A2.71: Worm reefs in the Atlantic littoral zone

Summary

The worm reef habitat, formed by *Sabellaria alveolata,* may take the form of sheets, hummocks and reefs as well as evolving from globular formations into reef platforms. In the Bay of Mont-Saint-Michel, France, they create irregularly shaped, patchy banks which were first described in the scientific literature in 1832. These are considered to be the largest reef formation in Europe with worm densities estimated to reach up to 60,000 individual/m^2 and reef structures more than 2m thick. At the extremes of its distribution range such as the Spanish Atlantic coast and north of Cumbria in the UK, the reefs tend to be very scattered and not particularly extensive.*S.alveolata* reefs can be unstable and undergo a natural cycle of development and decay.

The species assemblages associated with this habitat are unique because they are composed of a mixture of those typically found on hard structures, sandy and muddy sediments as well as from subtidal, intertidal and terrestrial habitats (insect larvae).

Changing sedimentary patterns, for example associated with mussel farming and coast protection works, and increase in trophic competition between cultivated and wild suspension-feeders has been identified as a potential indirect threat to this habitat. Human trampling and fishing activity (boulder turning and destruction of reef parts to collect oysters or uncover crabs) is the most damaging activity. Conservation measures include regulation of coast protection works, intertidal fisheries, and aquaculture to reduce the likelihood of introducing invasive species to the shore environment and minimise the competition with *Sabellaria*. Codes of conduct and educational information on the vulnerabilty of these reef features can also be used to try and minimise trampling damage to the reef structures by shore users.

Synthesis

There have been different trends in the extent and quality of this habitat across the North East Atlantic region and on various time scales. Change in abiotic conditions (temperature) resulted in significant loss of this habitat in the severe winter of 1962/3 in Europe which was the coldest since 1740 and had catastrophic effects on intertidal populations.

More recently, around the British Isles this habitat is considered to have been stable on a decadal scale between the 1980s- 2010s, but increased in abundance in the north of its range. In France there has been a decrease in overall extent of the reefs in Mont-Saint-Michel Bay between the 1970s and 2000s and a decline in quality for the larger reefs. In the latter case some of the changes are so drastic that they have altered the three dimensional configuration with some of the grand table-like structures that could still be seen at the beginning of the 1980s no longer present. Newly formed reefs have also been observed since 2010 in bay Mont-Saint-Michel and along the Normandy coast.

The overall trend is considered to be a decline although there are difficulties in making comparisons because changes are not limited to area covered but also the three dimensional structure of reefs.The most extensive examples of this habitat are in France where significant declines have taken place over the last 50 years.

The current Red List assessment is that although this habitat does not have a narrow geographical range and is distributed such that identified threats are unlikely to affect all localities at once, it should be considered Near Threatened for both the EU 28 and EU 28+ because of an overall decline in extent over the last 50 years.

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

None.

Habitat Type

Code and name

A2.71: Worm reefs in the Atlantic littoral zone

Sabellaria alveolata reef exposed at low tide, Duckpool, Cornwall, UK (© L.Bush).

Massive bioconstruction of *S.alveolata* reef in the Bay of Mont-Saint-Michel (Champeaux), France (© S.Dubois).

Habitat description

The sedentary polychaete S*abellaria alveolata* (honeycomb worm) is a sessile, tube-dwelling species which builds its tubes from sand and shell fragments held together with biological cement. Colonies form on fixed and stable substrates where there is a plentiful supply of sediment on the mid to lower shore. The colonies can form relatively quickly and may take the form of sheets, hummocks and reefs as well as evolving from globular formations into reef platforms. In the Bay of Mont Saint-Michel, France, they create irregularly shaped, patchy banks that cover approximately 225ha. These are considered to be the largest reef formation in Europe with worm densities estimated to reach up to 60,000 individuals/m^2 and reef structures more than 2m thick. At the other extreme the *S.alveolata* reefs at the edge of its range on the central coast of Portugal and north of the Cumbrian coast in the UK tend to be very scattered and not particularly extensive.

S.alveolata reefs can be relatively unstable and undergo a natural cycle of development and decay. As new individuals prefer to settle on active colonies or the remains of old colonies, the age and morphology of reefs are not directly related to the age of individual worms which are typically 4-5 years with a likely maximum of 9 years. The species assemblages found on *S.alveolata* reefs are unique because they are composed of a mixture of species typically found on hard structures, sandy and muddy sediments as well as from subtidal, intertidal and terrestrial habitats (insect larvae).

