A5.34: Marine Atlantic infralittoral fine mud

Summary

This habitat occurs in extremely sheltered areas with weak tidal currents such as sealochs and some rias and harbours, typically found in shallow sublittoral muds, extending from the extreme lower shore to about 15-20 m. Significant pressures and threats are associated with demersal fisheries. Closer inshore marine fish farms may have direct effects on mud communities, including smothering and increasing the Biological Oxygen Demand of the mud. Additional negative effects may result from the discharges of chemicals, some of which are especially toxic to crustaceans. Near the coast the construction of roads, bridges and barrages may affect the local hydrodynamic and sediment transport regimes of inshore enclosed areas and consequently affect the substratum. Nutrient enrichment leading to eutrophication can lead to changes in the structure and composition of the associated communities and there is evidence that shifts in community structure of the benthos have occurred in the North Sea corresponding with more widespread climatic changes.

This habitat can benefit from the regulation of the use of fishing gears that damage or disturb seabed communities. This may be achieved by spatial and temporal controls as well as gear design and deployment using fisheries management measures as well as conservation legislation in marine protected areas. Spatial planning (including zoning) can be used to address potential threats from coastal development and fish farming and the regulation of discharges and run off from agricultural land to the marine environment can be used to avoid eutrophication effects associated with nutrient enrichment.

Synthesis

This habitat is present across the region in shallow basins and sheltered inlets. There are no precise figures on its extent of however a combination of survey data and modelling indicates that it cannot be considered to have a restricted geographical distribution nor to occur in only a few locations in the North East Atlantic. Expert opinion is that there has been a decline in quality as exemplified by changes in species composition. There is a lack of comprehensive data however, expert opinion is that this habitat should be assesssed as Near Threatened for both the EU 28 and EU 28+ because of both past and likely future declines in quality.

Overall Category & Criteria			
EU 28		EU 28+	
Red List Category	Red List Criteria	Red List Category	Red List Criteria
Near Threatened	C/D1	Near Threatened	C/D1

Sub-habitat types that may require further examination

None.

Habitat Type

Code and name

A5.34: Marine Atlantic infralittoral fine mud

Habitat description

Shallow sublittoral muds, extending from the extreme lower shore to about 15-20 m depth in fully marine or near marine conditions, predominantly in extremely sheltered areas with very weak tidal currents. Such

habitats are found in sealochs and some rias and harbours. In very shallow extremely sheltered very soft muds the lugworm *Arenicola marina* may form very conspicuous mounds and casts. At such sites, high densities of synaptid holothurians such as *Labidoplax* media and *Leptosynapta bergensis* occur. The sediment surfaces may become covered by a diatom film at certain times of the year. Mobile species are opportunistic scavengers and predators and include starfish (e.g. *Asterias rubens*), crabs and hermit crabs (e.g. *Carcinus maenas* and *Pagurus bernhardus*), flatfish and gobies (e.g. *Pomatoschistus minutus*).

Sheltered sediments such as these are characterized by fine grain size, low porosity, generally low permeability (and hence high water content), high sediment stability (due to cohesion), a low oxygen content and highly reducing conditions. The mud surface is oxygenated. However, in fine muds, the anoxic reducing layer is likely to be very close to the surface, often less than 1cm. Bioturbation by burrowing species, results in mobilisation of the sediment and nutrients from deeper sediment to the surface, making nutrients available to surface dwelling organisms. In addition, continued irrigation of their burrows by *Arenicola marina* and *Leptosynata* sp. transports oxygenated water into the sediment, resulting in oxygenated micro-environments in the vicinity of their burrows.

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 indiceswhich 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. Key driving influences and output processes of shallow sublittoral mud habitats that are likely to be sensitive to pressures and may be useful for monitoring to identify anthropogenic causes of change include habitat structure changes, removal of particular species such as those which are key in bioturbation and biodeposition, or nutrient and biogeochemical cycling, changes in siltation rates and organic enrichment.

