Kelp communities on Baltic infralittoral coarse sediment/shell gravel

Summary

This habitat occurs off the coasts of Denmark, Sweden and Germany in the western Baltic, only extending into the Baltic proper as far as the island of Bornholm. Its geographical extent and the area it occupies is constrained by the extent of the shell gravel and coarse sediment substrate in areas where the salinity and light levels are high enough to support the establishment and growth of kelp. The habitat is known to be vulnerable to nutrient enrichment, reduced light levels and smothering by suspended sediment. These pressures are believed to have led to a decline in extent of the habitat over the last 50 years. Eutrophication, coastal and offshore developments, fishing activities which disturb the seabed or dislodge kelp plants and overturn the substrate, dredging and sand and gravel extraction are other known threats.

All actions to reduce physical disturbance of shell gravel/mixed substrate bottoms and eutrophication in the Baltic Sea are important for the conservation of this habitat. Proposed actions include limiting or prohibiting bottom trawling , exploitation of marine soil resources like oil, gas, sand or gravel in areas where it occurs. Reduction in salinity, especially in the Baltic proper is expected in the future as a response to climate change. This will most likely reduce the spatial distribution of most species of marine origin in the Baltic, such as the kelps which characterise this habitat, limiting their distribution to the Danish Straits.

Synthesis

This habitat is only present in the EU 28 in the Baltic Sea. The necessary environmental conditions (specific bottom morphology and currents) to enable shell gravel bottoms exist only within very few spatially restricted localities in the Baltic. Whilst these are known in general terms there is a lack of quantitative data on the extent and quality of this habitat. The current Red List assessment has therefore been based on expert opinion.

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 one of the associated biotopes (kelp on shell gravel) to be Near Threatened (based on criterion B1a (ii)). Kelp on coarse sediment and kelp on mixed substrate was assessed as Least Concern. Given the scarcity of kelp habitats on shell gravel and coarse sediment in the Baltic region, continuation of known threats, and the predicted increase in pressure on this habitat associated with climate change (temperature and salinity in particular), expert opinion has been used to assess this habitat as Near Threatened for 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, A2, A3, B3	Near Threatened	A1, A2, A3, B3

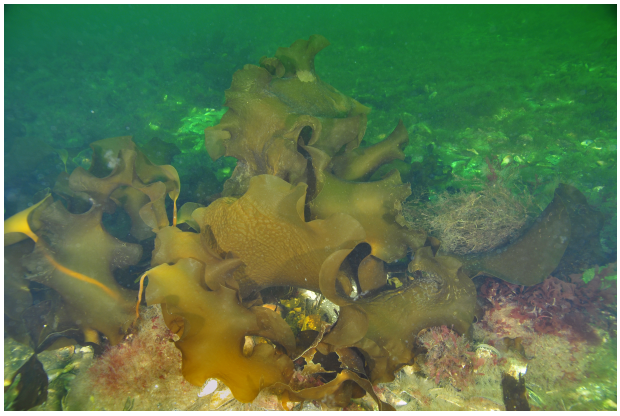
Sub-habitat types that may require further examination

AA.E1C4 Baltic photic shell gravel dominated by kelp.

Habitat Type

Code and name

Kelp communities on Baltic infralittoral coarse sediment/shell gravel



Kelp on coarse sediment/shell gravel, Ven Island, Sweden (© OCEANA/C.Minguell).

Saccharina latimissa attached to stones on coarse sediment (© OCEANA/C.Minguell).

Habitat description

This habitat occurs in the photic zone in areas where the more than 90% of the seabed is comprised of coarse sediments, including shell gravel and mixed substrates according to the HELCOM HUB classification. Kelp covers at least 10% of the seabed and more than other perennial attached erect groups. It is more common in areas exposed to wave action than sheltered locations and present in depths from around 0.5-10 m. Three associated biotopes have been identified. 'Baltic photic shell gravel dominated by kelp' (AA.E1C4), 'Baltic photic mixed substrate dominated by kelp' (AA.M1C4) and Baltic photic coarse sediment dominated by kelp' (AA.I1C4) where perennial attached kelp species such as *Saccharina latissima* and *Laminaria digitata* constitute at least 50% of the biovolume of such algae.

