is higher than the inflow. The riverine loading is the most important pathway of nutrients into the Gulf of Riga and exceeds the combined contribution from atmospheric deposition, point emission from cities and industries along the coast, and nitrogen fixation by marine organisms.

Habitats: Natura 2000 habitat type „Reefs“ are present in the area. Reefs form a continuous belt along the coastline and are mainly formed by boulders and stones. Total area of the reefs in the area is 60 km^2

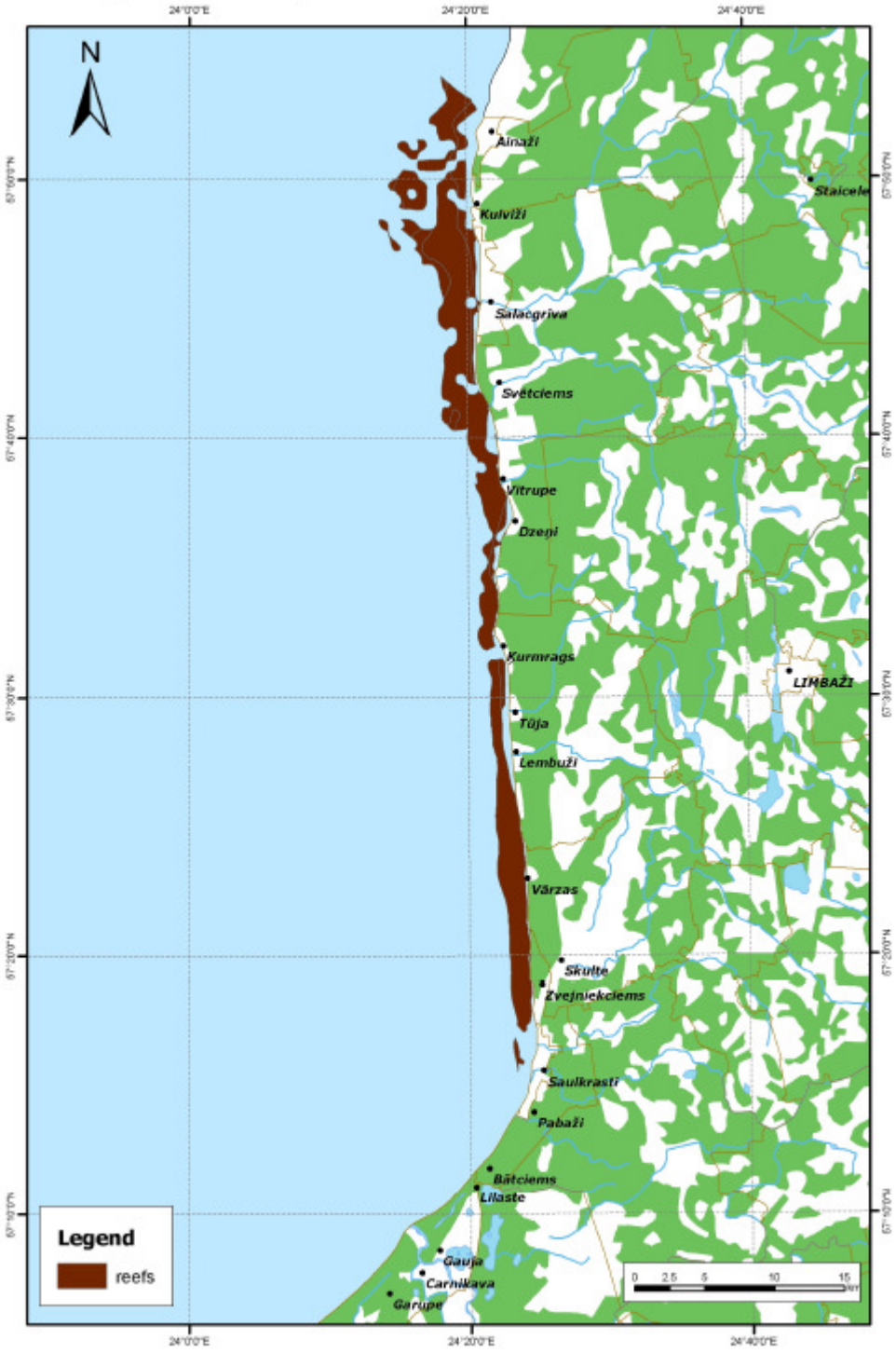


Figure 1. Map of Natura 2000 habitat types in the Ainaži-Tūja project area.

Based on EBHAB classification moderately exposed soft bottoms with bivalves or no particular species dominance prevail. Hard bottoms with mussels or algae are distributed sparsely along the coast.

Table 2. List of habitat types by the EBHAB classification in the Ainaži-Tūja project area.

Code	Name	Area ha	% of project area
8	Moderately exposed hard bottoms with *Fucus vesiculosus*	7239.11	2.19
10	Moderately exposed hard bottoms with bivalves and *Balanus improvisus*	26198.06	7.92
11	Moderately exposed hard bottoms with no particular species dominance, <20m	8224.21	2.48
14	Moderately exposed soft bottoms with higher plants excluding *Zostera marina.*	212.83	0.06
17	Moderately exposed soft bottoms with bivalves	67832.02	20.49
18	Moderately exposed soft bottoms with no particular species dominance	221279.46	66.85