Characteristic species:

Populations of the lugworm *Arenicola marina* may be dense, with anemones, the opisthobranch *Philine aperta* and synaptid holothurians also characteristic in some areas. Other species which may frequently occur include *Ophiodromus flexuosus, Aphelochaeta marioni, Caulleriella caputesocis, Hydrobia ulvae, Cerastoderma edule, Abra nitida , Asterias rubens*, as well as the crustaceans *Pagurus bernhardus, Liocarcinus depurator,* and *Carcinus maenas*.The extent of the oxidised layer may be shallow with some areas being periodically or permanently anoxic. In these areas bacterial mats may develop on the sediment surface. In areas of soft stable mud *Philine aperta* and *Virgularia mirabilis* are characteristic whereas *Ocnus planci* aggregations may be present on sheltered sublittoral muddy sediment and oligochaetes in mobile mud.

Classification

EUNIS (v1405):

Level 4. A sub-habitat of ‘Atlantic shallow infralittoral mud’ (A5.3).

Annex 1:

1160 Large shallow inlets and bays

MAES:

Marine - Marine inlets and transitional waters

Marine - Coastal

MSFD:

Shallow sublittoral mud

EUSeaMap:

Shallow mud

IUCN:

9.6 Subtidal muddy

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

Regions
Atlantic

Justification
This habitat type is present in sheltered coastal waters as well as further offshore across the North East Atlantic region. It is common and widespread in the regional sea.

Geographic occurrence and trends

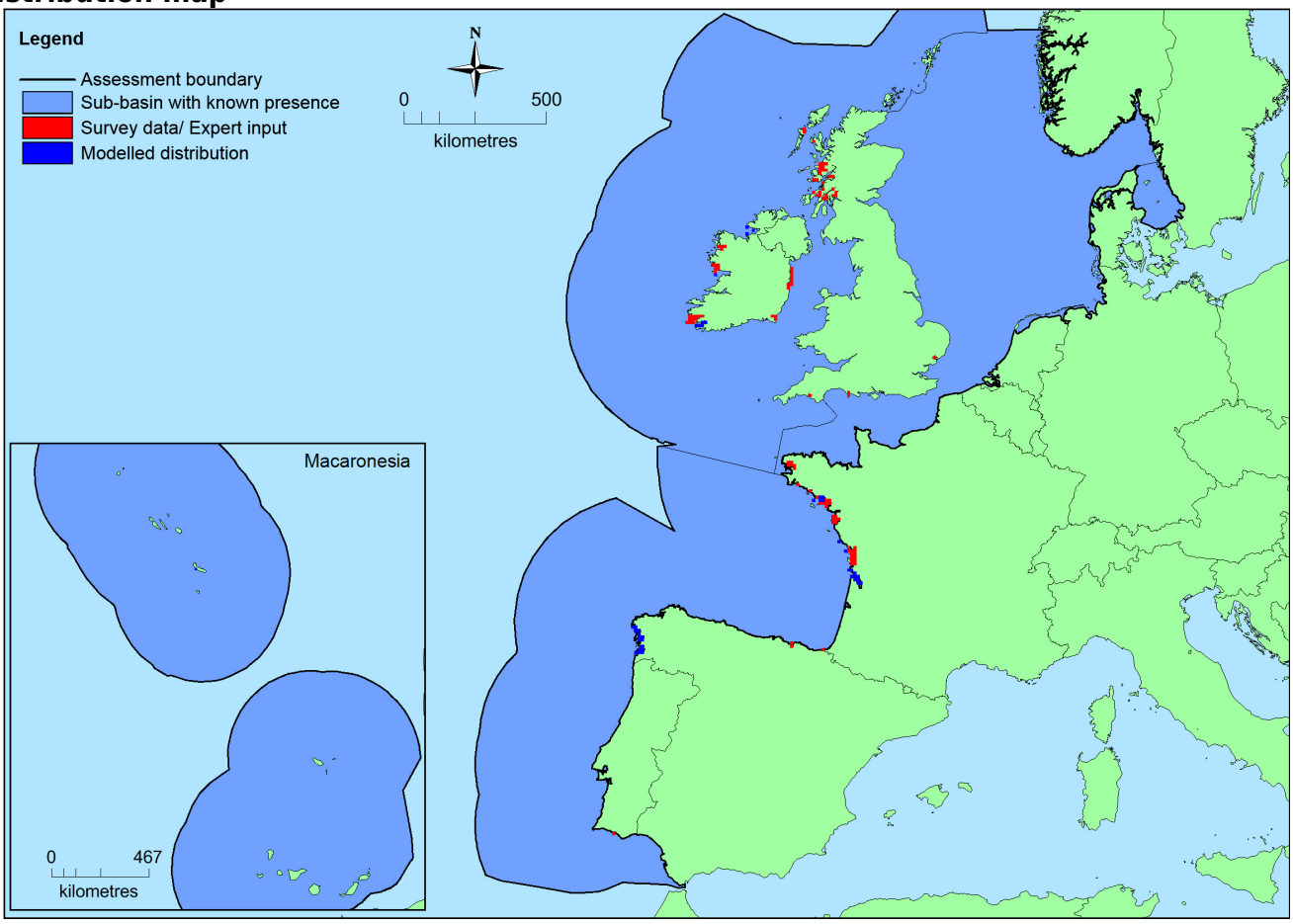
Region	Present or Presence Uncertain	Current area of habitat	Recent trend in quantity (last 50 yrs)	Recent trend in quality (last 50 yrs)
North-East Atlantic	Bay of Biscay and the Iberian Coast: Present Celtic Seas: Present Kattegat: Present Greater North Sea: Present Macaronesia: Present	Unknown Km^2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

