Submerged rooted plant communities on Baltic infralittoral sand

Summary

This habitat occurs in all Baltic sub-basins in the shallow waters of the photic zone with the submerged rooted plant communities providing 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. Reducing light penetration through the water column can reduce 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. Spatial measures are also important, such as area protection and restrictions on coastal works and dredging.

Synthesis

The presence of this habitat type in the Baltic is well known with different submerged rooted plant communities dominating depending on the salinity and exposure. There are quantitative data for some of the associated biotopes in some areas (e.g. in Isefjord, Kalundborg fjord and Flensborg Fjord in Denmark and along the entire German coastline) as well as maps indicating presence in 100 x 100 km squares prepared by HELCOM. There have been significant declines (>25%) in the extent of the seagrass and charophyte dominated communities in the last 50 years. *Zostera marina* and several species of Charales are on the HELCOM Red List of threatened species in the Baltic. Deeper water eelgrass meadows are at risk of disappearing in the future if there is continued reduction in light levels (e. g. due to eutrophication or sediment disturbance).

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 biotopes AA.J1B1, AA.J1B2, AA.J1B3, AA.J1B6 and AA.J1B8 as Least Concern (A1). Biotopes AA.J1B4, AA.J1B5 and AA.J1B7 were assessed as Near Threatened (A1). On the basis of these assessments and expert opinion, this habitat is assessed as Near Threatened for both the EU 28 and EU 28+ since there has been a significant decline in the area of some of the biotopes with the overall decline estimated to be between 25-30%.

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.J1B4 Baltic photic sand sominated by Charales AA.J1B5 Baltic photic sand dominated by spiny naiad (*Najas marina*) AA.J1B7 Baltic photic sand sominated by common eelgrass (*Zostera marina*).

Habitat Type

Code and name

Submerged rooted plant communities on Baltic infralittoral sand

Charophytes (mainly *Chara baltica*) mixed with some higher plants on sandy seabed, Greifswalder Bodden, Germany (© K. Fürhaupter).

Myriophyllum spp. and pondweeds are typical underwater vegetation in narrow Baltic inlets (© M.Westerbom, FINMARINET).

Habitat description

This is a Baltic Sea benthic habitat in the photic zone where at least 90% of the substrate is sand according to the HELCOM HUB classification. Submerged rooted plants, including plants with rhizoids (i.e. Charales) cover at least 10% of the seabed and more than other perennial attached erect groups. The habitat is present across the full salinity range of the Baltic, in locations that are moderately to very sheltered from wave action and in depths of up to 6m.

Eight associated biotopes with different dominant (>50% of the biovolume) macrophyte taxa (spiny naiad, spikerush, pondweed, watermilfoil, *Ranunculus* spp. Charales, and seagrass.) have been described. They differ in their distribution along gradients in salinity, depth and wave exposure with the biotope dominated by the common eelgrass (*Zostera marina*)' (AA.J1B7) differing most strongly from the others in distribution. This occurs mainly under conditions of moderate exposure to wave action and in salinities of 5 psu or higher. It is also typically found deeper than the other 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 Gulf of Finland and 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 over time. 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. The overall quality and continued occurrence of this habitat is, however, largely dependent on the presence of the rooted plant communities which create the biogenic structural complexity on which the characteristic associated communities depend. The density and the maintenance of a viable population of these species

is a key indicator of habitat quality, together with the visual evidence of presence or absence of physical damage.

Characteristic species:

Stuckenia pectinata, Potamogeton perfoliatus, Zostera marina, Z. noltei, Ruppia cirrhosa, R maritima, Zannichellia palustris, Myriophyllum spicatum, Najas marina, Chara aspera Ch. baltica, Ch. canescens, Ranunculus peltatus subsp*. baudotii, Eleocharis* spp.

Classification

EUNIS:

The closest correspondence in EUNIS (2004) level 4 is A5.53 Sublittoral seagrass beds, A5.54 Angiosperm communities in reduced salinity and A5.21 Sublittoral sand in low or 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:

1110 Sandbanks slightly covered all the time

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 sand

EUSeaMap:

Shallow sands

IUCN:

9.4 Subtidal Sandy

9.9 Seagrass

9.10 Estuaries

Other relationships:

Level 5 of the HELCOM HUB classification (2013):

