# A5.61 Polychaete worm reefs on sublittoral sediment

## Summary

Sublittoral reefs of polychaete worms in mixed sediments are found in a variety of hydrographic conditions. The habitats take a range of forms from extensive structures of tightly packed tubes to loose agglomerations of tubes. Three reef biotopes have been described with different species of polychaete dominating. The most extensive and abundant subtidal reefs are formed by *Sabellaria spinulosa. Sabellaria alveolata* reefs more typically occur in the intertidal zone but do extend into the sublittoral. *Sabellaria alveolata* can form significant structures of tubes in tightly packed masses with a distinctive honeycomb-like appearance. These reefs can be up to 30 or even 50 cm thick and take the form of hummocks, sheets or more massive formations (e.g. the Severn Estuary, UK). The third reef forming polychaete is *Serpula vemicularis* which form calcareous reef structures. *S. vemicularis* reefs are relatively rare and have been only recorded in sea lochs/loughs of the west coasts of Scotland and Ireland.

The greatest impact on polychaete reefs is considered to be physical disturbance, for example from demersal fishing gears and aggregate dredging. Such impacts can break once extensive reef habitats down into smaller fragments. This habitat fragmentation, tmakes the habitats more vulnerable to further damage and changes the habitat for the associated fauna. Pollution has been considered a major threat to *S. spinulosa* in the Wadden Sea where an increase in coastal eutrophication is thought to have favoured the proliferation of *Mytilus edulis* and gammerids. Altered hydrodynamics (e.g. due to coastal engineering works) and the installation of infrastructure such as pipelines and offshore wind turbines may also have a detrimental effect. Management measures for this habitat have been directed at activities which disturb the seabed and/or break up reef structures. They have included recommendations or requirements to avoid areas where reef structures are present for example when routing offshore pipelines. Other measures include micrositing individual offshore wind turbines, establishing fishing exclusions zone and controls on vessel moorings.

## Synthesis

This habitat does not have a restricted geographical distribution however determining its extent and any trends in quantity and quality is problematic not only because patchiness is a feature of this habitat, with the reef structures interspersed with areas of sediment, but also because of the apparently ephemeral nature of the most abundant and widespread polychaete worm reefs (i.e. those created by *S.spinulosa*).

While detailed, repeat assessments of *S. spinulosa* reef structures are rare *S.spinulosa* reefs are known to have been seriously degraded and reduced in the German Waddensea (by around 85%) over the last century. Over the last decade a further decline of around 33% is considered to have occurred. In the UK there are some localities where reefs are no longer present. Records indicate increases from the 1980's to the 2000's in the western North Sea with new reefs located off the southern North Sea in 2009. Trends in quality of subittoral *S.alveolata* reefs are also largely unknown whilst those of *S.vermicularis* appear to have shown substantial degradation. As the most abundant and extensive examples of this habitat are the reefs of *S.spinulosa*, the overall current trend in quantity and quality of this habitat is unknown.

Historical losses are known to have been substantial however it is not possible to determine whether these losses exceeded the threshold for Red Listing (loss of more than 40% of the extent of this habitat since 1750).

This habitat has a large EOO and AOO, and therefore qualifies as Least Concern under criterion B. However the habitat is assessed as Data Deficient both at the EU 28 and EU 28+ levels given the lack of information on its trends in quantity and quality and the fact that its overall distribution is unknown.

| Overall Category & Criteria | | | |
|---|---|---|---|
| EU 28 | | EU 28+ | |
| Red List Category | Red List Criteria | Red List Category | Red List Criteria |
| Data Deficient | - | Data Deficient | - |

## Sub-habitat types that may require further examination

A5.613 *Serpula vermicularis* reefs on very sheltered circalittoral muddy sand.

Habitat A5.613 has been assessed separately because it exists at very few locations has a small Area of Occupancy and is capable of becoming Critically Endangered or Collapsed within a very short time period.