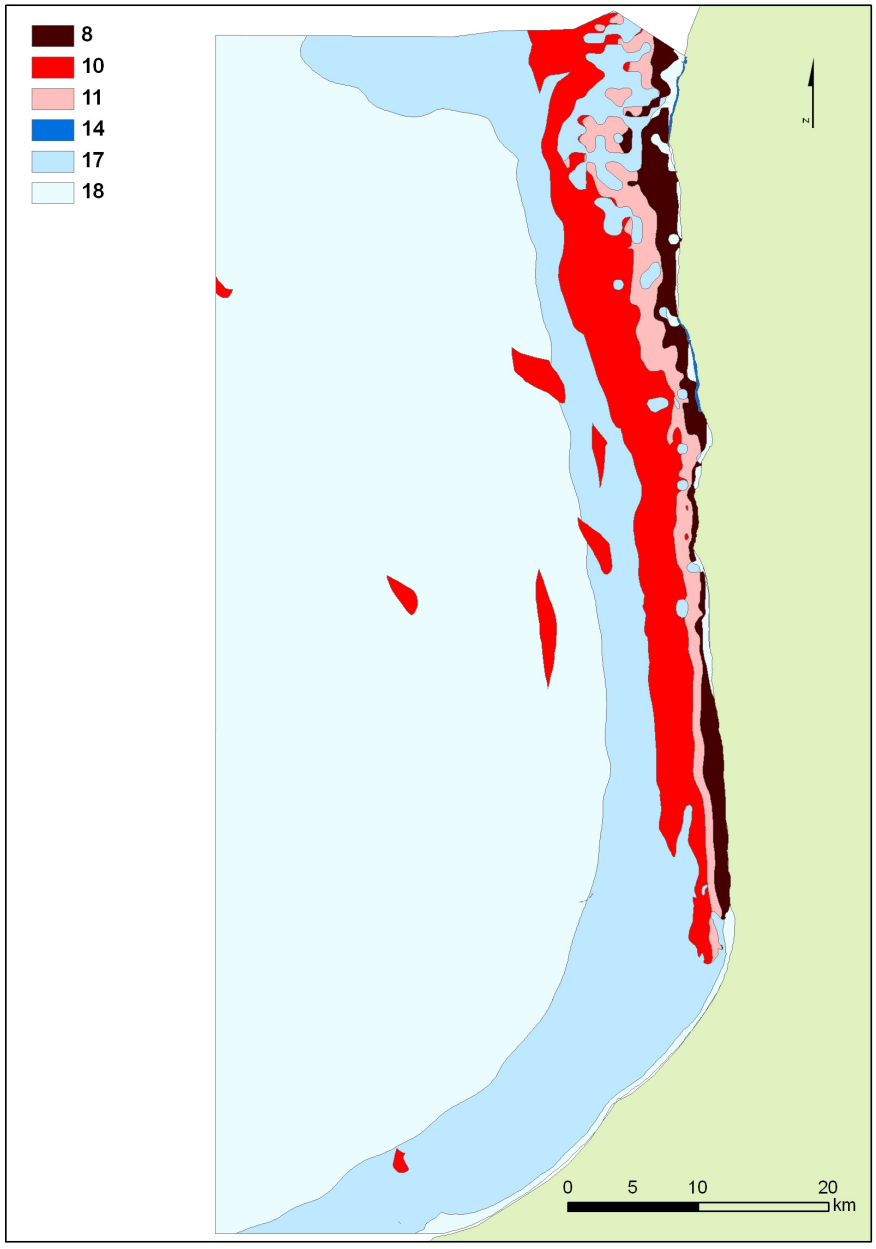


Figure 2. Map of habitat types by the EBHAB classification in the Ainaži-Tūja project area.

8LAT West Coast of Gulf of Riga

General description of a project area:

The project area represents coastal waters from Kauguri to Kolka, which are influenced by outlet of the Lake Engure and several small rivers. Sea bottom coverage is very diverse ranging from stones to muddy bottoms.

Tentatively, *Rhodophyta* and *Phaeophyta* groups of algae dominate phytobenthic community. Zoobenthic community exhibits certain variability, e.g. in zones with vegetation, the dominant species are *Theodoxus fluviatilis, Gammarus salinus*, on hard substrate without vegetation, the dominant species are *Dreissena polymorpha, Mytilus trossulus*, and on sandy bottom - *Macoma baltica*. Altogether, at least eleven species of phytobenthos and fifteen species of zoobenthos were previously recorded in this area.

The territory attracts large numbers of benthic-feeding seaducks (*Clangula hyemalis*, *Melanitta fusca, Melanitta nigra*) and piscivorous waterbirds (*Gavia stellata, Podiceps grisegena*) during winter and migration time (for *M.fusca* and *P.grisegena* more than 1 % of total Baltic Sea wintering population) and 2 – 3 % of *Bucephala clangula* NE Europe population during moulting time.

The fish community is mixed. The main marine fish species are *Clupea harengus membras, Zoarces viviparus, Platichthys flesus, Coregonus lavaretus, Belone belone*, *Ammodytes tobianus* and *Pomatoschistus minutus*. Anadromous and catadromous fish species occur mostly during feeding migrations and they are *Salmo trutta, Vimba vimba, Anguilla anguilla* and *Osmerus eperlanus*. Freshwater fish species dominating here are *Perca fluviatilis, Rutilus rutilus, Abramis brama* and *Leuciscus idus*. The area is rather important for Coregonus lavaretus.

Existing Natura areas:

Name	Area ha	Natura code
Kemeri National Park SPA/pSCI	7 397	LV0200200
Lake Engure Nature Park SPA/pSCI	1 906	LV0302800

Pressures: In consequence of limited water exchange, the Gulf is more eutrophicated than the Baltic Proper, and the outflow of nutrients through the straits is higher than the inflow. The riverine loading is the most important pathway of nutrients into the Gulf of Riga and exceeds the combined contribution from atmospheric deposition, point emission from cities and industries along the coast, and nitrogen fixation by marine organisms.

Habitats: Natura 2000 habitat type „Reefs“ are present in the area. Reefs form a continuous belt along the coastline and are mainly formed by boulders and stones. Total area of the reefs in the area is 73.93 km^2 .

