A2.32: Polychaete/ oligochaete-dominated upper estuarine Atlantic littoral mud

Summary

This habitat is found on upper estuarine sandy mud and muddy shores, in areas with significant freshwater influence. The upper estuarine mud communities support few infaunal species and are principally characterised by a restricted range of polychaetes and oligochaetes.

The most significant pressures on this habitat which occurs at the head of estuaries are land claim and coastal developments which change the tidal regime. The use of estuaries for industrial and urban purposes also has an effect on intertidal habitats in the upper reaches. These effects are associated with activities such as harbour construction and the dredging of navigation channels as well as indirectly through the contamination of the sediment by heavy metals. Climate change and the associated rising sea levels, surge levels and wave climate as well as freshwater discharge will affect the estuarine environment including the intertidal areas although the precise effects will depend on the characteristics of the estuary.

Management of both terrestrial and marine activities will be important to control factors leading to the decline of quantity and quality of this habitat. Integrated Coastal Zone Management which includes spatial planning measures and limits land claim and other activities that alter the tidal regime in the upper reaches of estuaries are examples of beneficial measures. Other include the regulation of dredging, of coastal development, aquaculture, hard coastal defence structures and the control of invasive species

Synthesis

Historically, estuarine mudflats have suffered considerable declines in extent as a result of human activity. Whilst this no longer takes place on the scale practiced several centuries ago, piecemeal loss of areas of estuarine mudflat continues to occur. Declines in abiotic and biotic quality have also taken place, for example as a result of the discharge of industrial effluents and nutrient enrichment due to run-off from surrounding land, and this remains an issue in some estuaries.

Because of the very substantial historical loss in quantity of this habitat, expert opinion is that this habitat should be assessed as Endangered under criterion A3 for both the EU 28 andEU 28+.

Overall Category & Criteria			
EU 28		EU 28+	
Red List Category	Red List Criteria	Red List Category	Red List Criteria
Endangered	A3	Endangered	A3

Sub-habitat types that may require further examination

None.

Habitat Type

Code and name

A2.32: Polychaete/ oligochaete-dominated upper estuarine Atlantic littoral mud

Littoral muddy shore of the upper estuary of the River Avon, Devon (© A.R. Davis).

Littoral muddy shore of the upper estuary of the River Avon, Devon (© A.R. Davis).

Habitat description

Upper estuarine sandy mud and muddy shore communities, in areas with significant freshwater influence. The littoral mud typically forms mudflats, though dry compacted mud can form steep and even vertical structures, particularly at the top of the shore adjacent to saltmarshes. Little oxygen penetrates these cohesive sediments, and an anoxic layer is often present within millimetres of the sediment surface.

The upper estuarine mud communities support few infaunal species and are principally characterised by a restricted range of polychaetes and oligochaetes. There are three oligochaete dominated upper estuarine mud biotopes associated with this habitat. Of these three, the biotope characterised by *Nephtys hombergii* and *Streblospio shrubsolii* occurs the furthest towards the mid estuary, and possibly lower on the shore than the other two. The biotope characterised by *Tubificoides benedii* and other is the most extreme upper estuarine biotope, occurring at the head of estuaries where there is no strong river flow and hence conditions are very sheltered, and there is a very strong freshwater influence. Further towards the mid estuary, this biotope may occur at the top of the shore.

Indicators of quality:

Many indicators of quality have been used for this habitat with particular parameters 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. Indicators of quality of this habitat are frequently linked to those for the whole estuarine environment and therefore include morphological and physical characteristics, carrying capacity and water quality parameters. For the mudflat itself benthic indices, contaminant levels and productivity are some of the frequently used measures of quality.

Indices developed to assess the ecological status of coastal waters, including estuaries, according to the Water Framework Directive, include physical indicators, water quality indicators and measures of benthic diversity, species richness and abundance. The latter group, which is particularly relevant to benthic habitats, includes a Benthic Quality Index, an Infaunal Trophic Index, a Marine Biotic index based on ecological groups, and the Benthic Opportunistic Polychaetes/Amphipods index.

Characteristic species:

These include *Hediste diversicolor, Nephtys hombergii,* and *Streblospio shrubsolii*, the amphipod *Corophium volutator*, and molluscs *Hydrobia ulvae* and *Scrobicularia plana*. *Enteromorpha* spp. and *Ulva lactuca* may form mats on the surface of the mud during the summer months, particularly in areas of nutrient enrichment.

Classification

EUNIS (v1405):

Level 4. A sub-habitat of ‘Atlantic littoral mud’ (A2.3).

