Submerged rooted plant communities on Baltic infralittoral muddy sediment

Summary

This habitat occurs in all Baltic sub-basins in the shallow waters of the photic zone. The submerged rooted plant communities provide structure for the benthic environment and associated communities on the underlying sediment. Distribution of the associated biotopes depends on the dominant species and is influenced mainly by salinity and exposure. *Zostera noltei,* for example, is not found east of the Darss Sill in the Arkona basin, while *Potamogeton perfoliatus* occurs mostly in the northern part of the Bothnian Bay, and *Chara horrida* in the central Baltic and Archipelago Sea.

Eutrophication (increasing N, P and organic matter) has both direct and indirect negative impacts on this habitat, for example by reducing light penetration through the water column and therefore the depth penetration of submerged species. Increased sedimentation can prevent settlement and excess of nutrients often favours opportunistic species with short life cycles and rapid development over perennial species with lower productivity, causing a shift in the community composition. Climate change may also result in a shift in the dominant species due to predicted associated changes in salinity. All actions to reduce eutrophication of the Baltic Sea are important for the conservation of this habitat. Conservation measures are also important, such as area protection and restrictions on coastal construction and dredging where these are likely to have an impact on the habitat.

Synthesis

The presence of this habitat type in the Baltic is well known. The best studied biotopes are those dominated by seagrass, brackish water angiosperms and charophytes. There have been significant declines (>25%) in the extent of the seagrass and Charales dominated communities in the last 50 years. *Zostera marina* and several species of Charales are also on the HELCOM Red List of threatened species in the Baltic.

The overall assessment for this EUNIS level 4 habitat has been based on the HELCOM (2013) assessments for the associated HELCOM HUB biotopes. Draft assessments were derived using a weighted approach whereby the HELCOM assessment outcomes were assigned a score. This was averaged across the relevant biotopes. The outcomes were reviewed by Baltic experts to reach a final conclusion. HELCOM (2013) assessed AA.H1B1, AA.H1B2, AA.H1B3 and AA.H1B6 as Least Concern (A1) and AA.H1B4, AA.H1B5 and AA.I1B7 as Near Threatened (A1). The overall assessment for this habitat type based on expert opinion is Near Threatened (A1) for both the EU 28 and EU 28+.

Overall Category & Criteria			
EU 28		EU 28+	
Red List Category	Red List Criteria	Red List Category	Red List Criteria
Near Threatened	A1	Near Threatened	A1

Sub-habitat types that may require further examination

AA.H1B4 Baltic photic muddy sediment dominated by *Charales*

AA.H1B5 Baltic photic muddy sediment dominated by spiny naiad (*Najas marina*)

AA.H1B7 Baltic photic muddy sediment dominated by common eelgrass (*Zostera marina*)

Habitat Type

Code and name

Submerged rooted plant communities on Baltic infralittoral muddy sediment

Stuckenia pectinatus in a coastal lagoon near Stralsund, Germany (© K.Fürhaupter, MariLim GmbH).

Habitat description

This Baltic Sea benthic habitat occurs in the photic zone with at least 90% coverage of muddy sediment according to the HELCOM HUB classification. The habitat covers the full salinity range of the Baltic Sea and is distributed from lagoons in the Belt Sea up to the northern part of Bothnian Bay. Muddy bottoms covered by rooted plants are mainly distributed in sheltered to very sheltered exposure conditions. In this habitat submerged rooted plants, including plants with rhizoids (i.e. Charales) cover at least 10% of the seabed and more than any other perennial attached erect groups. The charactersitic species depends on the salinity and depth.