Indicators of Quality:

The overall quality and continued occurrence of this habitat is largely dependent on the presence of *S. alveolata* which creates the biogenic structural complexity on which the characteristic associated communities depend. The density and the maintenance of a viable population of this species is a key

indicator of habitat quality, together with the visual evidence of presence or absence of physical damage. Scientists working on the Mont-Saint-Michel *S. alveolata* reefs defined the vitality status of the reef by integrating the physical characteristic of the reef and its dynamics. This took into account the degree of fragmentation of reef features, cover by species which are known to degrade, smother and break up areas of *S.alveolata* reef (the oyster *Crassostrea gigas* and the mussel *Mytilus galloprovinciallis*) and the prevalence of different structural characteristics within the reef formations. In Morecambe Bay (UK), the health of the reefs was determined with reference to the percentage of newly settled worms, those with crisp apertures, to those with worn apertures and dead worms. A generic and universally applicable health metric has still to be developed.

Characteristic species:

S. alveolata reefs are quite distinct from the mosaic of seaweeds and barnacles or red seaweeds generally associated with moderately exposed rocky shores though many of the same species are present (A1.2). These include the anemone *Actinia equina and Cereus pedunculatus*, the barnacles *Semibalanus balanoides* and *Elminius modestus,* the limpet *Patella vulgata*, the top shell *Gibbula cineraria* and the winkle *Littorina littorea*. The whelk *Nucella lapilus* and the mussel *Mytilus edulis* is also present on the boulders. In the surrounding sediment, the tubiculous polychaete *Lanice conchilega* and *Diopatra* spp are routinely found. Scour resistant red seaweeds including *Palmaria palmata, Corallina ifficinalis, Mastocarpus stellatus, Chondrus crispus, Ceramium nodulosum, Osmundea pinnatifida, Polysiphonia* spp. and coralline crusts can also be present where suitable substrata exist. Brown and green seaweeds also present include *Fucus serratus, Fucus vesioculosus, Cladostephus spongiosus, Enteromorpha intestinalis* and *Ulva lactuca*. The colonisation of bioconstruction by epibonts (e.g. green macroalgae) is typically a symptom of a non-healthy state). The richness of the associated infauna varies according to the stage of reef development or degradation.

Classification

EUNIS (v1405):

Level 4. A sub-habitat of ‘Littoral biogenic habitats’ (A2.7).

Annex 1:

1160 Large shallow inlets and bays

1170 Reefs

MAES:

Marine - Marine inlets and transitional waters

Marine - Coastal

MSFD:

Littoral rock and biogenic reef

EUSeaMap:

Not mapped

IUCN:

12.1 Rocky shoreline

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

Justification
This habitats is only found in a few locations.