Annex 1:

1130 Estuaries

MAES:

Marine - Marine inlets and transitional waters

MSFD:

Littoral Sediment

EUSeaMap:

Not mapped

IUCN:

9.10 Estuaries

12.4 Mud Shoreline and Intertidal Mud Flats

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

Regions
Atlantic

Justification
Estuarine mudflats are a characteristic coastal habitat of the North East Atlantic. They are present in all the sub-basins of this regional sea, except for Macaronesia, and are common because of the numerous rivers which discharge to the sea in a region where there is a significant tidal range (over 12 m). This also enables the development of some very large expanses of estuarine mudflat.

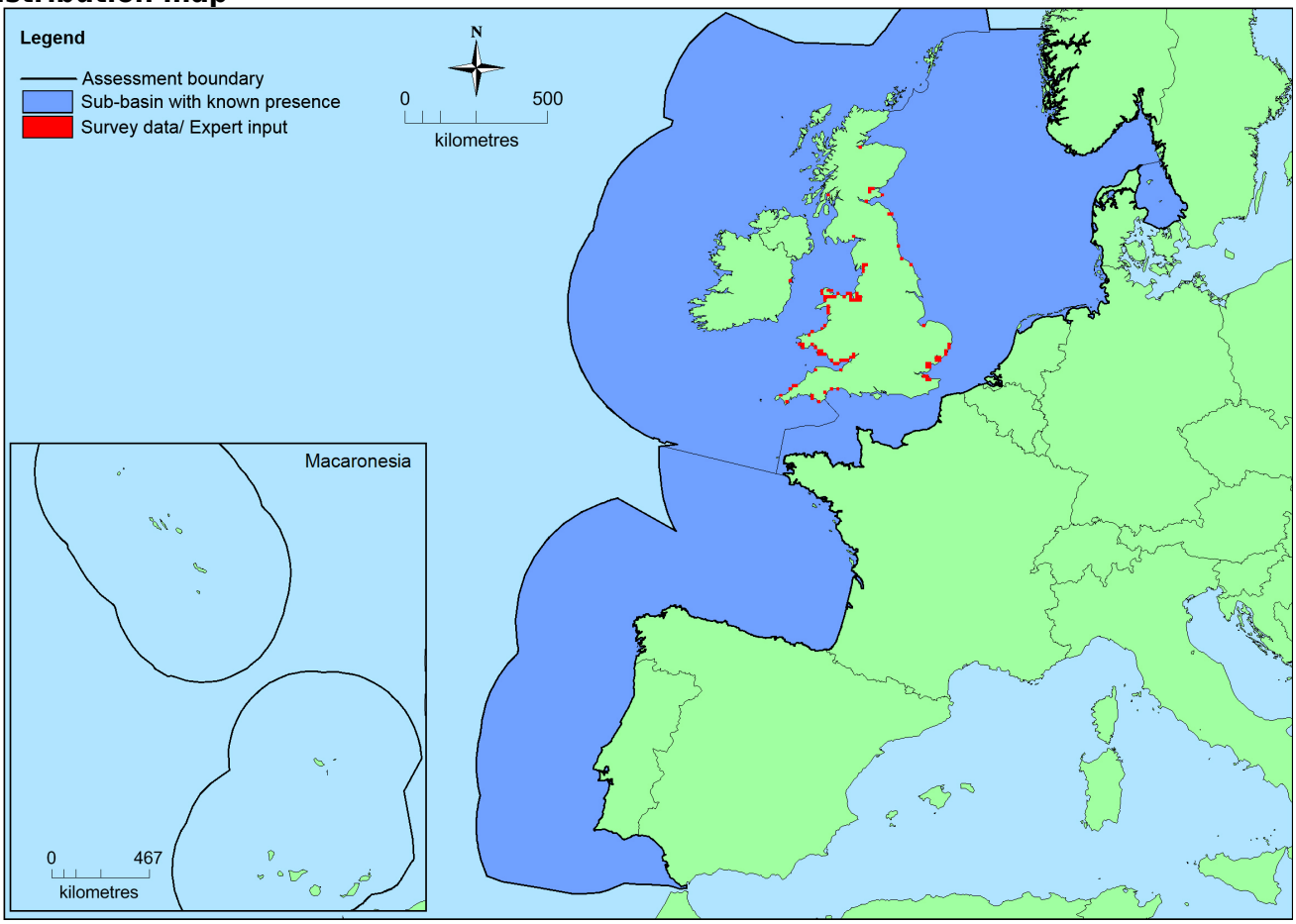
Geographic occurrence and trends

Region	Present or Presence Uncertain	Current area of habitat	Recent trend in quantity (last 50 yrs)	Recent trend in quality (last 50 yrs)
North-East Atlantic	Bay of Biscay and the Iberian Coast: Present Celtic Seas: Present Kattegat: Present Greater North Sea: Present	unknown Km^2	Stable	Stable