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 lower depth limit of the kelp is a potential indicator of quality of this habitat.

Characteristic species:

Saccharina latissima, Laminaria digitata

Classification

EUNIS:

The closest corresponsence in EUNIS (2004) level 4 is A5.11 Infralittoral coarse sediment 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 by seawater

1160 Large shallow inlets and bays

1650 Boreal Baltic narrow inlets

MAES:

Marine - Marine inlets and transitional waters

Marine - Coastal

MSFD:

Shallow sublittoral coarse sediment

Shallow sublittoral mixed sediment

EUSeaMap:

Shallow coarse or mixed sediments

IUCN:

9.3 Subtidal loose rock/pebble/gravel

Other relationships:

This habitat has three sub-habitats on HUB level 6;

AA.E1C4 Baltic photic shell gravel dominated by kelp

AA.M1C4 Baltic photic mixed substrate dominated by kelp

AA.I1C4 Baltic photic coarse sediment dominated by kelp

Does the habitat type present an outstanding example of typical characteristics of one or more biogeographic regions?
No

Justification
Kelp forests are more typically found in fully saline waters making this a marginal habitat in the Baltic.

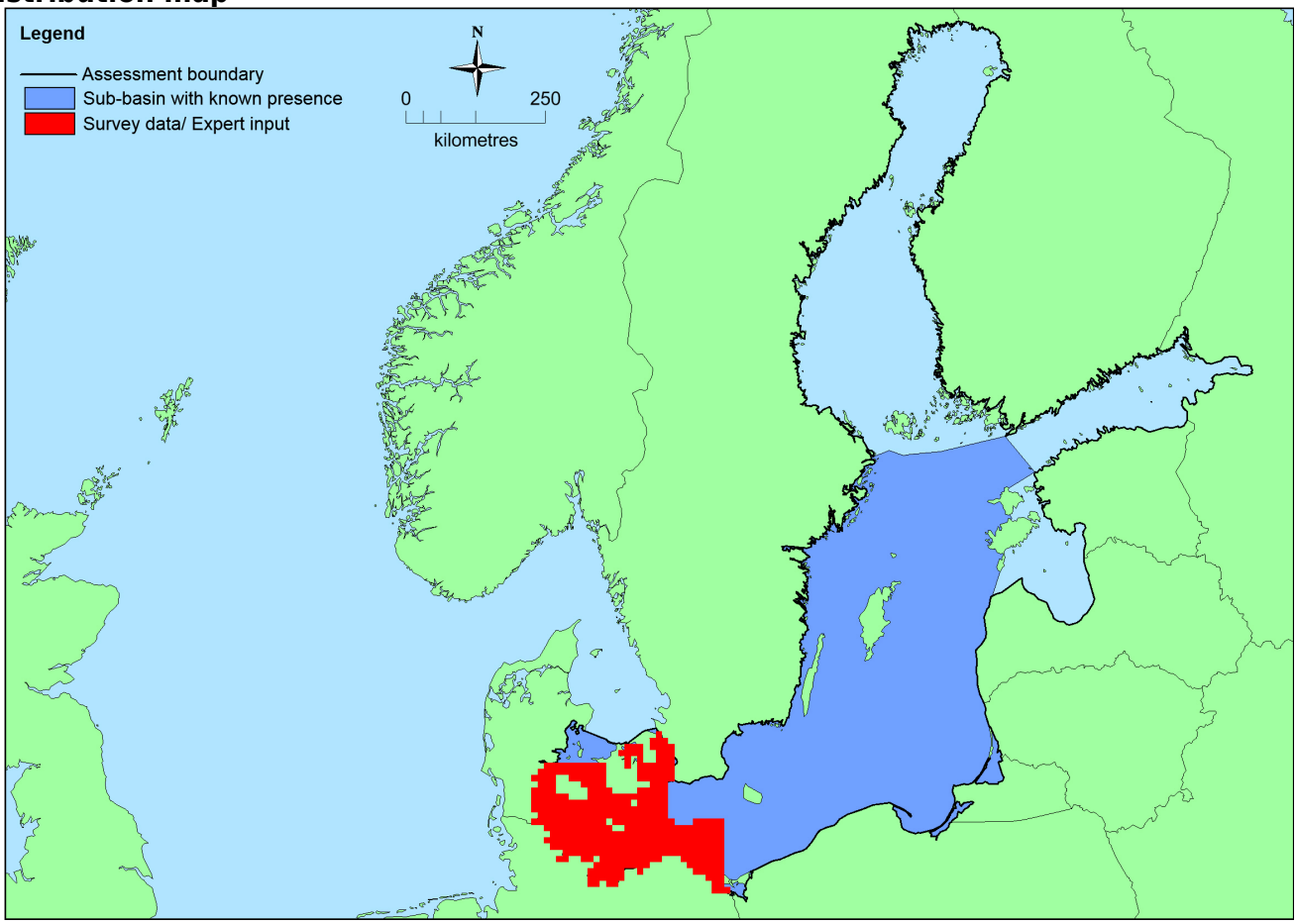
Geographic occurrence and trends

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	Belt Sea: Present The Sound: Present Baltic Proper: Present	max 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	max 63,250 Km^2	max 410	max 60,000 Km^2	EOO and AOO are based on HELCOM mapping in 100 x 100km cells that were converted to 10 x 10 km cells. The values therefore represent a maximum as the habitat may not occur in all these 10 x 10 km cell
EU 28+	max 63,250 Km^2	max 410	max 60,000 Km^2	

Distribution map



This map is based on HELCOM mapping of the presence of this habitat in 100 x 100 km cells that were converted to 10 x 10 km cells. The calculated EOO and AOO values therefore represent a maximum based on current information as the habitat may not occur in all these 10 x 10 km cells.

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

This habitat type does not occur in the Russian Baltic Sea area therefore 100% is hosted by EU 28. A similar habitat occurs in the North East Atlantic Regional Sea.

Trends in quantity

This habitat is only present in the western and south-western Baltic Sea. HELCOM (2013) have indicated that it occurs in six 100 x 100 km grid squares therefore it may cover a maximum of 60,000 km^2, but exact figures are lacking. Further mapping is required to provide an accurate figure for the extent of this habitat and this needs to take place during the months when the vegetation is fully developed.

The quantity of the habitat is believed to have declined over the last 50 years in response to eutrophication. Climate change modelling forecasts a decrease in algal cover in the southern Baltic over the next 100 years therefore a continuing decline is expected.

