Test feature dossiers compiled as part of the work on the identification of nationally important marine features in the Irish Sea (part 1)

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This document contains 16 test feature dossiers that were compiled as part of the work on developing and testing the RMNC criteria on nationally important marine features, carried out as part of the Irish Sea Pilot during 2003-04. A further nine dossiers were compiled by *MarLIN*/MBA under contract for the JNCC, and are also available to download on the Irish Sea Pilot website (www.jncc.gov.uk/irishseapilot). The dossiers should always be read in conjunction with the following report:

Lieberknecht, L. M., Vincent, M.A. and Connor, D. W., 2004. *The Irish Sea Pilot - Report on the identification of nationally important marine features in the Irish Sea.* JNCC, Peterborough. Available online at www.jncc.gov.uk/irishseapilot.

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1. Test feature: *Axinella damicornis* (A sponge)

Basic information

The following basic information on the sponge *Axinella damicornis* is taken from the *MarLIN* website (Avant, 2003).

> Phylum: Porifera (Sponges); Class: Demospongiae
>
> Habitat information: Found sublittorally to a depth of about 30 m on sloping rock surfaces, sometimes in silty conditions, at sites with varying degrees of wave exposure. Commonly found with other sponges, cnidarians and bryozoans.
>
> Description: An erect, squat sponge that grows up to 10 cm in height and is bright yellow, verging on orange at the margins. The branches fuse to form variable stubby finger-like shapes. The surface is velvety due to unevenly projecting skeletal spicules and looks as if it is dusted with small yellow particles. The sponge has a firm consistency and does not contract when out of water.

Application of the criteria for special importance

Proportional importance

A south-western species in the British Isles, recorded on the south coast of Devon, the Isles of Scilly, Lundy, and west Wales (Avant, 2003), also occurring in Lough Hyne, Co Cork, scattered sites on the west coast of Ireland and North to the west coast of Scotland (Picton & Morrow, 2002).

Verdict: ?

Rarity

Scarce in Britain (Sanderson, 1996).

Verdict: ?

Application of the criteria for threatened / declined features

Decline

No information found.

Verdict: ?

Threat of significant decline

No information found.

Verdict: ?

Additional information

No information found.

Overall verdict

Insufficient information to reach a verdict.

References

Avant, P., 2003. *Axinella damicornis.* A sponge. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 02/03/2004]. Available from: http://www.marlin.ac.uk/species/Axidam.htm

Picton, B.E. & Morrow, C.C., 2002 (Oct 2002). *Axinella damicornis. [In] Encyclopedia of Marine Life of Britain and Ireland* – http://www.ulstermuseum.org.uk/marinelife/porifera/axidam.htm

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2. Test feature: *Balanophyllia regia* (Scarlet and Gold Star coral)

Basic information

The following basic information on *Balanophyllia regia* is taken from the *MarLIN* website (Tyler-Walters, 2003).

> Phylum: Cnidaria (Hydroids, jellyfish, sea anemones & corals); Class: Hexacorallia (Sea anemones and true corals).
>
> Habitat information: Found occasionally on the shore at extreme low water but more commonly in the shallow sublittoral down to 10 m in depth. Attached to rocks in surge gullies, caves or beneath overhangs.
>
> Description: A brilliantly coloured solitary coral. Up to 48 short, stout, evenly tapering tentacles span about 25 mm and are arranged in groups of six around the mouth. The tentacles are a rich translucent golden yellow colour (the colour restricted to the nematocyst warts) and shade into a yellow, orange or scarlet disc. The calcareous exoskeleton (corallum) is broad and low, about 10 mm across but usually less in height. The corallum is porous, spongy in texture and fragile; less durable than in other British corals.

Application of the criteria for special importance

Proportional importance

In Britain, *B. regia* is found around the coast of south-west England, the Scilly Isles and south-west Pembrokeshire (Tyler-Walters, 2002). It has also been recorded from southwest Europe and the Mediterranean (Picton & Morrow, 2002), as far south as Morocco and the Canary Islands (Hayward & Ryland, 1990) and as far east as the Adriatic (Kruzic *et al*., 2002).

Verdict: Limited information but based on distribution, unlikely to meet criterion.