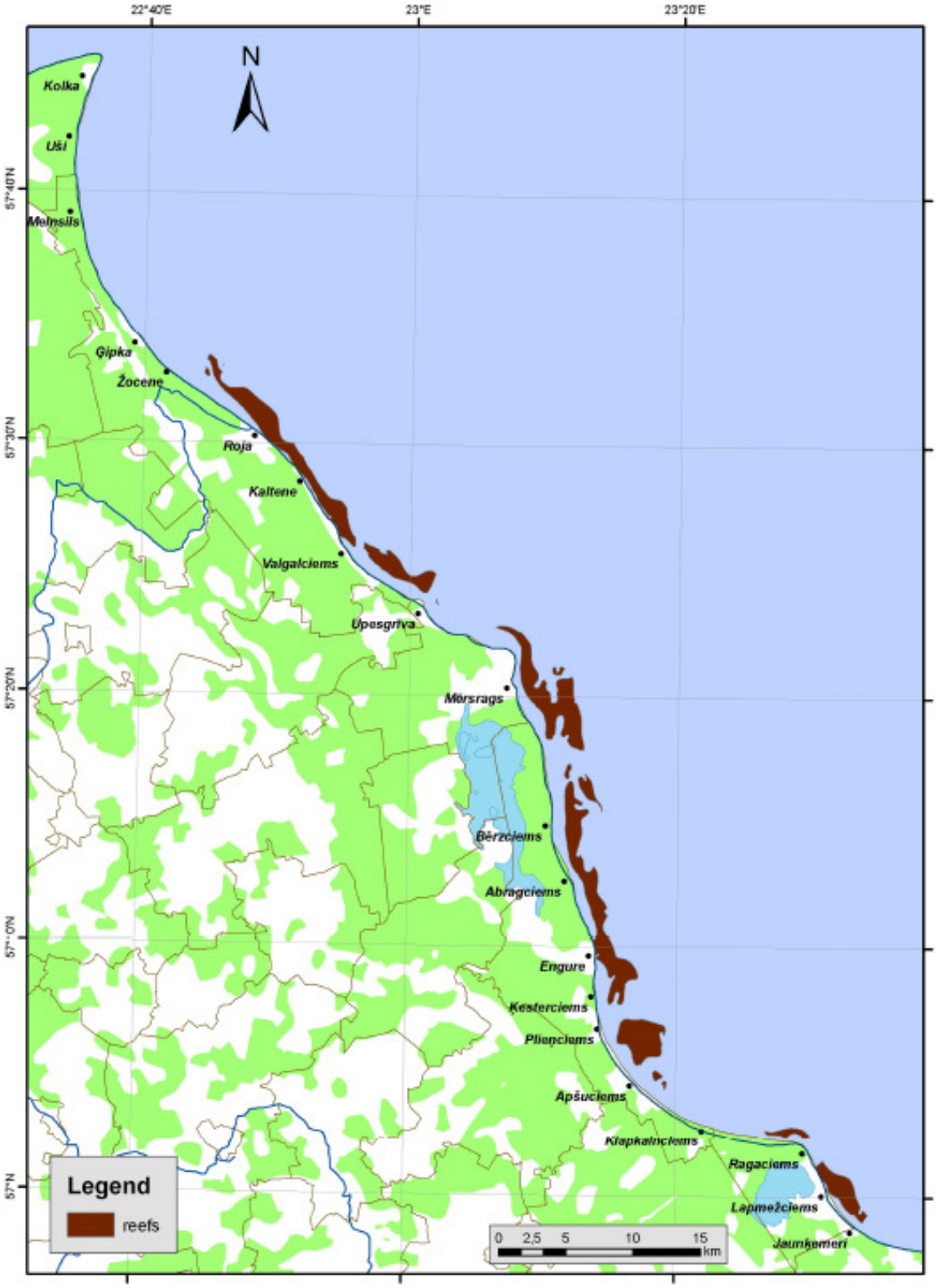


Figure 1. Map of Natura 2000 habitat types in the West Coast of Gulf of Riga project area.

Based on EBHAB classification moderately exposed soft bottoms with bivalves or no particular species dominance prevail. Hard bottoms with mussels or algae are distributed sparsely along the coast.

Table 2. List of habitat types by the EBHAB classification in the West Coast of Gulf of Riga project area.

Code	Name	Area ha	% of project area
1	Sheltered hard bottoms with *Fucus vesiculosus*	4297	3.35
10	Moderately exposed hard bottoms with bivalves and *Balanus improvisus*	9819	7.66
11	Moderately exposed hard bottoms with no particular species dominance, <20m	5270	4.11
14	Moderately exposed soft bottoms with higher plants excluding *Zostera marina.*	548	0.43
17	Moderately exposed soft bottoms with bivalves	59656	46.52
18	Moderately exposed soft bottoms with no particular species dominance	48654	37.94

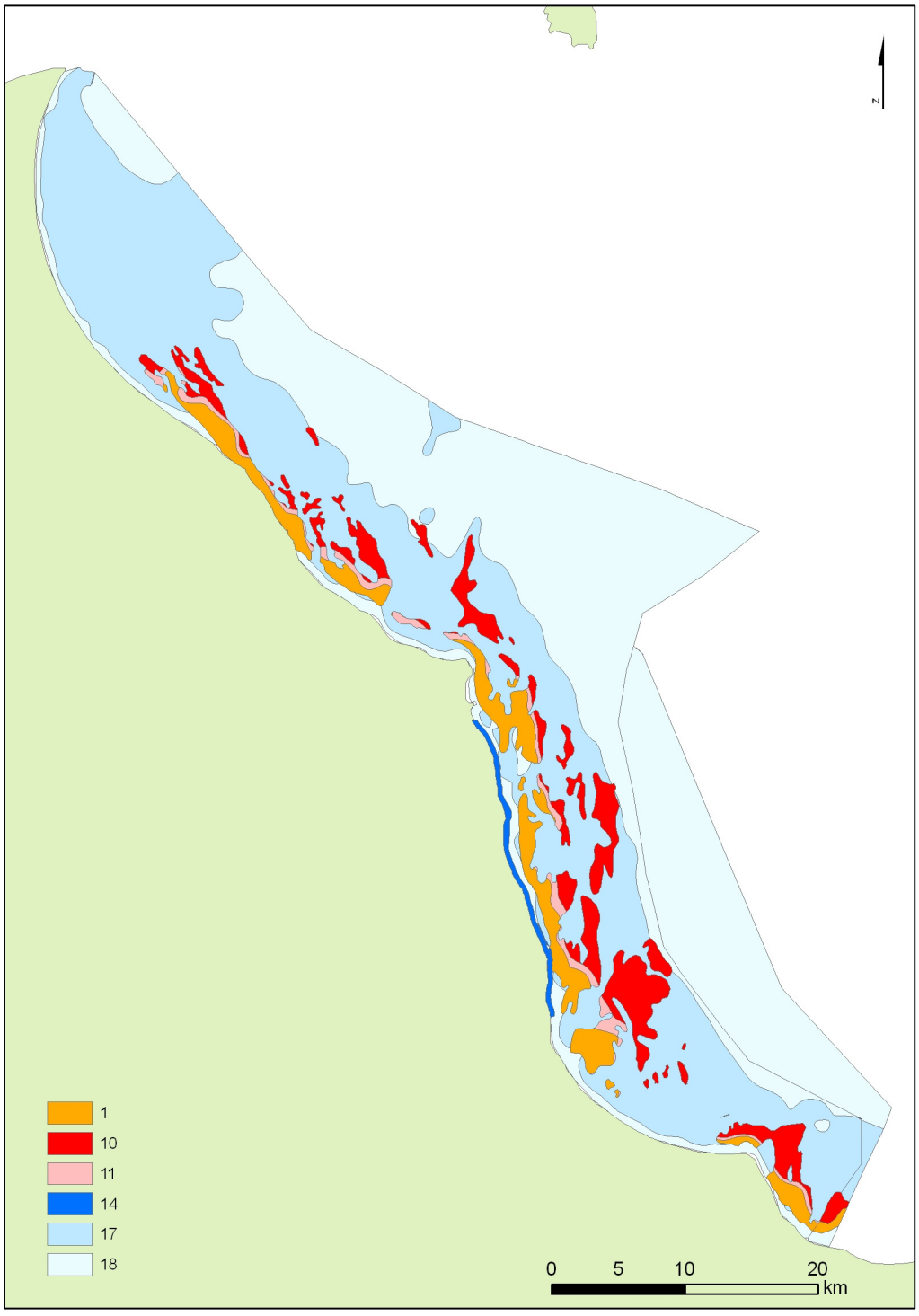


Figure 2. Map of habitat types by the EBHAB classification in the West Coast of Gulf of Riga project area.