Extent of Occurrence, Area of Occupancy and habitat area

	Extent of Occurrence (EOO)	Area of Occupancy (AOO)	Current estimated Total Area	Comment
EU 28	2,738.380 Km^2	183	>710 Km^2	The area estimate for this habitat has been derived from a synthesis of EUNIS seabed habitat geospatial information for the European Seas but is recognised as being an underestimate.

	Extent of Occurrence (EOO)	Area of Occupancy (AOO)	Current estimated Total Area	Comment
EU 28+	>2,738.380 Km^2	>183	>710 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. Norway, Isle of Man, Channel Islands). The percentage hosted by the EU 28 is likely to be between 85-90% but there is insufficient information to establish the exact figure.

Trends in quantity

Estimates of the area and extent of this habitat show considerable variation and are recognised as being biased and an underestimate. Trends in quantity cannot be determined with any accuracy although some habitat loss may have occurred as a result of changes in the sediment type e.g. the shift to a less muddy substrate in the Grande Vasiere, Bay of Biscay. Changes in the distribution of fine muds have been reported (e.g. over a 100 year period off the coast of Belgium) but not changes in the habitat.

- Average current trend in quantity (extent)
  EU 28: Unknown
  EU 28+: Unknown
- 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 as widely separated as off the Atlantic coast of southern Spain, west of the British Isles and the North Sea.
- 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 as widely separated as off the Atlantic coast of southern Spain, west of the British Isles and the North Sea.

Trends in quality

Whilst the physical habitat is unlikely to decline, the biotopes that characterise the habitat are believed to have been substantially changed by fishing activities. Most sedimentary benthic systems on the continental shelf of Europe have been modified by fishing activities in the last 100 years. In the southern North Sea fishing is thought to have long been the main ecological structuring force on the benthos. Generally, studies have found that long-living, sessile and suspension-feeding organisms show the greatest declines in response to a given type and frequency of trawl disturbance while opportunistic species, e.g. short-living polychaetes, are less affected. The response of a benthic community to trawling will also depend on the pre-fished composition of the community which is largely affected by the degree of natural disturbance, due to currents, waves or storms. Various analysis of the extent of disturbance over different sediment types provide more detail. In the Kattegat, for example 41% of the area of muddy sediments was trawled over a three year study period and considered to be permanently disturbed.

Salmon farming facilities have also led to degradation of mud habitats in sheltered locations. This has been extensively studied in Scottish sea lochs revealing marked changes in species number, species diversity, faunal abundance, and biomass of the benthic fauna. The most severely affected areas are directly beneath the cages, where an azoic zone may develop. Two other zones of effect have also been described with increasing distance from fish farm cages; a highly enriched zone, dominated by *Capitella capitata* and *Scolelepis fuliginosa* and a slightly enriched ″transitional ″ zone.