Rarity

B. regia has been defined as "uncommon" in the British Isles (Picton & Morrow, 2002). It is listed as nationally scarce by Sanderson (1996).

Verdict: Doesn't meet criterion.

Application of the criteria for threatened / declined features

Decline

No information found.

Verdict: ?

Threat of significant decline
No information found.

Verdict: ?

Additional information
No information found.

Overall verdict
Insufficient information found to reach a verdict.

References

Hayward, P. J. & Ryland, J. S. (1990) *The marine fauna of the British Isles and North-West Europe. Vol 1. Protozoans to Arthropods.* Clarendon Press, Oxford

Kruzic P, Zibrowius H, Pozar-Domac A (2002) Actiniaria and Scleractinia (Cnidaria, Anthozoa) from the Adriatic Sea (Croatia): first records, confirmed occurrences and significant range extensions of certain species. *Italian Journal of Zoology* **69** 345-353 (Abstract only)

Picton, B.E. & Morrow, C.C., 2002 (Oct 2002). *Balanophyllia regia* Gosse 1853 *[In] Encyclopedia of Marine Life of Britain and Ireland* - http://www.ulstermuseum.org.uk/marinelife/cnidaria/balreg.htm

Sanderson, W. G. (1996) *Rare benthic marine flora and fauna in Great Britain: the development of criteria for assessment*. Peterborough, Joint Nature Conservation Committee.

Tyler-Walters, H., 2003. Balanophyllia regia. Scarlet and gold star coral. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 15/03/2004]. Available from: <http://www.marlin.ac.uk/species/Balreg.htm>

3. Test feature: *Eunicella verrucosa* (Pink sea fan)

Basic information

The following basic information on *Eunicella verrucosa* is taken from the *MarLIN* website (Hiscock, 2001).

> Phylum: Cnidaria (Hydroids, jellyfish, sea anemones & corals); Class: Octocorallia (Sea pens, sea fans and soft corals)
>
> Habitat information: Found mainly on upward facing bedrock in areas where water movement (wave action or tidal streams) is moderately strong.
>
> Description: The "pink" sea fan may be white to deep pink in colour. Colonies branch profusely and the branches are covered in warty protuberences from which the small anemone-like polyps emerge. Colonies may be up to 50 cm high but more often up to 25 cm and are usually oriented in one plane (at right angles to the prevailing water currents).

There are still gaps in knowledge about the basic biology of *E. verrucosa.* As with most deeper water reef species, very little is known about the reproductive cycle and population dynamics of *E. verrucosa*. The size/age at which colonies become fertile, the sex ratios of colonies within populations, the seasonality and duration of spawning, the survivorship of newly settled colonies are all as yet unknown, though there are current studies attempting to fill these knowledge gaps (Anonymous, 2003; Munro, 2001).

Application of the criteria for special importance

Proportional importance

E. verrucosa is found on the south west coast of Britain and Ireland. The British distribution is from south Devon and Cornwall to Lundy and northwards to north Pembrokeshire, and eastwards to Portland Bill (Hiscock, 2001). The species is common off South Cornwall and South West Dorset (Anonymous, 2003). The northern limit of distribution is thought to be around Skomer where population densities are far lower than in Lyme Bay (Munro & Munro, 2002). It occurs to Donegal Bay off the Atlantic coast of Northern Ireland. *E. verrucosa* has also been recorded in Galway bay, Ireland. It appears to be absent from Scottish waters, the central and northern Irish Sea, the eastern end of the English Channel and all of the North Sea (Anonymous, 2003).

Globally, *Eunicella verrucosa* is found south to northwest Africa and present in the western Mediterranean (Hiscock, 2001). It is widely distributed on rocky seabeds around the Atlantic coasts of South France, the Iberian peninsula and Nothern Africa (possibly as far south as the Gulf of Guinea). It extends into the Western Mediterranean (colonies have been collected as far east as the Ligurian Sea) (Anonymous, 2003; Cocito *et al*, 2002).

Verdict: No quantitative data found, but the inference from the distribution pattern is that *E. verrucosa* is unlikely to meet this criterion. The species reaches northern limits in UK waters, and is far more widely distributed further south.