Eight associated biotopes have been described. AA.H1B5 ’Baltic photic muddy sediment dominated by spiny naiad (*Najas marina*)’ has a restricted distribution at 0-1 m depth in extremely sheltered areas at low salinity (<4 psu). AA.H1B8 ’Baltic photic muddy sediment dominated by spikerush (*Eleocharis* spp.)’ is also found in shallow (0-2 m depth) and sheltered areas with low salinity (<5 psu). AA.H1B1 ’Baltic photic muddy sediment dominated by pondweed (*Potamogeton perfoliatus* and/or *Stuckenia pectinata*)’ is found between 0.2-4 m depth in sheltered sites with up to 6 psu. AA.H1B3 ‘Baltic photic muddy sediment dominated by watermilfoil (*Myriophyllumspicatum* and/or *Myriophyllumsibiricum*)’ has a similar distribution but a more narrow depth range (0.2-2 m). AA.H1B6 ’Baltic photic muddy sediment dominated by *Ranunculus* spp.’ is also found up to 6 psu but is restricted to extremely sheltered sites. AA.H1B4 ’Baltic photic muddy sediment dominated by Charales’ is found in a wider range of salinity (2-15psu), depth (0.2-7 m) and wave exposure (low to moderate).AA.H1B2 ’Baltic photic muddy sediment dominated by

Zannichellia spp. and/or *Ruppia* spp. and/or *Zostera noltei*' is found at 0-4 m depth throughout the salinity gradient of the Baltic Sea and in low to moderate exposure. AA.H1B7 'Baltic photic muddy sediment dominated by common eelgrass (*Zostera marina*)' differs most strongly from the other associated biotopes in distribution, occurring mainly at moderate to high exposure, in salinities of 5 psu or higher and sedldom on muddy sediments. It is typically found deeper than the other associated biotopes (1-6 m) and often marks the lower depth limit distribution of soft bottom vegetation. This biotope is absent from areas with low salinity in the inner part of the Gulf of Bothnia.

Indicators of quality:

Both biotic and abiotic indicators have been used to describe marine habitat quality. These include: the presence of characteristic species as well as those which are sensitive to the pressures the habitat may face; water quality parameters; levels of exposure to particular pressure, and more integrated indices which describe habitat structure and function, such as trophic index, or successional stages of development in habitats that have a natural cycle of change overtime. There are no commonly agreed indicators of quality for this habitat, although particular parameters may have been set in certain situations e.g. protected features within Natura 2000 sites, where reference values have been determined and applied on a location-specific basis. The vertical depth limit of submerged rooted plants is used in several countries as a Water Framework Directive parameter for assessing ecological status.

Characteristic species:

Stuckenia pectinata, Potamogeton perfoliatus, Zostera marina, Ruppia maritima, Zanichellia palustris, Myriophyllum spicatum, Najas marina, Chara tomentosa, Chara aspera, Ranunculus peltatus subsp. baudotii, Eleocharis sp.

Classification

EUNIS:

The closest correspondence in EUNIS (2004) level 4 is A5.31 Sublittoral mud in low or reduced salinity and A5.54 Angiosperm communities in reduced salinity

Annex 1:

The relationship between HUB biotopes and Annex 1 habitats has not yet been mapped by HELCOM, however this habitat may occur in the following Annex 1 habitats:

1130 Estuaries

1160 Large shallow inlets and bays

1650 Boreal Baltic narrow inlets

MAES:

Marine - Marine inlets and transitional waters

Marine - Coastal

MSFD:

Shallow sublittoral mud

EUSeaMap:

Shallow muds

IUCN:

9.6 Subtidal Muddy

9.9 Seagrass

9.10 Estuaries

Other relationships:

Level 5 of the HELCOM HUB classification (2013):

AA.H1B Baltic photic muddy sediment characterized by submerged rooted plants This habitat has eight associated biotopes on HUB level 6; AA.H1B1 'Baltic photic muddy sediment dominated by pondweed (*Potamogeton perfoliatus* and/or *Stuckenia pectinata*)' AA.H1B2 'Baltic photic muddy sediment dominated by *Zannichellia* spp. and/or *Ruppia* spp. and/or *Zostera noltii*' AA.H1B3 'Baltic photic muddy sediment dominated by watermilfoil (*Myriophyllum spicatum* and/or *Myriophyllum sibiricum*)' AA.H1B4 'Baltic photic muddy sediment dominated by Charales' AA.H1B5 'Baltic photic muddy sediment dominated by spiny naiad (*Najas marina*)' AA.H1B6 'Baltic photic muddy sediment dominated by *Ranunculus* spp.' AA.H1B7 'Baltic photic muddy sediment dominated by common eelgrass (*Zostera marina*)' AA.H1B8 'Baltic photic muddy sediment dominated by spikerush (*Eleocharis* spp.)'.