Extent of Occurrence, Area of Occupancy and habitat area

	Extent of Occurrence (EOO)	Area of Occupancy (AOO)	Current estimated Total Area	Comment
EU 28	271,876 Km^2	106	unknown Km^2	EOO and AOO have been calculated on the available data. Although this data set is known to be incomplete the figures exceed the thresholds for threatened status.
EU 28+	>271,876 Km^2	>106	unknown Km^2	EOO and AOO have been calculated on the available data. Although this data set is known to be incomplete the figures exceed the thresholds for threatened status.

Distribution map



There are insufficient data to provide a comprehensive and accurate map of the distribution of this habitat. This map has been generated using EMODnet data from modelled/surveyed records for the North East Atlantic (and supplemented with expert opinion where applicable) (EMODnet 2010). EOO and AOO have been calculated on the available data presented in this map however these should be treated with caution as expert opinion is that this is not the full distribution of the habitat .

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

This habitat occurs in the EU 28+ (e.g. in sheltered locations at the head of inlets, estuaries and fjords in Norway, Isle of Man, Channel Islands). The percentage hosted by the EU 28 is likely to be more than 90% but there is insufficient information to establish the exact figure.

Trends in quantity

Historically there have been dramatic changes in quantity of this habitat with significant permanent

loss, for example, as a result of the conversion of flood plains into polders in Germany and the Netherlands. Land claim has also been widespread, cumulative and piecemeal in the UK. It has affected at least 85% of British estuaries and has removed over 25% of intertidal land from many estuaries and over 80% in some such as the Tees and the Tyne. Whilst it is not possible to determine how much of this constituted mudflat habitat, the scale and extent of the land claim schemes suggests this has been significant.

In recent decades, the direct losses of intertidal habitat in estuaries appears to have stabilised (in the German Wadden Sea an estimated loss of less than 10% within the last 50 years compared to over 70% loss over the last 250 years) although piecemeal losses continue to occur.

Climate change, with predicted sea level rise and changes in storm surge levels and frequency is considered likely to lead to future habitat loss unless there is scope for inland migration of intertidal habitats within estuaries.

- Average current trend in quantity (extent)
  EU 28: Stable
  EU 28+: Stable
- Does the habitat type have a small natural range following regression?
  No
  Justification
  This habitat has a large natural range in the North East Atlantic region with examples a far south as the Atlantic coast of Spain, along the western coasts of Ireland, around the British Isles, and on mainland Europe, in France, The Netherlands, Germany and Denmark.
- Does the habitat have a small natural range by reason of its intrinsically restricted area?
  No
  Justification
  This habitat has a large natural range in the North East Atlantic region with examples a far south as the Atlantic coast of Spain, along the western coasts of Ireland, around the British Isles, and on mainland Europe, in France, The Netherlands, Germany and Denmark.

Trends in quality

There has been a significant historical decline in quality of this habitat. In Germany this is estimated to have affected over 90% of the habitat to the extent where a "natural" hydrographic regime no longer exists for German North Sea estuaries. An estimated 70% has declined in quality over the last 50 years. Land claim has affected at least 85% of British estuaries, including areas of mudflat, leading to a decline in quality.

More recently activities such as dredging, discharge of effluents, development of anoxic conditions and eutrophication have affected the quality of mudflats in some estuaries but overall they are considered to be mostly stable.

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

Pressures and threats

The most significant pressures on this habitat which occurs at the head of estuaries are land claim and coastal developments which change the tidal regime. The storm surge barriers and dams on the Ossterschelde/Krammer-Volkerak in the Netherlands, built between 1982-87 are one example. This work resulted in 50 km^2 of intertidal flats about 30% of the former intertidal area becoming freshwater lakes. A further 3% was lost through reduction in the tidal range.

The use of estuaries for industrial and urban purposes also has an effect on intertidal habitats in the upper reaches. These effects are associated with activities such as harbour construction and the dredging of navigation channels as well as indirectly through the contamination of the sediment by heavy metals. Climate change and the associated rising sea levels, surge levels and wave climate as well as freshwater discharge will affect the estuarine environment including the intertidal areas although the precise effects will depend on the characteristics of the estuary.

OSPAR has identified the scale of the threat to intertidal mudflats from waste/effluent discharge, invasion by alien species, pollution, reclaimation (localised) and climate change to be high, and from collecting, and shell fisheries as moderate. Disturbance, for example from recreational activities, is also a significant threat in some locations.