## Habitat Type

### Code and name

A5.61 Polychaete worm reefs on sublittoral sediment
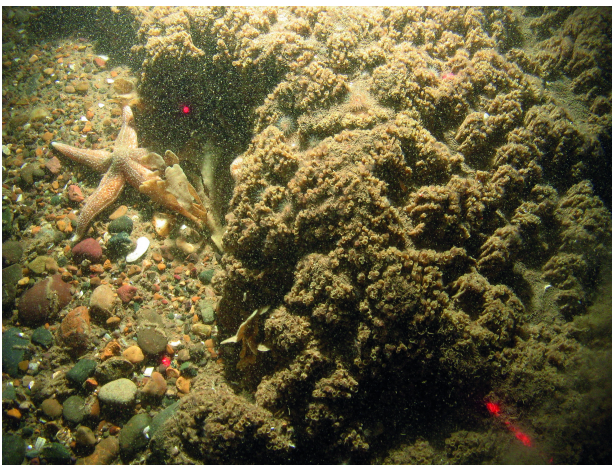


Colonies of the polychaete worm *Sabellaria spinulosa* forming a reef. North Norfolk Sandbanks/Saturn Reef, UK (©JNCC/Cefas).

### Habitat description

Sublittoral reefs of polychaete worms in mixed sediments are found in a variety of hydrographic conditions. Such habitats may range from extensive structures of tightly packed tubes to loose agglomerations of tubes. Patchiness can be a feature of this habitat with the reef structures interspersed with areas of sediment.They often play an important role in the structural composition or stability of the seabed and provide a wide range of niches for other species to inhabit. Consequently polychaete worm reefs often support a diverse flora and fauna. Three biotopes associated with this habitat have been described with different species of polychaete dominating: *Sabellaria spinulosa* on stable circalittoral mixed sediment, *Sabellaria alveolata* on variable salinity sublittoral mixed sediment and *Serpula vermicularis* reefs on very sheltered circalittoral muddy sand.

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 overall quality and continued occurrence of this habitat is, largely dependent on the presence of tubeworms 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.

Characteristic species:

Reef forming polychaetes: *Sabellaria spinulosa Sabellaria alveolata* and *Serpula vermicularis. Nemertesia antennina, Harmothoe impar, Eulalia tripunctata, Eumida sanguinea,Nereis longissima, Scoloplos armiger,Mediomastus fragilis, Lanice conchilega, Pomatocerostriqueter,  Pagurus bernhardus, Gibbula cineraria, Buccinum undatum, Abra alba, Flustra foliacea, Asterias rubens, Ophiothrix fragilis, Psammechinus miliaris, Ascidia mentula*, and *Dendrodoa grossularis.*

## Classification

EUNIS (v1405):

Level 4. A sub-habitat of 'Sublittoral biogenic reefs' (A5.6).


Annex 1:

1170 Reefs


MAES:

Marine - Marine inlets and transitional waters

Marine - Coastal


MSFD:

Shallow sublittoral rock and biogenic reef


EUSeaMap:

Shallow photic rock or biogenic reef

Shallow aphotic rock or biogenic reef


IUCN:

9.4 Subtidal sandy

9.5 Subtidal sandy-mud

9.6 Subtidal muddy

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

## 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<br>Celtic Seas: Present<br>Greater North Sea: Present<br>Kattegat: Uncertain<br>Macaronesia: Uncertain | Unknown Km$^2$ | Unknown | 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* | 174,236 Km$^2$ | 52 | 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+* | >174,236 Km$^2$ | >52 | 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
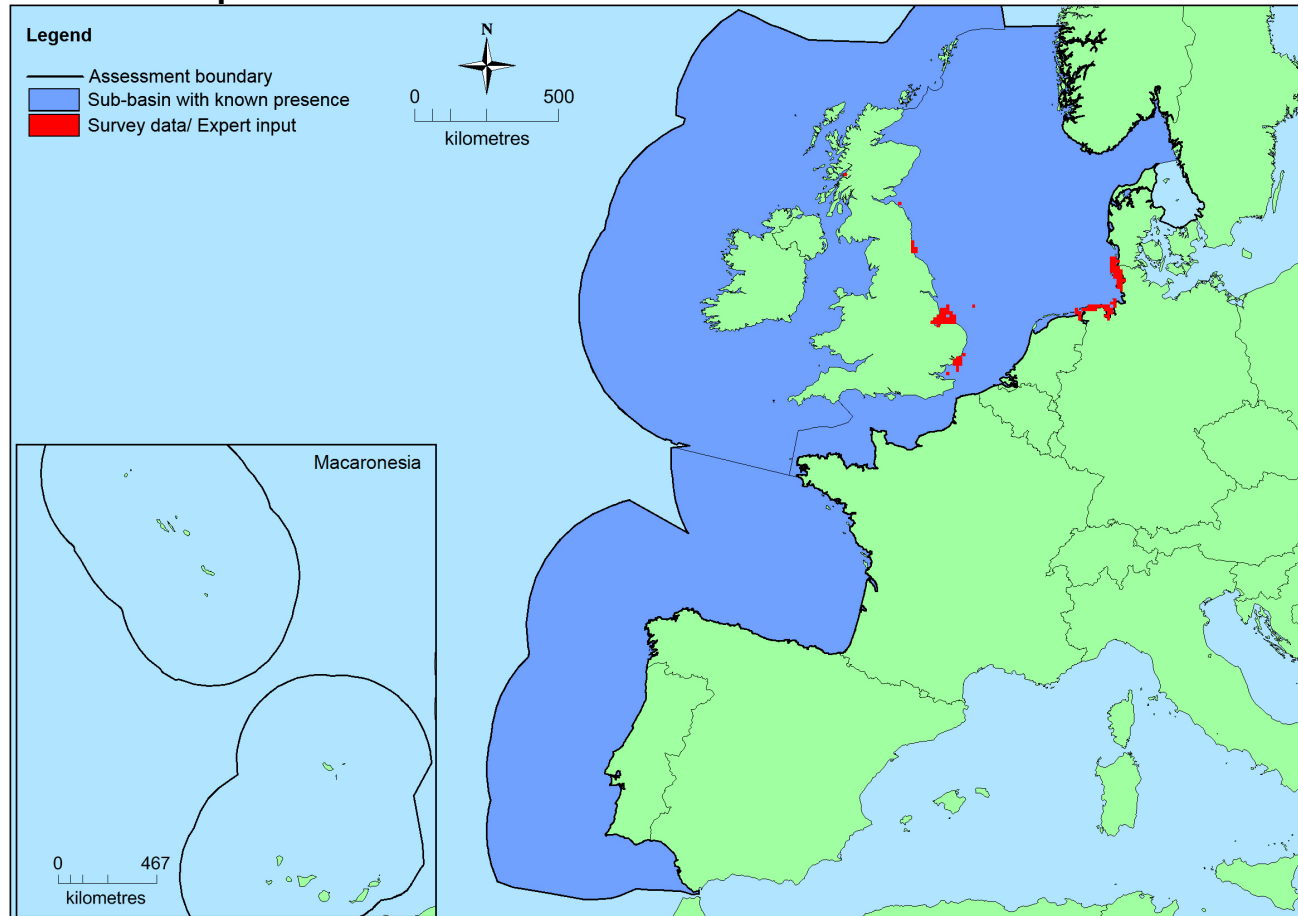


There are insufficient data to provide a comprehensive and accurate map of the distribution of this habitat.

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?

Unknown but as the main areas of distribution are in the southern North Sea, Channel and Irish Sea it is likely to be a high proportion.

## Trends in quantity

*S.spinulosa* reefs are the most abundant of the three biotopes associated with this habitat. They have been seriously degraded and reduced in the German Wadden Sea (by around 85%) over the last century. Over the last decade a further decline of around 33% is considered to have occurred. Remnant reef areas are present in the Dutch Waddden Sea and they appear to be quite common on the border of UK/Germany in the North Sea. In the UK increases have been reported from the 1980's to the 2000's in the western North Sea with new reefs located off the southern North Sea in 2009. There are also localities where they have disappeared (e.g. approach channels to Morecambe Bay).