11LAT Nida-Pērkone

General description of a project area:

BSPA represents coastal waters, with depth interval from 0 to up to 30 m, from Pape to Pērkone. The area is characterized by a narrow (2 - 4 m) band of sandy bottom with subsequent hard bottoms down to the depths of 10 - 15 m, with occasional soft-bottom (muddy sands) areas.

Predominantly, *Furcellaria lumbricalis* dominates phytobenthic community, with small inclusions of *Coccotylus truncates* and *Polysiphonia fucoids*. In total, eight phytobenthos species were previously recorded in this area. The bivalves *Mytulis edulis*, *Macoma balthica*, *Mya arenaria* are dominant zoobenthos species, comprising 63 % and 98 % of abundance and biomass of the total area, respectively. Altogether, 6 molluscan, 7 polychaete and 12 crustacean species were recorded previously in this area.

During winter, it shelters many piscivorous (*Gavia stellata/arctica*, *Podiceps cristatus*, *Mergus merganser, Mergus serrator*) waterbirds, *Gavia* spp. and *M. merganser* in internationally significant numbers. The site is important during spring migration time.

There are mainly marine fish species dominating in very shallow waters. *Platichthys flesus*, *Gadus morhua callarias*, *Clupea harengus membras*, *Scopthalmus maximus* and *Ammodytes tobianus* occur in different seasons. Migratory Sa*lmo trutta, Vimba vimba, Osmerus eperlanus, Stizostedion lucioperca* and the relatively rare Bern Convention species, *Alosa fallax*, are also rather common but only during some seasons. Variability of freshwater fish numbers and species is low due the open coast without big rivers. Pape – Pērkone area is very valuable because of important herring *Clupea harengus membras* and turbot *Scopthalmus maximus* spawning areas found there.

Existing Natura areas:

Name	Area ha	Natura code
Pape Nature Park SPA/pSCI	40 905	LV0303500
Bernati Nature Park pSCI	1 822	LV0303600

Pressures: Pressures on the benthic habitats include various activities of dredging and dumping. Main threats include general level of eutrophication, nutrient and toxic substances load coming with freshwater inflow.

Habitats: Natura 2000 habitat type „Reefs“ are present in the area. Reefs form a continuous belt along the coastline and are mainly formed by boulders and stones. Total area of the reefs in the area is 238.7 km^2

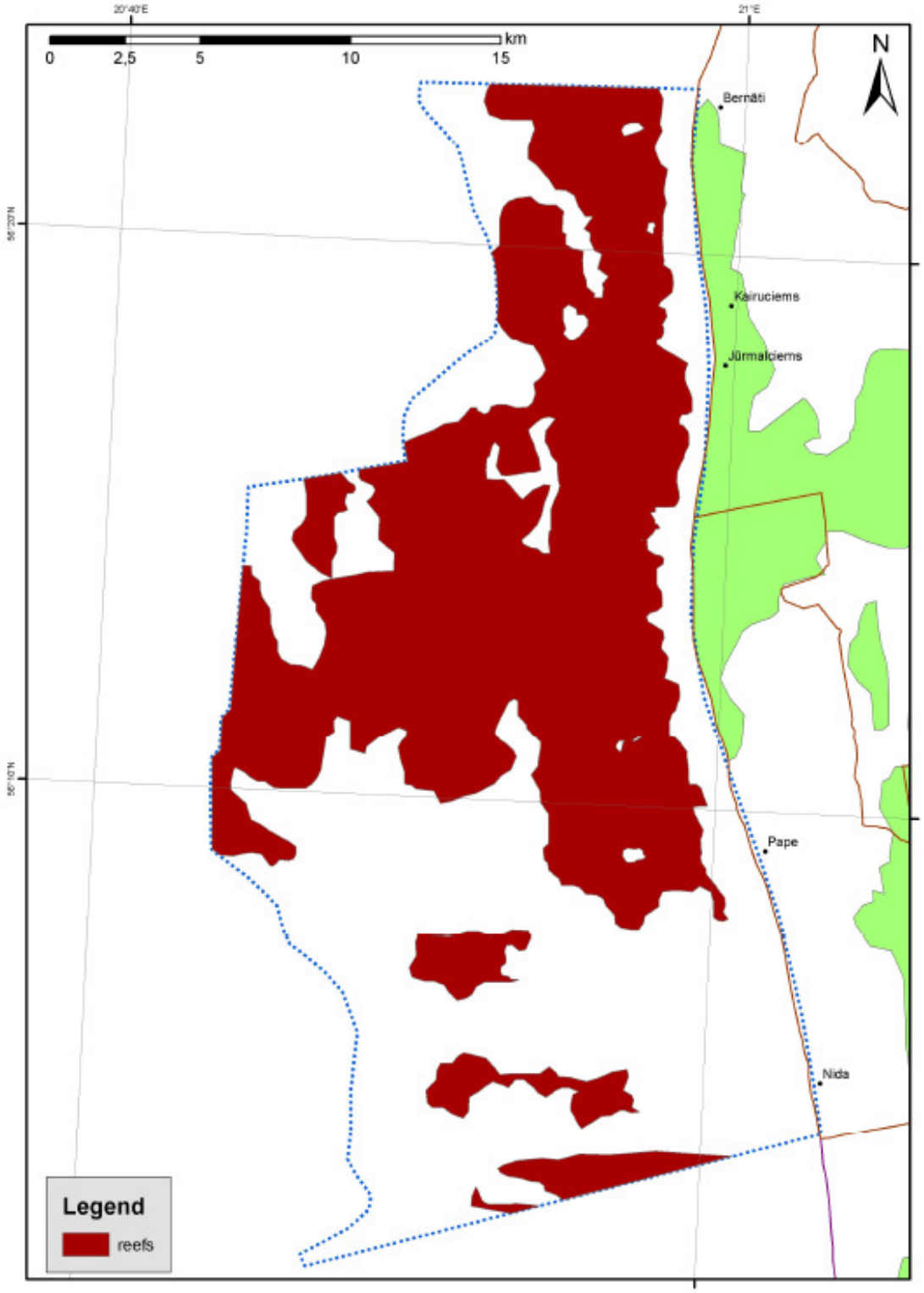


Figure 1. Map of Natura 2000 habitat types in the Nida-Pērkone project area.

Based on EBHAB classification exposed hard bottoms with bivalves dominance prevail. Hard bottoms with mussels or algae are distributed sparsely along the coast.

Table 2. List of habitat types by the EBHAB classification in the Nida-Pērkone project area.