AA.J1B Baltic photic sand characterised by submerged rooted plants

This habitat has eight biotopes on HUB level 6; AA.J1B1 'Baltic photic sand dominated by pondweed (*Potamogeton perfoliatus* and/or *Stuckenia pectinata*)' AA.J1B2 'Baltic photic sand dominated by *Zannichellia* spp. and/or *Ruppia* spp. and/or *Zostera noltii*' AA.J1B3 Baltic photic sand dominated by watermilfoil (*Myriophyllum spicatum* and/or *Myriophyllum sibiricum*)' AA.J1B4 'Baltic photic sand dominated by Charales' AA.J1B5 'Baltic photic sand dominated by spiny naiad (*Najas marina*)' AA.J1B6 'Baltic photic sand dominated by *Ranunculus* spp.' AA.J1B7 'Baltic photic sand dominated by common eelgrass (*Zostera marina*)' AA.J1B8 'Baltic photic sand 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 occurs in all the Baltic Sea sub basins and most of the associated biotopes are very typical of the Baltic. They have a characteristic species composition for the Baltic Sea, dominated by species of freshwater origin.

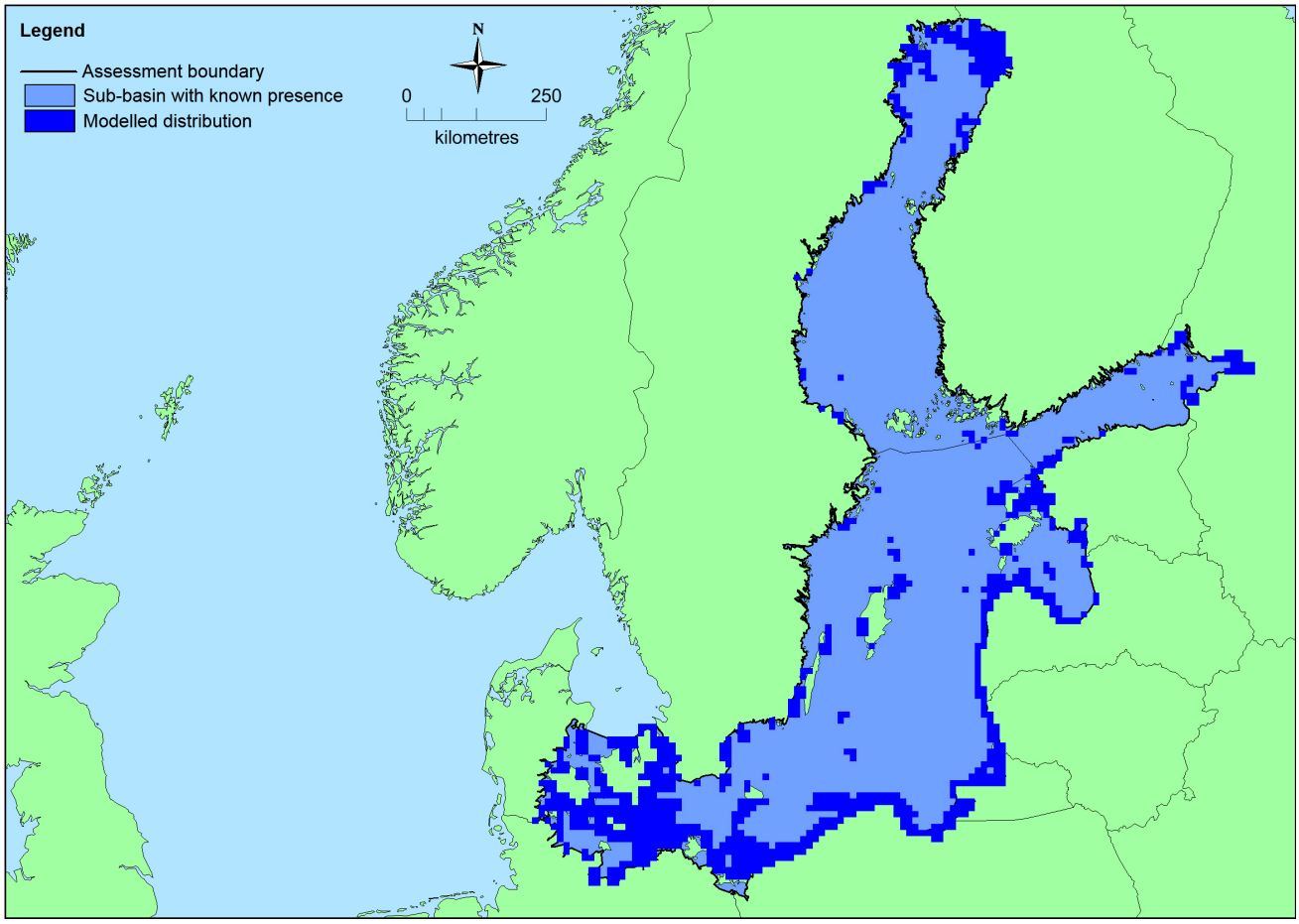
Geographic occurrence and trends

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 Gulf of Riga: Present The Sound: 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 however there is insufficient information for accurate calculation of EOO and AOO.
EU 28+	>50,000 Km^2	>50	Unknown Km^2	This habitat is present in all the Baltic sub-basins however there is insufficient information for accurate calculation of EOO and AOO.