*Serpula vermicularis* reefs are rare, have only been reported from the UK and Ireland and appear to be declining. *Sabellaria alveolata* reefs more typically occur in the intertidal zone but they do extend into the sublittoral where they can form significant structures (e.g. the Severn Estuary, UK).

- 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*
  The species *S. spinulosa* is widely distributed although the density of worms is typically low. Densely aggregated reef structures are relatively rare, and are typically restricted to areas with high levels of suspended sediment. However as they include areas in the southern North Sea, and the Irish Sea, this habitat does not have a small natural range.
- Does the habitat have a small natural range by reason of its intrinsically restricted area?
  No
  *Justification*
  The species *S. spinulosa* is widely distributed although the density of worms is typically low. Densely aggregated reef structures are relatively rare, and are typically restricted to areas with high levels of suspended sediment. However as they include areas in the southern North Sea, and the Irish Sea, this habitat does not have a small natural range.

## Trends in quality

Determining change in condition is problematic. Detailed, repeat assessments of *S. spinulosa* reef structures are rare. Where a particular reef has been repeatedly sampled, assessing temporal change is complicated by the patch dynamics of the reef system. Perceived changes may, for instance, simply result from differences in the position of samples between surveys, coupled with a naturally patchy distribution. Even where there is reasonable evidence of a change in reef condition the assessments focus on individual reef structures. The apparently ephemeral nature of *S. spinulosa* reefs is such that the condition of *S. spinulosa* reef habitat should be considered at a wider scale than individual reefs, though data are currently lacking in this regard. Trends in quality of subittoral *S.alveolata* reefs are also largely unknown whilst the quality of *S.vermicularis* appears to have declined substantially.  As the most abundant and

extensive examples of this habitat are the reefs of *S.spinulosa,* the overall trend in quality of this habitat is unknown.

- <u>Average current trend in quality</u>
  EU 28: Unknown
  EU 28+: Unknown

## Pressures and threats

The greatest impact on polychaete reefs is considered to be physical disturbance. The dwelling tubes constructed by *S. spinulosa* are relatively fragile and therefore susceptible to damage from direct physical impacts such as demersal fishing gears and aggregate dredging. If the individual worms themselves escape direct injury, they may still be left vulnerable to predation. Such impacts can also break the reef habitats down into smaller fragments, thus making them more vulnerable to further damage and changing the habitat for the associated fauna.

*S. spinulosa* is generally considered tolerant of chemical contamination and has been found to thrive in polluted areas. Despite this, pollution has been considered a major threat to *S. spinulosa* in the Wadden Sea where an increase in coastal eutrophication is thought to have favoured *Mytilus edulis* and *Bathyporei* spp. Altered hydrodynamics (e.g. due to coastal engineering works) and the installation of infrastructure such as pipelines and offshore wind turbines may also have a detrimental effect.

### List of pressures and threats

**Mining, extraction of materials and energy production**

Mining and quarrying
Sand and gravel extraction
Exploration and extraction of oil or gas
Renewable abiotic energy use

**Transportation and service corridors**

Utility and service lines

**Biological resource use other than agriculture & forestry**

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

**Natural System modifications**

Human induced changes in hydraulic conditions
Removal of sediments (mud...)
Extraction of sea-floor and subsoil minerals (e.g. sand, gravel, rock, oil, gas)

## Conservation and management

Protected areas and management measures include the regulation of fisheries and, waste water treatment (to reduce the risk of eutrophication) and reduction in suspended sediments can benefit this habitat. Proactive protection may be achieved through Environmental Impact studies prior to offshore developments or activities such as sand and gravel extraction that can damage this habitat type.

## 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 hunting, taking and fishing and species management

Regulation/Management of fishery in marine and brackish systems

## Conservation status

Annex 1:

1170: MATL U2, MMAC FV.