Rarity

Recorded as nationally scarce (Sanderson, 1996) but probably more widespread than recorded. Population of half a million colonies suggested for Lyme Bay (review by Hiscock, 2001).

Verdict: Doesn't meet criterion.

Application of the criteria for threatened / declined features

Decline

The collection as souvenirs, including commercial collection, occurred during the late 1960s and may have reduced populations in the long term (Anonymous, 2001).

The long-term effects of intensive potting and netting on local populations are not known and need further investigation. However, entanglement in fishing nets and line is a problem in some areas; it is known to damage soft tissue and may ultimately severely damage or kill colonies. Fin-strike damage by scuba divers on pink sea-fan colonies may also be detrimental (Anonymous, 2001). However, there is also some evidence that *E. verrucosa* colonies are not damaged by lobster pots, as they have the ability to straighten themselves after impact (Eno *et al*., 1996).

Older records suggest that this species used to be found much further east than today, in the English Channel almost to the Thames estuary (Manuel, 1988).

Verdict: Too little information available. Some evidence for decline, but not known how significant – probably doesn't meet criterion.

Threat of significant decline

The species does not have a large dispersal potential (100 –1000m), and it is long-lived with a lifespan of 20-100 years (Hiscock 2001). It appears that recruitment is infrequent (Anonymous, 2001). This may indicate low recoverability to removal of adult colonies. However, Anonymous (2003) state that at present, there is very little existing data underpinning the widely quoted claim that *E. verrucosa* is a slow-growing, long lived species. Survey results from Lyme Bay seem to indicate rapid early growth, possibly to avoid the risk of siltation; with slower growth in bigger colonies, possibly diverting energy to reproduction. Growth rates were found to be very variable between colonies, especially in colonies of intermediate size. A single figure of "average annual growth" probably does not adequately describe growth of *E. verrucosa* colonies (Munro, 2001).

The effects that climate change may have on the current UK distribution of this species are not known. Natural environmental factors affecting *E. verrucosa* populations globally need to be identified in order to differentiate them from local, anthropogenic impacts (Anonymous, 2001). Information is lacking on the natural patterns of change within *E. verrucosa*

populations. While this information is lacking accurate assessments of the effects of human activities on *E. verrucosa* populations cannot be made (Anonymous, 2003).

There are a number of difficulties in assessing mortality rates, population decline and growth of this species because of difficulties in studying reproduction and recruitment. Studies on Lyme Bay reef have indicated 50% survival rate for newly recruited colonies. It is not known to what extent newly recruited colonies can counterbalance loss of old, large colonies. It is very difficult to measure recruitment and mortality patterns in small colonies in the field because small colonies in faunal turf are hard to relocate in diving surveys (Munro, 2001).

The following table is based on the *MarLIN* sensitivity review for *E. verrucosa* (Hiscock 2001). An additional column has been added in attempting to estimate the degree of exposure of the species to a given factor, in order to be able to assess the threat of decline to the species due to each given factor. This information is probably not complete. Please refer to the *MarLIN* website for details on how the sensitivity assessment was carried out, and the benchmarks that were used. No information is available on larval sensitivity.

Physical factors				
	Sensitivity	**Recoverability**	**Evidence / Confidence**	**Degree of exposure to factor (Column not from *MarLIN*)**
Substratum Loss	**High**	**Very low**	Moderate	?
Smothering	Intermediate	Moderate	Moderate	?
Increase in suspended sediment	Low	Very high	Moderate	?
Increase in water flow rate	Intermediate	Moderate	Moderate	?
Decrease in water flow rate	Intermediate	Moderate	Moderate	?
Increase in temperature	Not sensitive*	Not Relevant	Moderate	Global warming
Decrease in temperature	Low	High	Moderate	unlikely?
Increase in turbidity	Not sensitive	Not Relevant	Moderate	?
Decrease in turbidity	Intermediate	Moderate	Low	?
Increase in wave exposure	Intermediate	Moderate	High	?
Decrease in wave exposure	Intermediate	Moderate	Moderate	?
Abrasion and physical disturbance	Intermediate	Moderate	Moderate	?