List of pressures and threats

Urbanisation, residential and commercial development

Discharges
Disposal of industrial waste

Biological resource use other than agriculture & forestry

Fishing and harvesting aquatic resources
Bait digging / Collection

Pollution

Marine water pollution

Natural System modifications

Human induced changes in hydraulic conditions
Landfill, land reclamation and drying out, general
Removal of sediments (mud...)
Modification of hydrographic functioning, general
Siltation rate changes, dumping, depositing of dredged deposits
Dykes, embankments, artificial beaches, general

Climate change

Changes in abiotic conditions
Flooding and rising precipitations
Water flow changes (limnic, tidal and oceanic)
Wave exposure changes
Sea-level changes
Changes in biotic conditions
Habitat shifting and alteration

Conservation and management

Management of both terrestrial and marine activities will be important to control factors leading to the decline of quantity and quality of this habitat. Integrated Coastal Zone Management which includes spatial planning measures and limits land claim and other activities that alter the tidal regime in the upper reaches of estuaries are examples of beneficial measures. Other include the regulation of dredging, of coastal development, aquaculture, hard coastal defence structures and the control of invasive species

The water quality on mudflats has been regulated by a number of EC Directives including the the Urban Waste Water Treatment Directive, the Nitrates Directive and the Water Framework Directive.

These commitments provide for the regulation of discharges to the sea and have set targets and quality standards covering many metals and pesticides, and other toxic persistent and bioaccumulative substances. National schemes, such as the Aquatic National Monitoring Programme in Denmark, provide data to indicate progress with implementation of such Directives.

List of conservation and management needs

Measures related to wetland, freshwater and coastal habitats

Restoring/Improving water quality
Restoring/Improving the hydrological regime

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 urban areas, industry, energy and transport

Urban and industrial waste management

Conservation status

Annex 1:

1130 MATL U2

Intertidal mudflats are on the OSPAR list of threatened and/or declining habitats and species for OSPAR regions I, II, III & IV (Arctic Waters, Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast).

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

Where the soft sediment habitat is no longer present restoration may be possible but involve substantive works. Some examples
are the depolderisation projects and restoration schemes on Elbe, Wesser, Scheldt, and Humber through s ediment management, allowing development of natural tidal floodplains, and set back/managed realingme nt/depolderisation to restore intertidal mudflats within estuaries.

Effort required

10 years	20 years	50+ years
Naturally and through intervention	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 %	>70 %
EU 28+	<25 %	Unknown %	Unknown %	>70 %

Land claim, coastal developments, and flood protection works have resulted in the decline in extent of this habitat but it is not possible to quantify the amount for the entire North East Atlantic region. Historically losses are considered likely to be over 70% given that losses of estuarine land have amounted to more than 80% in places and that it is the upper reaches which are the most likely to have been affected. In the last 50 years the percentage decline is believed to be much reduced and probably less than 25%. This habitat has therefore been assessed as Endangered under criterion A3 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 North East Atlantc region. The precise extent is unknown however as EOO >50,000^2 and AOO >50, this exceeds the thresholds for a threatened category on the basis of restricted geographic distribution. The habit may suffer a continuing decline in spatial extent or abiotic/biotic quality in the future, but the distribution of the habitat is such that the identified threats are unlikely to affect all localities at one. This habitat has therefore been assessed as Least Concern under Criteria B1, B2 & B3 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 %	>30 %	severe %
EU 28+	Unknown %	Unknown %	Unknown %	Unknown %	>30 %	severe %

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 are numerous studies indicating declines in the abiotic quality of estuaries and their associated mudflats over the last 50 years as well as over longer time periods. This has been associated with diffuse and point-source discharges from agriculture, industry and urban areas, as well as pollution from oil, tar, and hazardous substances. Resultant degradation of the associated communities has also taken place and long term risks also exist, for example through resuspension of toxic materials within sediments. These trends are difficult to quantify but are considered to be substantial historically. This habitat has therefore been assessed as Vulnerable under criteria C/D3 for both theEU 28and EU28+.

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	LC	DD	DD	EN	LC	LC	LC	DD	DD	VU	DD	DD	DD	DD	DD	DD	DD
EU28+	LC	DD	DD	EN	LC	LC	LC	DD	DD	VU	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
Endangered	A3	Endangered	A3

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.

Contributors
North East Atlantic Working Group: N. Sanders, N. Dankers, J. Forde, K. Fürhaupter , S. Gubbay, R. Haroun Tabraue, F.Otero-Ferrer, G. Saunders, H. Tyler-Walters.

Reviewers
S.Beal.

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