Code	Name	Area ha	% of project area
19	Exposed hard bottoms with *Furcellaria lumbricalis*	6400	3.35
20	Exposed hard bottoms with *Balanus improvisus*	200	4.11
21	Exposed hard bottoms with Mytilus trossulus and *Balanus improvisus*	33400	7.66
23	Exposed soft bottoms with *Macoma balthica*	5400	46.52
24	Exposed soft bottoms with the polychaetes *Pygospio elegans* and *Marenzelleria neglecta*	1600	37.94
25	Exposed soft bottoms with mobile amphipods	1500	0.43

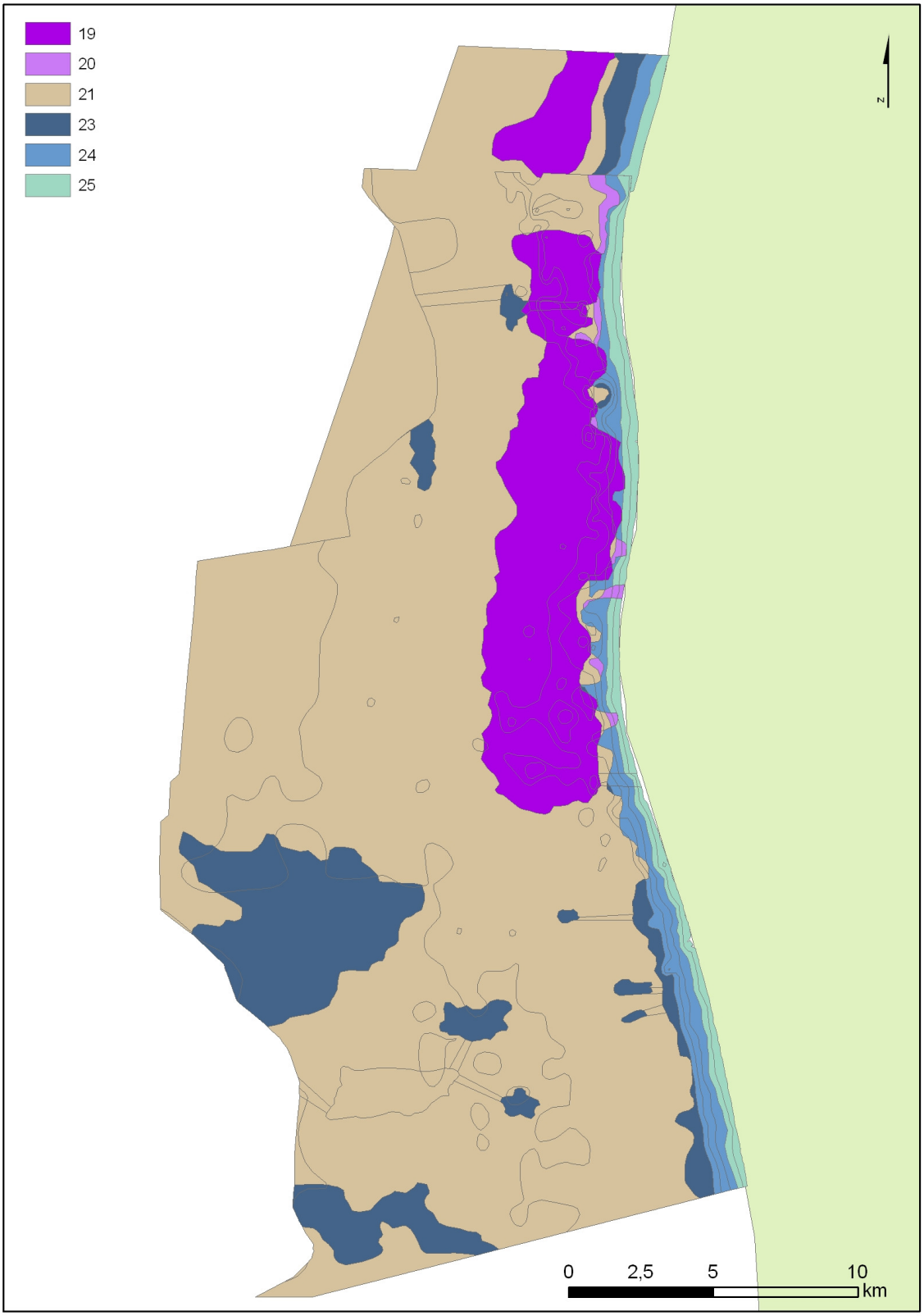


Figure 2. Map of habitat types by the EBHAB classification in the Nida-Pērkone project area.

12LIT Palanga

General description of a project area:

The project area is located in the northern part of the Lithuanian mainland coast. Total area of the project site is 79598 ha. Its southern and central parts belong to the Coastal Baltic Sea (Baltijos jūros priekrantė) SPA. Slightly smaller part of territory was designated as pSCI in April 2009 based on project results.

The project area covers underwater slope from 0 down to approx. 35 m depth. The seabed surface is dominated by moraine deposits consisting of gravel, pebble and boulders. Sandy areas are fragmented and common in the most shallow parts as well as in the deeper southern part of the project area. The bottom slope is gentle, however varies in different parts. Water salinity is typical for the eastern Gotland Basin and ranges between 6 and 8‰, however constantly affected by the influx of fresh water from the Curonian Lagoon.

Existing protected areas:

Name	Area	Natura code
Baltijos jūros priekrantė SPA	17097 ha	LTPALB001
Baltijos jūros priekrantė pSCI	12634 ha	LTPAL0001

Pressures: The area is relatively little influenced by point source pollution. During the period from 2006 to 2008 loads of treated municipal discharges from Palanga town into the project area ranged between 2.4 and 3.1 thous. tons of total phosphorus and between 27 and 38 tons of total nitrogen annually; untreated surface runoff loads vary between 100 and 200 thous. m^3. The total nutrient load into the area varies depending on the extent of climate driven fresh water influx from the Curonian Lagoon. Freshwater annually brings 40-55 thous. tons of total nitrogen and 1,5-3 thous. tons of total phosphorus. It remains unclear to which extent eutrophication level in the project area is determined by local nutrient load and regional levels of nutrient concentrations and atmospheric deposition.

The major pollution risk in the area is posed by Butinge Oil terminal situated at 20 m depth (during minimum water level) in the northernmost part of the project area in a distance of 2.3 km from the coastline and 1.2 km from the Latvian – Lithuanian border. Maximum oil load capacity of the terminal is 14 mln tons per year. During the last ten years seven accidents of oils spills ranging from 27 litres up to 56 tons of oil products were registered with the total amount of approx. 60 t spilled oil (approx. 15% collected). Accidental oil spills from ships crossing adjacent waters are recorded occasionally, however due to limited number of areal surveys and onshore observations an extent of this pollution remains undefined.