Does the habitat type present an outstanding example of typical characteristics of one or more biogeographic regions?

Yes

Regions
Baltic

Justification
This habitat is common on photic muddy sediment in the entire Baltic Sea. Most of the associated biotopes have a very typical and characteristic species composition for the Baltic Sea dominated by species with freshwater origin.

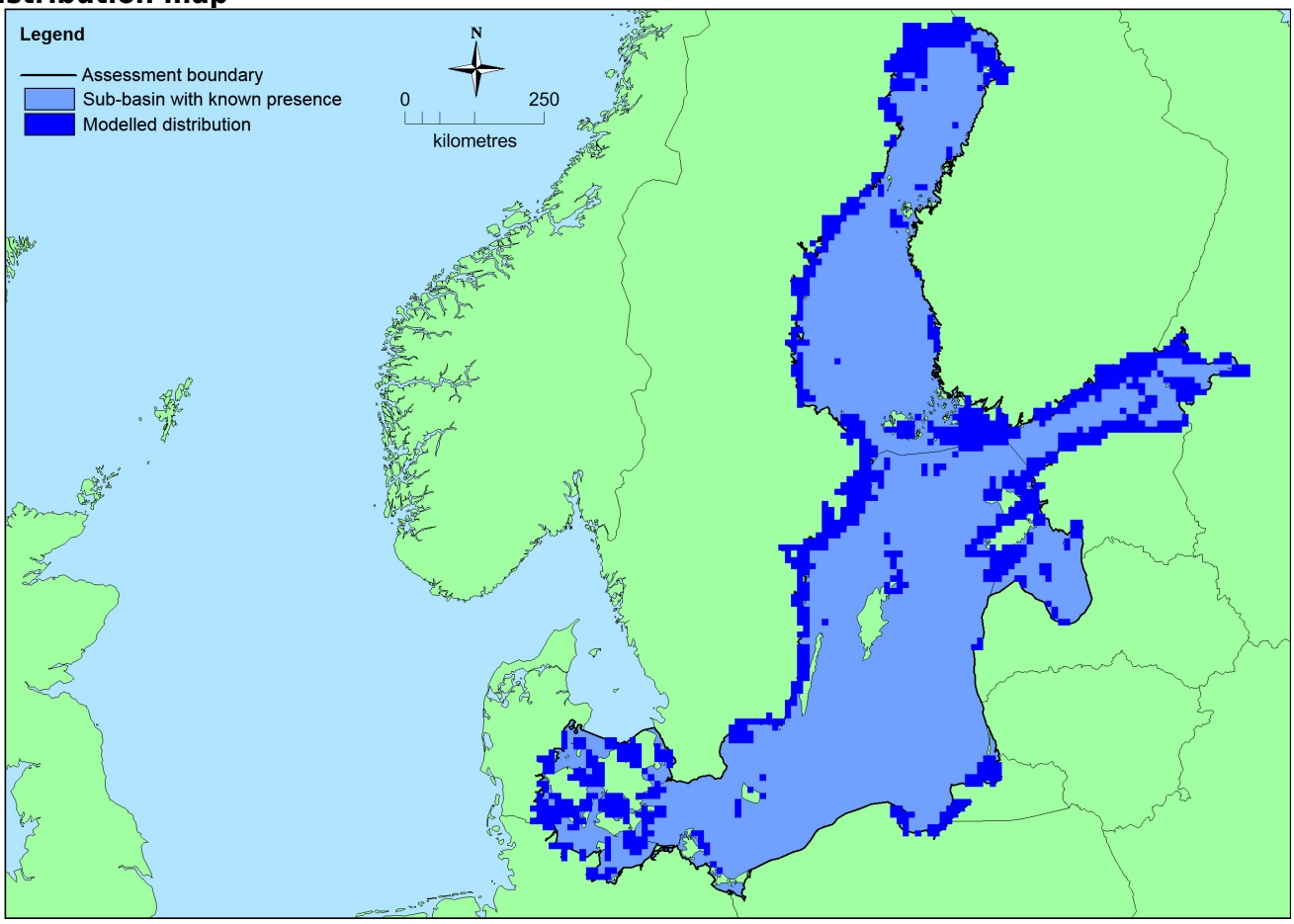
Geographic occurrence and trends

Region	Present or Presence Uncertain	Current area of habitat	Recent trend in quantity (last 50 yrs)	Recent trend in quality (last 50 yrs)
Baltic Sea	Baltic Proper: Present Belt Sea: Present Gulf of Bothnia: Present Gulf of Finland: Present The Sound: Present Gulf of Riga: Present	Unknown Km^2	Decreasing	Unknown

Extent of Occurrence, Area of Occupancy and habitat area

	Extent of Occurrence (EOO)	Area of Occupancy (AOO)	Current estimated Total Area	Comment
EU 28	>50,000 Km^2	>50	Unknown Km^2	This habitat is present in all the Baltic sub-basins
EU 28+	>50,000 Km^2	>50	Unknown Km^2	This habitat is present in all the Baltic sub-basins

Distribution map



There are insufficient data to provide a comprehensive and accurate map of the distribution of this habitat. This map has therefore been generated using the modelled data available on EMODnet for EUNIS level 3 habitats in the Baltic Sea (EMODnet, 2010). This means it indicates potential areas in which this habitat may occur, not the actual distribution of this EUNIS level 4 habitat.

How much of the current distribution of the habitat type lies within the EU 28?

This habitat occurs in the EU 28+ (Russia). The percentage hosted by EU 28 is therefore less than 100% but there is insufficient information to establish the proportion.

Trends in quantity

This habitat is very common in bays, inlets and coastal lagoons of all sub-regions of the Baltic Sea. Most of the associated biotopes are present across the Baltic Sea coastline but AA.H1B7 'Baltic photic muddy sediment dominated by common eelgrass (*Zostera marina*)' is absent from areas with low salinity in the inner part of the Gulf of