Displacement	**High**	Moderate	Moderate	probably not?
Chemical factors				
	Sensitivity	Recoverability	Evidence / Confidence	**Degree of exposure to factor (Column not from *MarLIN*)**
Synthetic compound contamination	Insufficient information	Not Relevant	Not relevant	?
Heavy metal contamination	Insufficient information	Not Relevant	Not Relevant	?
Hydrocarbon contamination	Insufficient information	Not Relevant	Not Relevant	?
Radionuclide contamination	Insufficient information	Not Relevant	Not Relevant	?
Changes in nutrient levels	Not sensitive	Not Relevant	Moderate	?
Decrease in salinity	**High**	**Very low**	Moderate	unlikely given habitat preferences > 20m
Changes in oxygenation	**High**	**Very low**	Moderate	?
Biological factors				
	Sensitivity	**Recoverability**	**Evidence / Confidence**	**Degree of exposure to factor (Column not from *MarLIN*)**
Introduction of microbial pathogens / parasites	Insufficient information	Not Relevant	Not Relevant	?
Extraction of this species	**High**	Moderate	Moderate	probably not? unless damage by fishing gear?

Verdict: There is a need to determine the potential damage by mobile fishing gear (the species occurs on rocks, so this is unlikely to be big threat). *E. verrucosa* probably doesn't meet this criterion.

Additional information

The pink seafan is a nationally protected species in British waters. It is also classed as a nationally scarce species. The seafan has become one of the few marine species to gain a degree of protection under the Wildlife and Countryside Act 1981. It is has been awarded partial protection under Schedule 5 of this Act, prohibiting intentional killing or damaging of seafans, or possessing or selling seafans. *E. verrucosa* is also the subject of national and regional Species Action Plans aimed at conserving seafans and informing the wider public of this species' perceived slow growth rates and vulnerability to disturbance (Anonymous 2003). Although it is unlikely to meet any of the criteria for nationally important status in this instance, it is considered that the existing protection measures are vital to prevent potential future threat to this species.

Information is lacking on almost all aspects of life cycle, reproduction, natural growth rates, dispersal potential, and on natural population dynamics and factors affecting populations of *E. verrucosa*. This lack of knowledge makes assessing human impacts / potential human impacts very difficult (Anonymous, 2003). Field and laboratory research is underway to address these issues in the East Tennants Reef population. This information is essential for determining the likely time scale for recovery and regeneration of damaged / disturbed areas of reef (Anonymous, 2003).

Overall Verdict

Does not meet any of the criteria for nationally important marine features.

References

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Sanderson, W. G. (1996) Rare benthic marine flora and fauna in great Britain: the development of criteria for assessment. *JNCC Report,* No. 240.

4. Test feature: *Funiculina quadrangularis* (Tall sea pen)

Basic information

The following basic information on *Funiculina quadrangularis* is taken from the *MarLIN* website (Ager, 2001).

> Phylum: Cnidaria (Hydroids, jellyfish, sea anemones & corals); Class: Octocorallia (Sea pens, sea fans and soft corals).
>
> Habitat information: Found in muddy substrata on sheltered coasts, especially in sea lochs, sublittoral and offshore to deep water.
>
> Description: A tall, narrow sea pen, which can exceed 2 metres in height. It has a calcareous white axis, square in section. The polyps are irregularly arranged along the axis or tend to form oblique rows. They are white or pale pink in colour.

Application of the criteria for special importance

Proportional importance

Funiculina quadrangularis is restricted in its distribution within Britain to west Scotland (mainland Scotland, Mull, Skye, Lewis and Harris), where soft mud habitats are found in the deep sheltered fjordic sea lochs and nearby inshore areas. It appears to be absent from inshore areas in the Clyde, Shetland, Orkney and Ireland (according to the JNCC Marine Nature Conservation Review database records at February 1999) but is cited as occurring around north and west coasts of Scotland and Ireland. Although relatively common where it occurs, its habitat requirements are very specific (soft undisturbed mud below about 15 m depth in fully marine conditions) and it is thus relatively restricted in its geographical distribution (Anonymous, 2001, Ager 2001).

Globally, *F. quadrangularis* has been described as common throughout the North Atlantic, specimens have been recorded from Madagascar, Japan and New Zealand, thus its range could be worldwide (Manuel, 1988; Hayward & Ryland, 1990).