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

Given the apparent the ephemeral nature of the most abundant and widespread polychaete worm reefs (i.e. those created by *S.spinulosa*) reef structures which have some capacity to regenerate after natural collapse events through the settlement and growth of new individuals the timescale is likely to be short.

## Effort required

| 10 years |
| --- |
| Naturally |

## Red List Assessment

### Criterion A: Reduction in quantity

| Criterion A | A1 | A2a | A2b | A3 |
| --- | --- | --- | --- | --- |
| *EU 28* | unknown % | unknown % | unknown % | substantial in south % |
| *EU 28+* | unknown % | unknown % | unknown % | substantial in south % |

There have been substantial historical losses of this habitat in the southern North Sea. Large subtidal *S.spinulosa* reefs that were common along the slopes of the northern tidal inlets of the German Wadden Sea in the 1920's are now largely lost, including once extensive reefs around the island of Sylt. Furthermore off the west coast of Schleswig-Holstein only three living reefs were found during surveys in the early 1990's compared to 24 during the 19th century. The few examples of *S.vermicularis* reefs that are known have declined in recent years whilst the situation for sublittoral *S.alveolata* reefs is unknown.

Although historical losses are known to have been substantial, it is not possible to determine whether these losses exceeded the threshold for Red Listing (loss of more than 40% of the extent of this habitat since 1750).This habitat has therefore been assessed as Data Deficient under criterion A.

### Criterion B: Restricted geographic distribution

| Criterion B | B1 | | | | B2 | | | | B3 |
|---|---|---|---|---|---|---|---|---|---|
| | EOO | a | b | c | AOO | a | b | c | |
| EU 28 | >50,000 Km$^2$ | Unknown | Unknown | No | >50 | Unknown | Unknown | No | No |
| EU 28+ | >50,000 Km$^2$ | Unknown | Unknown | No | >50 | Unknown | Unknown | No | No |

The species *S. spinulosa* is widely distributed although the density of worms is typically low. Densely aggregated reef structures in contrast are relatively rare, and are typically restricted to areas with high levels of suspended sediment.

This habitat has a large natural range in the North East Atlantic region. The precise extent is unknown however as EOO >50,000 km$^2$ and AOO >50, this exceeds the thresholds for a threatened category on the basis of restricted geographic distribution. There have been substantial historical declines in extent. Current trends are unknown 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.

## 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. THis habitat has therefore been assessed as Data Deficient under criteria C/D1.

## 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 | DD | DD | DD | DD | DD | DD | DD | DD | DD | DD |
| *EU28+* | DD | 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 |
| Data Deficient | - | Data Deficient | - |

**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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# References

Anon. 2013. Diving Salt Lake. Available at: https://www.youtube.com/watch?v=ZJ2ONxU9CRk. (Accessed: 23/11/2015).

Benson, A., Foster-Smith, B., Gubbay, S., Hendrick, V. 2013. *Background Document for Sabellaria spinulosa reefs. OSPAR's vision of a clean, healthy and biological diverse North-east Atlantic used sustainably*. Southampton: OSPAR Commission Report.

Boscence, D. W. J.1979. *The factors leading to aggregation and reef formation in Serpula vermicularis L*. Biology and Systematics of Colonial Organisms. Larwood, G. & Rosen, B.R., eds 299-318. Academic Press.

Bush, L.E.Personal Observation

Connor, D.W., Allen, J.H., Golding, N. *et al.* 2004. The Marine Habitat Classification for Britain and Ireland Version 04.05 JNCC. [online] Peterborough: ISBN 1 861 07561 8. Available at: http://jncc.defra.gov.uk/pdf/04_05_introduction.pdf. (Accessed: 30/08/2014).

Covey, R., Emblow, C. 1992. *Littoral survey of the inner Solway Firth and additional sites in Dumfries and Galloway.* Joint Nature Conservation Committee Report (MNCR Report No. MNCR/SR/20).33127

De Grave, S., Whitaker, A. 1997. The Occurrence of a Subtidal Sabellaria alveolata(L.) Reef off Wicklow Head, Irish Sea. *The Irish Naturalists*' Journal 25(11/12): 416-418.