Finland and Gulf of Bothnia. There have been significant declines in the quantity of some of the associated biotopes. AA.H1B4 'Baltic photic muddy sediment dominated by Charales' has declined by >25% during the last 50 years. The greatest declines have been observed in the Western and Southern Baltic Sea. In some bays and lagoons conditions have changed so intensively that it has disappeared completely. The biotope dominated by spiny naiad (*Najas marina*)' has also exhibited a strong

decline in the highly eutrophicated areas of the Southern Baltic Sea and disappeared from some locations. A comparison of the current with the historical distribution status of *Najas marina* within the German Bodden areas of Mecklenburg Western Pomerania (Southern Baltic Sea) for example shows nearly total loss There are no data to support similar declines in other Baltic Sea areas but the subhabitat is largely restricted to lagoons which is an endangered biotope complex. Areas dominated by common eelgrass (*Zostera marina*)' have declined >25% during the last 50 years although to varying extents in the different Baltic Sea regions, with the largest decline recorded in the Southern Baltic Sea. The remaining associated biotopes are believed to have declined by less than 25% over the last 50 years. There is a lack of comprehensive quantitative data on the historic extent of this habitat and no future trends have been estimated.

- Average current trend in quantity (extent)
  EU 28: Decreasing
  EU 28+: Decreasing
- Does the habitat type have a small natural range following regression?
  No
  Justification
  This habitat is present in all the Baltic Sea sub-basins therefore does not have a small natural range
- Does the habitat have a small natural range by reason of its intrinsically restricted area?
  No
  Justification
  This habitat is present in all the Baltic Sea sub-basins therefore does not have a small natural range.

Trends in quality

The quality of the habitat is believed to have declined during the past 50 years, at least in some areas, but there are no comprehensive data to quantify the decline.