Habitats: Reefs are the only Habitat Directive Annex I habitat type found in the area. Characteristic features of reefs in the project area are steep moraine ridges surrounded by deeper waters or hard substrate (pebble or boulders) which supports typical zonation in the exposed sublittoral slope and maintains diverse benthic fauna and/or dense vegetation.

Table 1. Characteristics Habitat Directive Annex I habitat types in the Palanga project area.

Code	Name	Area ha	% of project area
1170	Reefs	31014	39

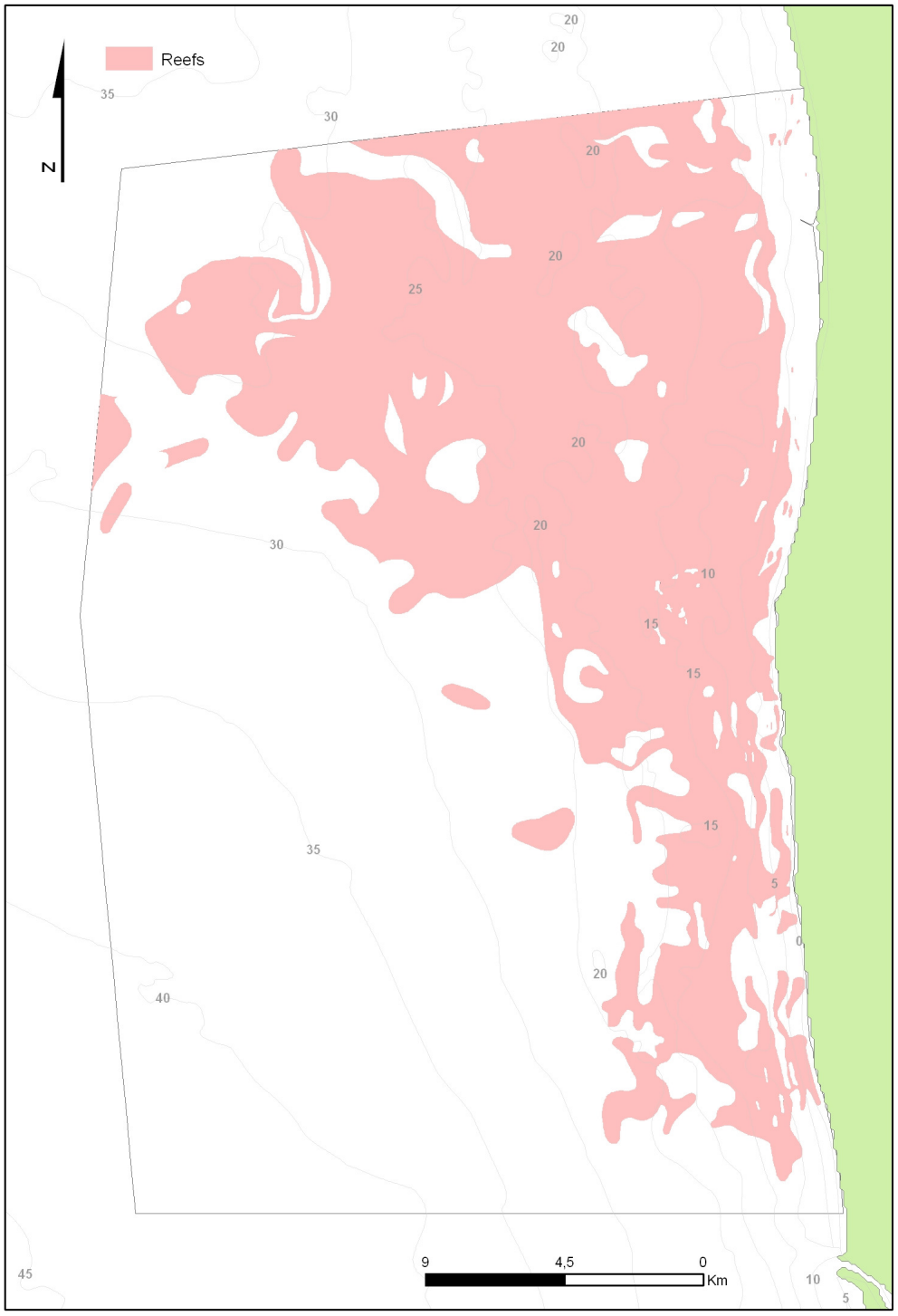


Figure 1. Map of reef distribution in the Palanga project area.

Four sub-types of reefs are distinguished in the project area. Hard bottoms dominated by perennial red algae *Furcellaria lumbricalis* are found in depths of 3 to 15 m off the Palanga. This sub-type is the most valuable from ecological perspective, since maintains the highest diversity of benthic species and supports unique and complex processes such as spawning of Baltic herring and feeding of migrating water birds.

Another sub-type of reefs, pebble and boulder bottoms dominated by *Mytilus trossulus* and *Balanus improvisus* are common in deeper areas, whereas in shallow areas only fragmented patches of the habitat with impoverished benthic communities are found. This sub-type is

widely distributed in the project area. This sub-type of reefs is exposed moraine ridges dominated by *Mytilus trossulus* and *Balanus improvisus*. Such steep seabed elevations surrounded by deeper waters is a unique sub-type of reefs of limited distribution in the distance of approx. 4 nm from the coast in depths of 18-19 m. Exposed hard bottoms with mobile amphipods is a fourth sub-type with the second least distribution area found in shallow waters.

Table 2. List of habitat types (LIFE project classification) in the Palanga project area.

Code	Name	Area ha	% of project area
19	Exposed hard bottoms with *Furcellaria lumbricalis*	2343	3
20	Exposed hard bottoms with *Balanus improvisus*	10757	14
21	Exposed hard bottoms with *Mytilus trossulus* and *Balanus improvisus*	17494	22
22	Exposed moraine ridges with *Mytilus trossulus* and *Balanus improvisus*	43	0.1
23	Exposed soft bottoms with *Macoma balthica*	45816	58
24	Exposed soft bottoms with the polychaetes *Pygospio elegans* and *Marenzelleria neglecta*	2768	3
25	Exposed hard bottoms with mobile amphipods	377	0.5