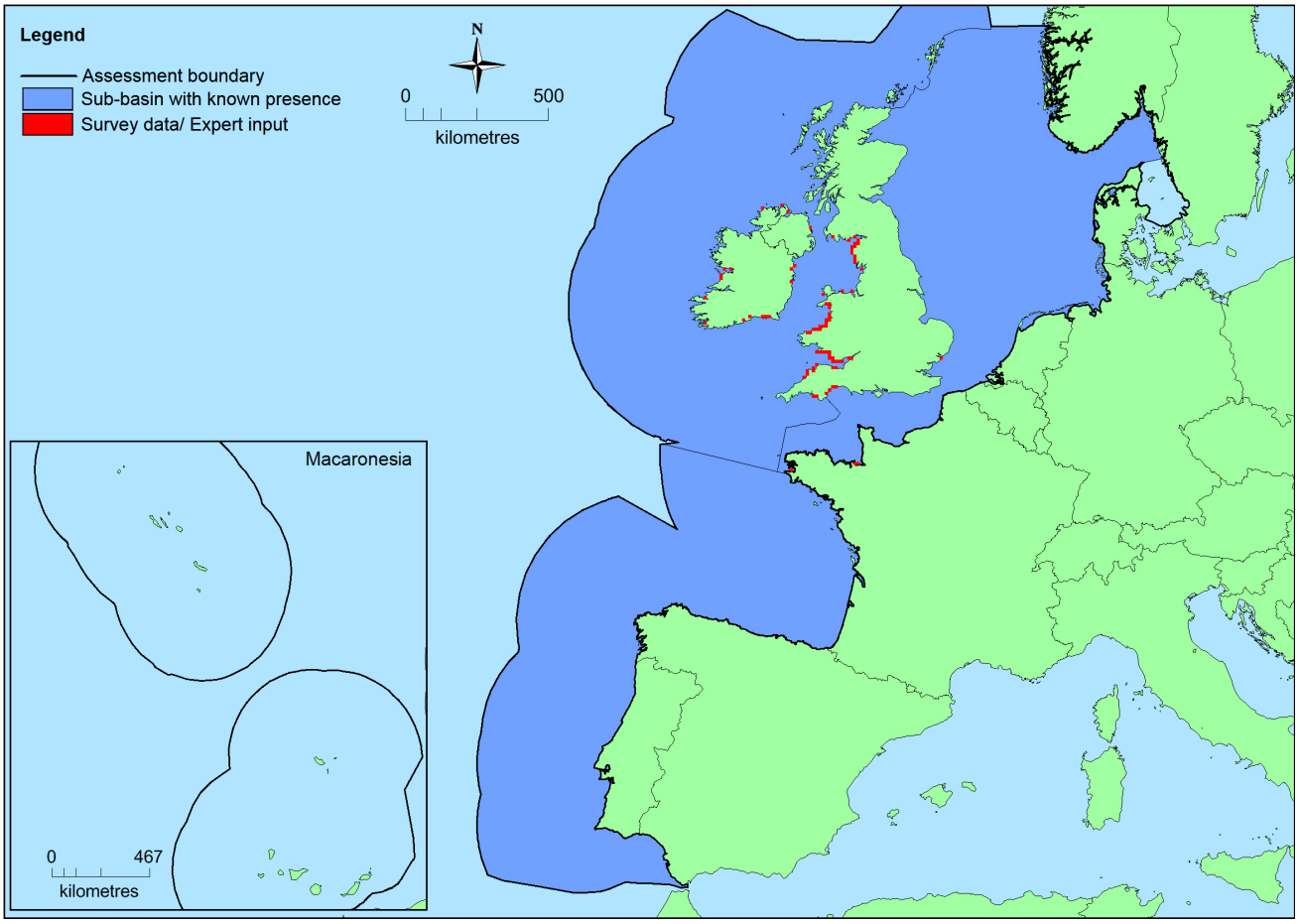
Geographic occurrence and trends

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 Greater North Sea: 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	399,828 Km^2	83	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+	399,828 Km^2	83	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) (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?

More than 95% of this habitat is likely to be hosted by the EU 28 as this habitat is not believed to be present in Norway.

Trends in quantity

Although the geographic range of *S.alveolata* reefs is fairly stable there is a degree of fluctuation in the distribution and abundance of the reef habitat within this range. This is apparent from the different trends in different locations, some of which have comprehensive records going back more than 50 years. The reefs in Bay Mont-Saint-Michel, France, were first described in the scientific literature in 1832. Around the British Isles this habitat is considered to have been stable on a decadal scale between the 1980s- 2010s although decreases in distribution were noted, specifically along the north coast of Wales, after the extremely cold winter of 1962. Decreases have been reported in Northern Ireland although not quantified. In France there has been a decrease in overall extent of the reefs in Mont-Saint-Michel between the 1970s and 2000s. In the latter case some of the changes are so drastic that they have altered the three dimensional configuration of the reefs. The grand table-like structures which could still be seen at the beginning of the 1980s can no longer be observed on the massif as a whole.

- 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
  Although not present in all sub-basins of this region, this habitat has a large natural range with examples as widely separated as Aguda on the Atlantic coast of Spain, Avencas on the central coast of Portugal, Oleron island on the Atlantic coast of France, the Solway Firth on the west coast of Scotland, and the west coast of Ireland in Tralee Bay.
- Does the habitat have a small natural range by reason of its intrinsically restricted area?
  No
  Justification
  Although not present in all sub-basins of this region, this habitat has a large natural range with examples as widely separated as Aguda on the Atlantic coast of Spain, Avencas on the central coast of Portugal, Oleron island on the Atlantic coast of France, the Solway Firth on the west coast of Scotland, and the west coast of Ireland in Tralee Bay.