- Average current trend in quality
  EU 28: Unknown
  EU 28+: Unknown

Pressures and threats

Eutrophication, epidemics (wasting disease), bottom trawling, water traffic, construction, dredging, dumping, aquaculture and coastal works have all been identified as past and current threats. These are also likely to be threats in the future along with climate change. One predicted effect is a lowering of salinity in the northern parts of the Baltic Sea due to an increase of precipitation, which may threaten *Zostera marina* in the northernmost areas where it currently exists on the limits of its salinity tolerance.

Observed declines of the spatial distribution of the associated biotopes where Charales' and the spiny naiad dominate are mainly caused by increased eutrophication and connected effects. Decreasing light penetration depth, massive growth of ephemeral algae and increased siltation rates cause massive alterations in the biotopes of sheltered coastal areas. The enclosed characteristic of bays and lagoons intensify the eutrophication impacts. Coastal constructions (e.g. dredging for deepening of harbour access channels, ditching and construction of leisure facilities) and increased tourism have led to a further degradation. The threat level is particularly high in the Western and Southern Baltic Sea. In the future climate change (increasing exposure levels, temperatures) or increasing aquaculture in bays may cause additional threats.

The main causes of the observed declines of the spatial distribution of the biotope dominated by common eelgrass (*Zostera marina)*' are (1) the "wasting disease" that caused about 90% of the North European stock to disappear in the 1930 and also affected the *Zostera* beds in Danish and German waters and (2)

eutrophication of the Baltic Sea that has resulted in significant decline of eelgrass meadows in mainly Danish, German, Swedish and Polish coastal areas. Eutrophication has decreased the depth where *Zostera* can receive enough light and may in addition cause a shift from eelgrass meadows to communities dominated by fast-growing macro-algae. Climate change is predicted to lower the salinity level in the northern parts of the Baltic Sea due to an increase of precipitation, which may threaten *Zostera marina* in the northernmost areas where it currently exists on the limits of its salinity tolerance.

List of pressures and threats

Biological resource use other than agriculture & forestry

Marine and Freshwater Aquaculture
Fishing and harvesting aquatic resources
Professional active fishing
Benthic or demersal trawling
Benthic dredging

Pollution

Pollution to surface waters (limnic, terrestrial, marine & brackish)
Nutrient enrichment (N, P, organic matter)
Input of contaminants (synthetic substances, non-synthetic substances, radionuclides) - diffuse sources, point sources, acute events

Natural System modifications

Human induced changes in hydraulic conditions
Removal of sediments (mud...)
Estuarine and coastal dredging
Dykes, embankments, artificial beaches, general
Sea defense or coast protection works, tidal barrages

Climate change

Changes in abiotic conditions
Temperature changes (e.g. rise of temperature & extremes)
Sea-level changes
Changes in biotic conditions
Habitat shifting and alteration

Conservation and management

All actions to reduce eutrophication of the Baltic Sea are important for the conservation of this habitat. For the associated biotopes that mainly occur in bays with limited water exchange with the open ocean (those dominated by Charales' and the spiny naiad) combating local sources of eutrophication is essential. Conservation measures are also important, such as area protection and restrictions on coastal construction and dredging in shallow regions and archipelago areas.

List of conservation and management needs

Measures related to wetland, freshwater and coastal habitats

Restoring/Improving water quality

Measures related to marine habitats

Restoring marine habitats

Measures related to spatial planning

Establish protected areas/sites

Measures related to urban areas, industry, energy and transport

Other measures
Managing marine traffic

Conservation status

Annex 1:

1130: MBAL U2

1160: MATL U2

1650: MBAL U2

HELCOM (2013) assessments:

1130 CR C1

1160 VU C1

1650 VU C1

HELCOM (2013) have assessed associated biotopes AA.H1B1, AA.H1B2, AA.H1B3, AA.H1B6, and AA.H1B8 as LC(A1), AA.H1B4, AA.H1B5 and AA.H1B7 were assessed as NT(A1)

When severely damaged, does the habitat retain the capacity to recover its typical character and functionality?