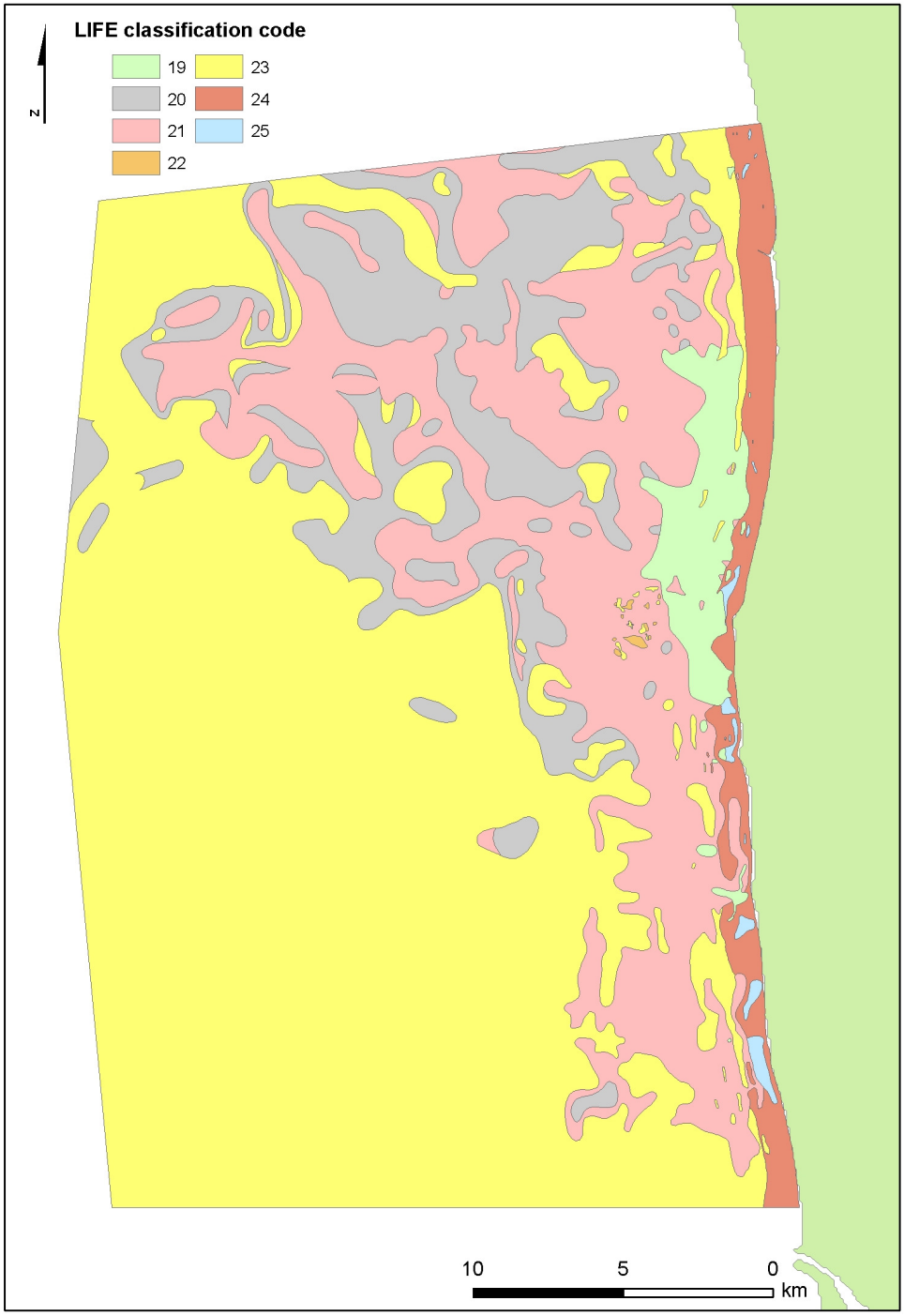


Figure 2. Map of habitat types by the LIFE project classification in the East Gulf of Finland project area.

Species: More than 40 benthic macrofauna species or higher level taxa have been recorded in the project area. Several of them are observed only occasionally by divers (e.g. shrimps *Palaemon elegans*, crabs *Rhithropanopeus harriisii*). Approximately of half of recorded taxa are associated with hard bottoms, colonised by epifaunal benthic species such mussels *Mytilus trossulus,* barnacles *Balanus improvisus,* bryoazoans *Electra crustulenta* or hydroids *Cordylophora caspia*. Gastropod *Theodoxus fluviatilis* is also typical hard bottom species, however becomes abundant on stones in high hydrodynamic activity bottoms unsuitable for mussel colonies due to sand abrasion. Several species such as polychaetes *Fabricia sabella* and

isopod crustaceans *Jaera albifrons* are exclusively associated with colonies of blue mussels and barnacles, however typical infaunal polychaete *Hediste diversicolor* may also occur frequently mussel clusters. Coarse or mixed sediment are usually inhabited by few species only, alien spionid *Marenzelleria neglecta*, *H. diversicolor* and barnacles *B. improvisus* being the most characteristic organisms for these substrates. Mobile amphipods *Bathyporeia pilosa* are typical for exposed shallow sandy bottoms, where only few species usually occur. Deeper soft bottoms are dominated by common in the eastern Baltic Sea infaunal species – bivalve *Macoma balthica* and spionid polychaetes *Pygospio elegans* and *M. neglecta*.

Table 3. Benthic macrofauna species abundance, biomass and occurrence in the Palanga project area.

	Species	Abundance ind m^{-2}		Biomass ww g m^{-2}		Occurrence%
		Mean	StErr	Mean	StErr	Mean
1	*Balanus improvisus*	20362	10118	737.96	323.06	67.1
2	*Bathyporea pilosa*	16	7	0.01	0.00	14.5
3	*Cordylophora caspia*	+	0	0	0	0.0
4	*Chelicorophium curvispinum*	783	311	1.00	0.35	47.4
5	*Corophium sp.*	969	261	0.14	0.04	39.5
6	*Corophium volutator*	540	261	1.45	0.75	56.6
7	*Crangon crangon**	+				1.3
8	*Electra crustulenta**	+				67.1
9	*Fabricia sabella*	11979	2829	0.54	0.13	55.3
10	*Gammarus duebeni*	8	5	0.13	0.08	5.3
11	*Gammarus inaequicauda*	2	1	0.04	0.03	3.9
12	*Gammarus locusta*	1	0	<0.01	<0.01	2.6
13	*Gammarus oceanicus*	24	18	0.14	0.10	11.8
14	*Gammarus salinus*	221	65	1.63	0.47	36.8
15	*Gammarus sp.*	3318	1419	2.11	0.92	61.8
16	*Gammarus tigrinus*	287	84	0.21	0.05	44.7
17	*Gammarus zaddachi*	325	103	3.87	1.46	34.2
18	*Halicryptus spinulosus*	<1	<1	<0.01	<0.01	1.3
19	*Harmothoe sarsi*	4	3	<0.01	<0.01	7.9
20	*Hediste diversicolor*	63	20	0.50	0.25	47.4
21	*Hydrobia sp.*	49	14	0.10	0.03	39.5
22	*Idothea balthica*	3	2	0.03	0.03	5.3
23	*Jaera albifrons*	116	57	0.03	0.01	22.4
24	*Macoma balthica*	9	3	0.15	0.10	18.4
25	*Marenzelleria neglecta*	625	320	0.19	0.09	68.4
26	*Mya arenaria*	287	263	0.99	0.92	32.9
27	*Mysis mixta**	+				2.6
28	*Mytilus trossulus*	7123	1473	937.69	162.18	67.1
29	*Nemertini*	7	5	0.01	0.00	3.9
30	*Neomysis integer**	+				0.0
31	*Oligochaeta*	84	31	0.02	0.01	25.0
32	*Ostracoda*	<1	<1	<0.01	<0.01	1.3
33	*Planaria sp.*	2	1	<0.01	<0.01	3.9
34	*Planaria torva*	6	3	<0.01	<0.01	7.9
35	*Praunus inermis*	1	1	<0.01	<0.01	3.9
36	*Pygospio elegans*	59	20	0.02	0.01	42.1
37	*Streblospio shrubsolii*	7	4	<0.01	<0.01	7.9
38	*Theodoxus fluviatilis*	38	13	0.85	0.30	23.7