- 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 only occurs in the southern Baltic and has a small natural range. It has declined during the last 50 years as a result of reduced water quality, primarily eutrophication. This decline is predicted to continue and to be exacerbated by climate change effects on sea temperature and salinity in the Baltic.
- Does the habitat have a small natural range by reason of its intrinsically restricted area?
  Yes
  Justification
  The necessary environmental conditions (specific bottom morphology and currents) to enable shell gravel bottoms exist only within very few spatially restricted localities in the Baltic. The conditions to enable kelp species to grow on the shells, such as light availability and salinity, further restricts the spatial distribution of this habitat in the Baltic.

Trends in quality

There is insufficient information on which to assess the current quality of this habitat or any historical trends. No estimates have been made of future trends.Nevertheless as quantity is considered likely to decline an associated decline in quality seems likely.

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

Pressures and threats

Eutrophication as a result of nutrient enrichment (N, P or organic matter) reduces light penetration and consequently the depths to which kelp dominated habitats can thrive. At the same time the upper distributional limit of this habitat is restricted by the low salinity conditions in much of the Baltic which hinders the establishment of kelp. Increasing siltation caused by eutrophication as well as increased turbidity arising from dumping, marine offshore construction activities, and bottom trawling may also damage existing areas as well as prevent the settlement of kelp and therefore the occurrence of this habitat. Bottom trawling and other activities may also have a direct effect by destroying reefs and dislodging kelp plants.

Climate change is a current and future threat to this habitat. Low and fluctuating salinity, as is typical for inner Danish waters, may contribute to relatively low production as osmotic stress can exert physiological stress on kelps. Temperature is also known to affect the establishment and growth rate of kelp and considered to be a plausible reason for *S. latissima* productivity being inhibited in Aarhus Bay (Kattegat, Denmark) after a period of decline. Increasing sea temperature could create suitable conditions for kelp habitats to extend further into the Baltic (in areas of suitable substrate), but this is considered unlikely as salinity is predicted to decline as well. Future pressures and threats are therefore likely to reduce the extent of this Baltic habitat.