Verdict: Given its broad global distribution, probably fails criterion. No quantitative data found.

Rarity

The known distribution of *F. quadrangularis* in British Waters is restricted to the north and west coasts of Ireland and Scotland (Hughes, 1998). Because of its specific habitat requirements *F. quadrangularis* is relatively restricted in its geographical distribution. It is absent from many sea lochs which appear to hold a suitable habitat for the species; these lochs have soft mud habitats and support other species normally associated with *F. quadrangularis* (Anonymous, 2001). Howson *et al*. (1994) cited in Hughes (1998) recorded it in only 17 of 98 listed Scottish sea lochs. The species tends to occur in isolated basins protected by shallow sills (Anonymous, 2001).

Because of its restricted distribution in the UK, it is thought to be of greater conservation importance than other sea pens which occur in Britain. It is reported as "nationally rare" in Hughes (1998) but does not appear as rare on the list in Sanderson (1996).

Verdict: Possibly meets criterion. Not listed as nationally rare / scarce.

Application of the criteria for threatened / declined features

Decline

F. quadrangularis appears to be absent from the *Nephrops* fishing grounds of the Irish and North Seas. It is possible that trawling activities in open coast areas and the more accessible sea lochs (ie not the more isolated basins behind shallow sills) have removed populations of *F. quadrangularis* (Hughes (1998)). Where *F. quadrangularis* has been recently recorded, in the isolated sea loch basins, it is creeling (potting) for *Nephrops norvegicus* which traditionally occurs, rather than trawling. Recent research on the effects of creeling indicates that it has a considerably less damaging effect to *F. quadrangularis*, as the seapen has the ability to right itself if hit by a creel pot (Anonymous, 2001, Picton and Morrow, 2002). There is also evidence that it can recover after being uprooted, smothered or dragged by creels, with low mortality rates after creel disturbance provided that the basal peduncle of the seafans remain in contact with the sediment surface (Kinnear *et al*., 1996 cited in Hughes (1998)). Overall, however, it seems that *F. quadrangularis* is much more susceptible to damage by fishing gear than other species of seapen, as it is not able to retreat into the sediment if disturbed (Hughes (1998)). It is thought to be especially sensitive to high impact fishing gear such as beam trawls, dredges and rockhoppers (MacDonald *et al*., 1996). The extent of trawling in areas of soft bottom, coupled with the distribution pattern of this species, provides circumstantial evidence pointing towards possible decline as a result of fishing.

Verdict: Likely to meet this criterion, though no direct evidence was found.

Threat of significant decline

F. quadrangularis occurs in relatively isolated sea loch basins and water exchange with the open coast may be limited, thus concentrating the effects of any pollutants or eutrophication within the loch basins (Anonymous, 2001).

The following table is based on the *MarLIN* sensitivity review for *E. verrucosa* (Ager 2001). Rows that are not relevant were deleted. An additional column has been added in attempting to estimate the degree of exposure of the species to a given factor, in order to be able to assess the threat of decline to the species due to each given factor. This information is probably not complete. Please refer to the *MarLIN* website for details on how the sensitivity assessment was carried out, and the benchmarks that were used.

Physical factors				
	Sensitivity	**Recoverability**	**Evidence / Confidence**	**Degree of exposure (Column not from *MarLIN*)**
Substratum Loss	**High**	**Low**	Moderate	? Possibly high if occurs in areas where sand/gravel extraction, trawling
Smothering	Low	Immediate	Moderate	? Possibly high