Trends in quality

There is a natural cycle of reef development, maturity and relict/senescence, but some reef structures, such as those in Bay Mont-Saint-Michel have been recorded on the same site since 1832. In this location the reef quality is declining as they are being increasingly colonised by oysters *C.gigas* from local aquaculture operations and by green algae (*Ulva* sp.) due to the increasing inputs of nitrates from terrestrial origin. Oysters affect the reef species assemblage more strongly than algal epibionts. Epibionts, especially green algae, alter *S.alveolata* population structure causing a reduction in new recruits that over the long run may cause significant damage to the reef structure itself.

Worm reefs on the eastern Irish Sea coast are considered to be mostly in moderate to good health, with a small proportion (<10%) considered to be poor quality.

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

Pressures and threats

Activities which change sedimentary patterns such as coastal protection works. Also mussel farming by changing sedimentation rates and increasing trophic competition between cultivated and wild suspension-feeders, bait digging, boulder turning, trampling and destruction of the reef to uncover crabs and lobsters. Change in abiotic conditions (temperature) resulted in significant loss of this habitat in the severe winter of 1962/3 in Europe which was the coldest since 1740 and had catastrophic effects on intertidal populations.

List of pressures and threats

Biological resource use other than agriculture & forestry

Marine and Freshwater Aquaculture

Human intrusions and disturbances

Other human intrusions and disturbances
Trampling, overuse

Invasive, other problematic species and genes

Invasive non-native species

Natural System modifications

Human induced changes in hydraulic conditions

Siltation rate changes, dumping, depositing of dredged deposits

Natural biotic and abiotic processes (without catastrophes)

Abiotic (slow) natural processes

Interspecific faunal relations

Competition

Conservation and management

This habitat is present within Marine Protected Areas. Specific management measures include regulation and specification of types of coast protection works to avoid changes in sedimentation regime, and regulation of intertidal fisheries to prevent break up of reefs for bait collection, or promoting access routes to aquaculture facilities that avoid reef structures. Operational measures such as hygiene requirements related to aquaculture are also important to minimise the likelihood of introducing invasive species to the shore environment. Codes of conduct and educational information on the vulnerability of these reef features can also be used to try and minimise trampling damage to the reef structures by shore users. National and European recognition of the need for protection of this habitat is also valuable as this encourages the introduction of local measures that have a direct benefit on the reefs.

List of conservation and management needs

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

Conservation status

Annex 1:

1160: MATL U2, MMAC FV

1170: MATL U2, MMAC FV

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

The intensity of settlement is extremely variable from year to year and place to place and once established growth can be rapid (e.g. up to 12cm/yr increase in tube length has been reported for northern France) and the worms can mature within the first year. New individuals prefer to settle on active colonies or the remains of old colonies. In-depth investigations regarding reef function, maintenance of function for degraded reefs and resilience are needed to determine the recovery capacity of this habitat.

Effort required

10 years	20 years
Naturally	Naturally

Red List Assessment

Criterion A: Reduction in quantity

Criterion A	A1	A2a	A2b	A3
EU 28	25-30 %	unknown %	unknown %	unknown %
EU 28+	25-30 %	unknown %	unknown %	unknown %

This habitat appears to have either been stable or declining in much of its range in the North East Atlantic over the last 50 years but increasing in the north of its range within the Irish Sea. The overall trend is considered to be a decline although there are difficulties in making comparisons because changes are not limited to area covered but also the three dimensional structure of reefs.

There are long term data on the changes that have taken place in some locations (most notably the reefs at Bay Saint-Michel, France), where both quanity and quality has declined but a lack of comprehensive quantiative data on overall long term trends of the habitat. The overall decline is estimated to be between 25-30%. 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	Unknown	No	>50	Yes	Unknown	No	No
EU 28+	>50,000 Km^2	Yes	Unknown	No	>50	Yes	Unknown	No	No

This habitat has a large natural range in the North East Atlantic region 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. Current trends are declining and future trends are unknown. The distribution of the habitat is such that the identified threats are unlikely to affect all localities at once. This habitat has therefore been assessed as Least Concern under criteria B1(a,c), B2 (a,c) & B3 and Data Deficient for the other criteria.

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%

Changes in quality of reef habitat are difficult to determine as they go through a natural cycle of development. Newly established reefs as well as senescent reefs are potentially present in any one location. Declines in quality have been reported in some locations but there is a lack of data and therefore insufficient information to assess changes in quality of this habitat over the last 50 years. This habitat has therefore been assessed as Data Deficient under 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)

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Date of assessment
06/08/2015

Date of review
14/01/2016

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