List of pressures and threats

Biological resource use other than agriculture & forestry

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)

Natural System modifications

Human induced changes in hydraulic conditions
- Siltation rate changes, dumping, depositing of dredged deposits
- Other human induced changes in hydraulic conditions

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 physical disturbance of shell gravel/mixed substrate bottoms and eutrophication in the Baltic Sea are important for the conservation of this habitat. The areas where it occurs should be protected for example by limiting or prohibiting bottom trawling, or the exploitation of oil, gas, sand or gravel.

List of conservation and management needs

Measures related to wetland, freshwater and coastal habitats

Restoring/Improving water quality

Measures related to marine habitats

Other marine-related measures

Measures related to spatial planning

Establish protected areas/sites

Measures related to hunting, taking and fishing and species management

Regulation/Management of fishery in marine and brackish systems

Measures related to special resouce use

Regulating/Management exploitation of natural resources on land

Conservation status

Annex 1:

1110: MBAL U1

1170: MBAL U1

1650: MBAL U2

HELCOM (2013) assessments:

1110: VU C1

1170: VU C1

1650: VU C1

One biotope ‘Baltic photic shell gravel dominated by kelp’ (AA.E1C4) has been assessed as Near Threatened according to criterion B1a (ii) in the HELCOM (2013) Red List Assessment.

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

Harvesting experiments have shown that sugar kelp has a relatively quick recolonization response following removal from an area but there are circumstances where this may not happen. For example, the very high sea temperatures in 1994 may have prevented recolonization in a 15 year period in the Flensburg Fjord Denmark. Timescale for recolonization after severe damage will also depend on whether the causes of decline such as eutrophication, have been addressed, whether the shell gravel substrate is still present and whether it remains suitable for recolonization.

Effort required

10 years
Naturally

Red List Assessment

Criterion A: Reduction in quantity

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

This habitat is only present in the EU 28. There has been a decrease in area covered by the kelp biotope associated with shell gravel over the last 50 years but no quantitative data on trends in the overall area covered by this habitat type in the Baltic. Expert opinion is that there is the potential for more than a 25% decline in the next 50 years associated with climate change (temperature and salinity in particular). This habitat has therefore been assessed as Near Threatened under Criteria A.

Criterion B: Restricted geographic distribution

Criterion B	B1				B2				B3
	EOO	a	b	c	AOO	a	b	c	
EU 28	max 63,250 Km^2	Yes	Yes	Yes	max 410	Yes	Yes	Yes	Yes
EU 28+	max 63,250 Km^2	Yes	Yes	Yes	max 410	Yes	Yes	Yes	Yes

This habitat is only present in the EU 28. EOO and AOO calculations are based on reported presence of this habitat in 100 x 100 km grid squares. These are considered likely to be maximum figures as the habitat is not present in the aphotic zone but such occurrences could not be excluded from the calculations due to limitations with the underlying data. A continuing decline in extent and quality of this habitat is considered likely but cannot be quantified at the present time. The habitat is capable of becoming Critically Endangered or Collapsed within a very short period of time because of threats associated with climate

change (temperature and salinity in particular) that could cover the full range of this habitat in the Baltic. It has therefore been assessed as Near Threatened under Criteria 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%

Experts consider there to be insufficient data on which to assess 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 that estimates 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	NT	NT	DD	LC	LC	NT	DD	DD	DD	DD	DD	DD	DD	DD	DD	DD
EU28+	NT	NT	NT	DD	LC	LC	NT	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, A2, A3, B3	Near Threatened	A1, A2, A3, B3

Confidence in the assessment

Low (mainly based on uncertain or indirect information, inferred and suspected data values, and/or limited expert knowledge)

Assessors

S. Gubbay and N. Sanders.

Contributors
HELCOM RED LIST Biotope Expert Team 2013 and Baltic Sea Working Group for the European Red List of Habitats 2014 and 2015.

Reviewers
S. A. Wikström.

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