The biotope dominated by common eelgrass (*Zostera marina*)' can be slow to recover after strong decline (taking more than 20 yrs). Intervention may speed up the recovery but transplantation experiments have had limited success to date. Regeneration from root systems is slow and recovery of entire beds, with characteristic structure and associated species will take a long time. In the northern Baltic low salinity means that any expansion takes place vegetatively. *Zostera* plants are believed to be from the same genotype, estimated to be between 800-1600 years old. Clonal growth and low genetic diversity may reduce the acclimation capacity and survival of the species in rapidly changing environmental conditions. For the other associated biotopes natural recovery can probably occur within 10 years.

Effort required

10 years	20 years
Naturally	Naturally

Red List Assessment

Criterion A: Reduction in quantity

Criterion A	A1	A2a	A2b	A3
EU 28	>25 %	unknown %	unknown %	unknown %
EU 28+	>25 %	unknown %	unknown %	unknown %

Losses of some of the associated biotopes are estimated to be more than 25% and, in some cases, muddy sediments dominated by the spiny naiad, have almost totally disappeared. Expert opinion is that overall the decline in quantity over the last 50 years is likely to have been > 25%. This habitat is therefore

assessed as Near Threatened under Criteria A for both the EU 28 and EU 28+.

Criterion B: Restricted geographic distribution

Criterion B	B1				B2				B3
	EOO	a	b	c	AOO	a	b	c	
EU 28	>50,000 Km^2	Unknown	Unknown	No	>50	Unknown	Unknown	unknown	No
EU 28+	>50,000 Km^2	Unknown	Unknown	No	>50	Unknown	Unknown	unknown	No

This habitat has a large natural range in the Baltic Sea extending from the Danish coast in the west to the Bothnian Bay in the north-east. EOO >50,000 km^2 and AOO >50 and it is not limited to a few locations. Future trends have not been estimated. This habitat has therefore been assessed as Least Concern under criterion B.

Criterion C and D: Reduction in abiotic and/or biotic quality

Criteria C/D	C/D1		C/D2		C/D3	
	Extent affected	Relative severity	Extent affected	Relative severity	Extent affected	Relative severity
EU 28	unknown %	unknown %	unknown %	unknown %	unknown %	unknown %
EU 28+	unknown %	unknown %	unknown %	unknown %	unknown %	unknown %

Criterion C	C1		C2		C3	
	Extent affected	Relative severity	Extent affected	Relative severity	Extent affected	Relative severity
EU 28	unknown %	unknown %	unknown %	unknown %	unknown %	unknown %
EU 28+	unknown %	unknown %	unknown %	unknown %	unknown %	unknown %

Criterion D	D1		D2		D3	
	Extent affected	Relative severity	Extent affected	Relative severity	Extent affected	Relative severity
EU 28	unknown %	unknown%	unknown %	unknown%	unknown %	unknown%
EU 28+	unknown %	unknown%	unknown %	unknown%	unknown %	unknown%

There have been declines in the quality of some of the associated biotopes in some areas e.g. charophytes and *Zostera marina* however experts consider there to be insufficient data on which to make an overall assessment of criteria C/D.

Criterion E: Quantitative analysis to evaluate risk of habitat collapse

Criterion E	Probability of collapse
EU 28	unknown
EU 28+	unknown

There is no quantitative analysis available to estimate the probability of collapse of this habitat type.

Overall assessment "Balance sheet" for EU 28 and EU 28+

	A1	A2a	A2b	A3	B1	B2	B3	C/D1	C/D2	C/D3	C1	C2	C3	D1	D2	D3	E
EU28	NT	DD	DD	DD	LC	LC	LC	DD	DD	DD	DD	DD	DD	DD	DD	DD	DD

	A1	A2a	A2b	A3	B1	B2	B3	C/D1	C/D2	C/D3	C1	C2	C3	D1	D2	D3	E
EU28+	NT	DD	DD	DD	LC	LC	LC	DD	DD	DD	DD	DD	DD	DD	DD	DD	DD

Overall Category & Criteria			
EU 28		EU 28+	
Red List Category	Red List Criteria	Red List Category	Red List Criteria
Near Threatened	A1	Near Threatened	A1

Confidence in the assessment
Medium (evenly split between quantitative data/literature and uncertain data sources and assured expert knowledge)

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