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. EOO and AOO cannot be calculated at the present time, although the habitat is known to occur in all the Baltic Sea sub-basins.

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. This habitat may be present in other European regional seas.

Trends in quantity

The best studied biotopes are those dominated by seagrass, brackish water angiosperms and charophytes and for most of them there have been significant declines in extent. Two examples are in Greifswalder Boden, Germany where dense *Z. marina* meadows covered the seafloor in the 1930s, but between 1950 and 1980 there was been a decline of up to 90%; a decline of between 75-80% has been recorded in Oresund, Denmark. In Puck Bay, Poland the underwater meadows of vascular plants (including *Z. marina*) have been also reduced respectively between 1950 and 1980 but increasing since the 1990s. Present cover is very patchy and only a small fraction of its extensive historic distribution in the Bay. Also reductions for the sub-biotope dominated by charophytes are known from German inner bays and lagoons as well as the Polish Puck Bay.

The associated biotope AA.J1B4 'Baltic photic sand dominated by Charales' has declined by >25% during the last 50 years but to a varying extent in different Baltic Sea regions with the strongest decline in the Western and Southern Baltic Sea. In some bays and lagoons conditions have changed so intensively that it has disappeared completely. AA.J1B5 'Baltic photic sand dominated by spiny naiad (*Najas marina*)' has exhibited a strong decline in the highly eutrophicated areas of the Southern Baltic Sea and it is known to

have 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) shows nearly total loss of the biotope. There are no data to indicate similar declines in other Baltic Sea areas but the biotope is largely restricted to lagoons which is an endangered biotope complex. 'Baltic photic sand dominated by common eelgrass (*Zostera marina*)' has declined >25% during the last 50 years, 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 have been no estimates of future trends in the quantity of this habitat.

- 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 occurs 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 occurs in all the Baltic Sea sub-basins therefore does not have a small natural range.

Trends in quality

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

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

Pressures and threats

Observed declines of the spatial distribution of the biotopes AA.J1B4 'Baltic photic sand dominated by Charales' and AA.J1B5 'Baltic photic sand dominated by spiny naiad (*Najas marina*)' 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 works (e.g. dredging for deepening of harbour access channels, ditching and construction of leisure facilities) and increased tourism has led to a further degradation of the habitat. The threat level is particularly high in the Western and Southern Baltic Sea. In the future climate change (increasing exposure levels, temperatures) or increasingaquaculture in bays may cause additional threats.

The main causes of the observed declines of the spatial distribution of the biotope AA.J1B7 'Baltic photic sand 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* dominated biotopes can receive enough light and may in addition cause a shift from eelgrass meadows to communities dominated by fast-growing macroalgae. 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

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

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)
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 works and dredging in shallow coastal lagoons 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:

1110: MBAL U1

1130: MBAL U2

1160: MBAL U2

1650: MBAL U2

HELCOM (2013) assessments:

1110 VU C1

1130 CR C1

1160 VU C1

1650 VU C1

HELCOM (2013) have assessed associated biotopes AA.J1BI, AA.J1B2, AA.J1B3, AA.J1B6 and AA.J1B8 as LC(A1). AA.J1B4, AA.J1B5 and AA.J1B7 have been asssessed as NT(A1).

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

The associated biotope AA.J1B7 'Baltic photic sand dominated by common eelgrass (*Zostera marina*)' can be slow to recover after strong decline (>20 yrs)> intervention (through transplantation) 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 long. 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 biotopes natural recovery can probably occur within 10 years.

Effort required

10 years	20 years
Naturally and through intervention	Naturally and through intervention

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 %

There are quantiative data for changes in this habitat in some parts of its range in the Baltic Sea and for some of the sub-habitats. Expert opinion is that overall this is probably more than 25% in the last 50 years. This habitat has therefore been assessed as Near Threatened under Criterion 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	Yes	Yes	No	>50	Yes	Yes	No	No
EU 28+	>50,000 Km^2	Yes	Yes	No	>50	Yes	Yes	No	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. The habitat is believed to have declined in extent over the last 50 years and there is a likelihood of continuing decline but because it does not have a restricted geographic distribution it has been assessed as Least Concern under criterion B for both the EU 28 and EU 28+.

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* but 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
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)

Assessors

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Reviewers
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