European Environment Agency. 2014. EUNIS habitat type hierarchical view. Available at: http://eunis.eea.europa.eu/habitats-code-browser.jsp. (Accessed: 24/11/2015).

Hammond, N. 2000. *S. alveolata report: Solway Firth*. Hull: Solway Firth Partnership.

Holt, R. 2005. Marine Life News. Available at: http://www.glaucus.org.uk/News2005Summer.htm. (Accessed 24/11/2015).

Hughes, D. J. 2011. Where's the 'reef'? A five year study of serpulid tube bioerosion in a Scottish sea loch. *Marine Ecology Progress Series* 430: 273-280.

ICES 2007. *Section 6 and Annex 1*. 254 ICES Advisory Committee on Ecosystems

Mettam, C., Conneely, M. E., White, S. J. 1994. Benthic macrofauna and sediments in the Severn Estuary. *Biological Journal of the Linnean Society* 51: 71-81

Moore, C. G., Saunders, G. R. & Harries, D. B. 1998. The status and ecology of reefs of Serpula vermicularis L. (Polychaeta: Serpulidae) in Scotland. *Aquatic Conservation: Marine and Freshwater Ecosystems* 8: 645-656.

Moore, C. G., Saunders, G. R., Harries, D. B., Mair, J. M., Bates, C. R. & Lydon, A. R. 2006. *The establishment of site condition monitoring of the subtidal reefs of Loch Creran Special Area of Conservation*. Inverness: Scottish Natural Heritage.

Moran, B. 2011. Clifden 2011 Underwater, Salt Lake, Galway, Ireland by Brendan Moran. Available at: https://www.youtube.com/watch?v=MKqkzJNHL0Q. (Accessed 24/11/2015).

National Biodiversity Networkaccessed. 2013. Available at: https://data.nbn.org.uk/. (Accessed 24/11/2015).

OSPAR. 2013. *Background document on Sabellaria spinulosa reefs*. Southampton: OSPAR Commission, Biodiversity Series.

Pearce, B., Fariñas-Franco, J. M., Wilson, C., Pitts, J., deBurgh, A., Somerfield, P. J. 2014. Repeated mapping of reefs constructed by Sabellaria spinulosa Leuckart 1849 at an offshore wind farm site. *Geoscience and Habitat Mapping for Marine Renewable Energy* 83: 3-13.

Perkins, E. J. 1986. The Ecology of Scar Grounds in the Solway Firth. *Transactions of Dumfriesshire and Galloway Natural History and Antiquarian Society* 6: 14-19

Pinnion, J., Mackie, A. S. Y., Somerfield, P. J., Warwick, R. M. 2007. *Synthesis of Information on the Benthos of Area SEA.* Department of Trade and Industry 8: 94.

Purchon, R. D. 1948. Studies on the biology of the Bristol Channel. XVII. The littoral and sublittoral fauna of the northern shores near Cardiff. *Proceedings of the Bristol Naturalists Society* 27: 285-310.

Reise, K. (1989) Historical changes in the benthos of the Wadden Sea around the island of Sylt in the North Sea. *Helgoland Marine Research* 43: 417-433.

Smith W. A. 1887. *Loch Creran: Notes From The West Highlands*. Alexander Gardner: 155-156

Taylor, P. M., Parker, J. G. 1993. *An Environmental Appraisal: The Coast of North Wales and North West England.* Hamilton Oil Company Ltd, p.80.

Warwick, R. M., Uncles, R. J. 1980. Distribution of benthic macrofauna associations in the Bristol Channel in relation to tidal stress. *Marine Ecology Progress Series* 3: 97-103.

Warwick, R. M. 1984. The benthic ecology of the Bristol Channel. *Marine Pollution Bulletin* 15(2): 70-76

Warwick, R., Henderson, P. A., Fleming, J. M. & Somes, J. R. 2001. *The impoverished fauna of the deep*

*water channel and marginal areas between Flatholm island and King Road, Severn Estuary*. Report to the Bristol Port Company, p.21.