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

Pressures and threats

Physical disturbance and direct removal on sediment, infauna and eipfauna by bottom trawls and dredging, have the most effect on long-living, sessile and suspension-feeding organisms with the response depending on the type and frequency of trawl disturbance while opportunistic species, e.g. short-living polychaetes, are less affected. Marine fish farms may have direct effects on infralittoral fine mud communities, including smothering and increasing the Biological Oxygen Demand of the mud. Additional effects may result from the discharges of chemicals, some of which are especially toxic to crustaceans. Near the coast the construction of roads, bridges and barrages may affect the local hydrodynamic and sediment transport regimes of inshore enclosed areas and consequently affect the substratum. Nutrient enrichment leading to eutrophication can lead to changes in the structure and composition of the associated communities and there is evidence that shifts in community structure of the benthos have occurred in the North Sea corresponding with more widespread climatic changes.

List of pressures and threats

Urbanisation, residential and commercial development

Discharges

Biological resource use other than agriculture & forestry

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

Pollution

Nutrient enrichment (N, P, organic matter)

Natural System modifications

Human induced changes in hydraulic conditions
Modification of hydrographic functioning, general

Conservation and management

This habitat can benefit from the regulation of the use of fishing gears that damage or disturb seabed communities. This may be achieved by spatial and temporal controls as well as gear design and deployment using fisheries management measures as well as conservation legislation in marine protected areas. Spatial planning (including zoning) can be used to address potential threats from dredging, coastal development, and fish farming. The regulation of discharges and run off from agricultural land to the marine environment can be used to avoid eutrophication effects associated with nutrient enrichment.

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

Other spatial measures
Establish protected areas/sites

Measures related to hunting, taking and fishing and species management

Regulation/Management of fishery in marine and brackish systems

Conservation status

Annex 1:

1160: MATL U2, MMAC FV.

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

Timescale between incidents of damaging activity, the type of damaging activity and the predominant species, influences recovery. Studies have shown that recovery times following dredging

were significantly shorter for short-lived species (<1 – 3 years), free-living and tube-dwelling species and for scavenging or opportunistic species, than for medium-lived species (3 – 10 years), burrow-dwelling species and suspension feeders. In trawled areas, recovery times were significantly shorter for free-living species, species covered by an exoskeleton or a hard tunic and species that produce pelagic or benthic eggs than for epiphytic/zoic species, species that grow attached to the substratum and have an erect or stalked body form, and species that reproduce asexually. Areas with high levels of natural disturbance have community compositions and functions that are more resilient than those found in areas with less natural disturbance.

Recovery times following oxygen depletion and pollution has been investigated in several studies of the Gullmarsfjord, Sweden and reported to be between 2-8 years. Isolation is also a factor. Recruitment to isolated habitats, such as sea lochs, from outside the area may take some time and be dependant on sporadic events such as storms.

Differences in the recoverability of different species groups following fishing may result in changes in community composition and ecosystem functioning over the long term.

Effort required

10 years	20 years
Naturally	Naturally

Red List Assessment

Criterion A: Reduction in quantity

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

Estimates of the area and extent of this habitat show considerable variation and are recognised as being biased and an underestimate. No asssessment of trends in quantity have therefore been made. This habitat has therefore been assessed as Data Deficient 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	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 Atlantic region and is not present at a limited number of locations. Athough the extent of decline in quality cannot be quantified it is known to have occurred and the major threats are likely to continue in the near future. The precise extent is unknown however as EOO >50,000km^2 and AOO >50, this exceeds the thresholds for a threatened category on the basis of restricted geographic distribution. This habitat has therefore 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	<30 %	fairly substantial %	unknown %	unknown %	unknown %	unknown %
EU 28+	<30 %	fairly substantial %	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 is a lack of quantitative data to be able to calculate percentage change in abiotic and/or biotic quality however reductions in quality in at least some parts of this habitat are known to have occurred. Expert opinion is that this may be less than 30%. This habitat has therefore been assessed as Near Threatened under criteria C/D1 for both the EU 28 and EU 28+.

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	DD	DD	DD	DD	LC	LC	LC	NT	DD	DD	DD	DD	DD	DD	DD	DD	DD
EU28+	DD	DD	DD	DD	LC	LC	LC	NT	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	C/D1	Near Threatened	C/D1

Confidence in the assessment

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

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