* - quantitative characteristics can not be determined due to methodological limitations.

13LIT Nida

General description of a project area:

The project area is located in the southern part of the Lithuanian coast along the Curonian Spit. Total project site area is 97792 ha. Approximately 12435 ha of the project area belongs to the marine part of the Curonian Spit National Park (Kuršių Nerijos nacionalinis parkas) SPA with its seaward limit set in distance of 3 km from the coast, which roughly corresponds 10 m isobath. The project area was included into the habitat inventory due to low amount of available data and likely presence of seagrass beds in the shallow areas.

The project area covers underwater slope from 0 down to approx. 35 m depth. The seabed surface is dominated by sandy deposits. The bottom slope is gentle and uniform across the whole project area. Three to five sand bars of 1-4 m height are developed in depths between 1 and 12 m, however their geomorphological characteristics and distribution is changing over time. Approx. 7‰ average water salinity is typical for the eastern Gotland Basin. Only northernmost stretch of 7-8 km is affected by the influx of fresh water from the Curonian Lagoon, which is also reflected in grain-size of bottom sediments.

Existing protected areas:

Name	Area	Natura code
Kuršių Nerijos nacionalinis parkas SPA	12435 ha	LTKLAB001

Pressures: The area is not influenced by point source pollution and therefore is mainly exposed to background eutrophication level of the central Baltic. Only northernmost part is influenced by turbid and nutrient rich Curonian lagoon outflow waters. Geomorphologic effects of dredge spoil dumping are local and restricted to officially designated site in the central part of the project area (40-45 m depth). Elevated concentrations of some heavy metals and hydrocarbons is being monitored in this area, however does not exceed allowed levels. Recreational activity in several beaches remains limited over decades and is not likely to increase in coming years.

The major pollution risk to the area is posed by D-6 Oil Platform situated in the waters of Russian Federation close to Lithuania border. So far no accidents associated with operation of the platform have been reported by Russian Federation.

Habitats: Habitat Directive Annex I habitat types were not found in the area. Two potential areas have been investigated for the presence of sandbanks following bathymetric information and geological maps. Shallow sandbars in depth range of 1 to 11 m have not been qualified as sandbanks due to their high temporal and spatial dynamics in exposed waters, which prevent colonisation of benthic vegetation and result in extremely low benthic species diversity and absence of benthic vegetation.

Weak seabed elevations (ranging up to 3-4 m in height) in the central part of the project area (depths of 22-26 m) also result in significantly lower benthic species diversity. Although biomass and abundance of several taxa is significantly lower due to coarser sediment, the dominant species remain the same as in the surrounding areas. Recorded differences in structure of benthic community and sediment grain size do not influence general appearance of the benthic environment and these bottoms have not been qualified as specific habitat.

Table 2. List of habitat types (LIFE project classification) in Nida project area.

Code	Name	Area ha	% of project area
23	Exposed soft bottoms with *Macoma balthica*	92681	95
24	Exposed soft bottoms with the polychaetes *Pygospio elegans* and *Marenzelleria neglecta*	5111	5

Two major habitats have been distinguished in the project area, which differ in terms of sediment types, depth range and dominant species. Both habitats are widespread in the central part of the Baltic Sea. Exposed soft bottoms with the polychaetes *P. elegans* and *M. neglecta* are typical for the shallow part of the project area in depths down to 10-11 m. The area is very unstable in terms of hydrodynamic activity and dominance of two species is patchy. Exposed soft bottoms with *Macoma balthica* are the most widespread in the central Baltic found in wide depth range up to 60-70 m. In depth of 25-30 m structure of benthic community is changing due to gradual disappearance of shallow species and increased occurrence of deep and/or relict benthic organisms.

Figure 2. Map of habitat types (LIFE project classification) in Nida project area.

Species: All recorded species are exclusively characteristic for soft bottoms in the project area. Three basic species groups are distinguished according to their depth distribution, while some (e.g. *Saduria entomon*) are migratory between depth zones. Typical shallow taxa are oligochaetes, cockles *Cerastoderma edule*, *Mya arenaria*, whereas ostracods, crustaceans *Pontoporea affinis* and *Diastylis rathkey* are usually restricted to a deeper zones. Crustacean *Bathyporeia pilosa* is typically found in the most shallow part down to a depth of 3-5 m.

Table 3. Benthic macrofauna species abundance, biomass and occurrence in the Palanga project area.

Species	Abundance ind m^{-2}		Biomass ww g m^{-2}		Occurrence %
	Mean	StErr	Mean	StErr	Mean
1 *Bathyporea pilosa*	1655	256	1655.03	255.90	58.6
2 *Cerastoderma edule*	2	1	2.15	1.48	5.7
3 *Diastylis rathkey*	<1	<0.1	0.12	0.11	1.1
4 *Halicryptus spinulosus*	6	2	5.92	1.95	19.5
5 *Harmothoe sarsi*	<1	<0.1	<0.01	<0.01	1.1
6 *Hediste diversicolor*	223	40	223.34	39.58	63.2
7 *Hydrobia sp.*	10	4	10.41	3.64	18.4
8 *Macoma baltica*	60	11	60.26	10.99	51.7
9 *Marenzelleria neglecta*	953	141	953.38	141.16	93.1
10 *Mya arenaria*	36	10	36.44	9.63	32.2
11 *Neomysis integer*	13	6	13.41	6.14	5.7
12 *Oligochaeta*	34	17	34.22	16.93	39.1
13 *Pygospio elegans*	477	122	476.78	121.64	64.4
14 *Saduria entamon*	<1	<0.1	0.24	0.16	2.3
15 *Streblospio shrubsolii*	<1	<0.1	<0.01	<0.01	1.1