Suspended sediment	Low	Immediate	Moderate	?
Increase in water flow rate	**High**	**Low**	Moderate	? unlikely
Decrease in water flow rate	Intermediate	Moderate	Moderate	? unlikely
Increase in temperature	Intermediate	Moderate	Low	? global warming
Decrease in temperature	Intermediate	Moderate	Low	?
Increase in turbidity	Not sensitive	Not Relevant	Low	?
Decrease in turbidity	Intermediate	Moderate	Low	?
Increase in wave exposure	**High**	**Low**	Moderate	?
Noise	Not sensitive	Not Relevant	Very low	?
Visual presence	Not sensitive	Not Relevant	Very low	?
Abrasion and physical disturbance	**High**	Moderate	Moderate	? Possibly high
Displacement	Low	Immediate	Moderate	?
Chemical factors				
	Sensitivity	**Recoverability**	**Evidence / Confidence**	**Degree of exposure (Column not from *MarLIN*)**
Synthetic compound contamination	Insufficient information	Insufficient information	Not Relevant	?
Heavy metal contamination	Insufficient information	Insufficient information	Not Relevant	?
Hydrocarbon contamination	Insufficient information	Insufficient information	Not Relevant	?
Radionuclide contamination	Low	High	Low	?
Changes in nutrient levels	Intermediate	High	Moderate	?
Changes in oxygenation	Intermediate	Moderate	Low	?
Biological factors				
	Sensitivity	**Recoverability**	**Evidence / Confidence**	**Degree of exposure (Column not from *MarLIN*)**
Introduction of microbial pathogens / parasites	Insufficient information	Insufficient information	Not Relevant	?
Introduction of non-native species	Insufficient information	Insufficient information	Not Relevant	?

Extraction of other species	**High**	**Low**	Low	Probably high

Verdict: Likely to meet this criterion given the species occurs in soft sediments, its vulnerability to physical disturbance, and continued high fishing impacts.

Additional information

No further information found.

Overall verdict

Should go on nationally important list, given the evidence of past effect and continued likely threat of high-impact fishing gear.

References

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* References cited in other sources (not referred to directly)

5. Test feature: *Palinurus elephas* (European spiny lobster, crawfish, thorny lobster)

Basic information

The following basic information on *Palinurus elephas* is taken from the *MarLIN* website (Jackson, 1999).

> Phylum: Crustacea (Crustaceans, latin 'a crust', e.g. barnacles, shrimp, crabs & lobsters); Class: Eumalacostraca (Crabs, shrimps and lobsters)
>
> Habitat information: Lives subtidally on rocky, exposed coasts in the circalittoral zone.
>
> Description: A large spiny lobster, growing up to 60 cm in total length, with a stout, heavily armoured body. The colour is usually orange dorsally with darker spines and white underneath but brown, sandy and purple morphs are occasionally found (Hunter et al. 1996, Hunter 1999). It has numerous sharp spines on the carapace, over much of the abdomen and on the larger appendages. There are two long antennae and small hook-like claws.

Application of the criteria for special importance

Proportional importance

UK distribution: The main populations are confined to rocky bottoms on the west coast of Scotland, the extreme south-west coasts of England & Wales and the west coast of Ireland. Only occasional occurrences have been noted from elsewhere (Jackson, 1999).

Global distribution ranges from West Norway south along Atlantic shores of France and into the Mediterranean (Tambs-Lyche, 1958; Díaz and Abelló, 2001; Anonymous, 1999)

Distribution map taken from Anonymous, 1999.

Verdict: given the wide distribution of the species, it is unlikely to meet this criterion.

Rarity

P. elephas has been described as "common" off the south and west coasts of Britain (Hayward & Ryland, 1990), though this information should be treated with some caution now (Connor, pers. comm.). Not present on list of nationally rare and scarce marine features (Sanderson, 1996).

Verdict: Doesn't meet criterion.

Application of the criteria for threatened / declined features

Decline

The main populations are confined to rocky bottoms on the west coast of Scotland, the extreme south-west coasts of England & Wales and the west coast of Ireland. Only occasional occurrences have been noted from elsewhere (Jackson, 1999). In 1977 the species' distribution was described as continuous along the Scottish west coast, along the northern coast to Orkney, and in Shetland, with only rare vagrants recorded from the east coast. It was stated that with advent of SCUBA more records were obtained, and earlier data from traditional fishing methods is likely to have underestimated population abundance (Ansell and Robb, 1977). Earlier records (1950s – 60s) exist from the north and west coasts of Scotland but the species is referred to as "rare" (Rae and Lamont, 1963; Wilson, 1956; Stephen *et al*., 1957).

Note there may be evidence of overexploitation and resulting population decline as a result of fisheries throughout the global range of the species (Díaz and Abelló, 2001; Anonymous, 1999).

In the UK there is evidence for a decline of the population as a result of overfishing: landings are much reduced in Cornwall and Wales since 1970s, diving for crawfish is not economical anymore where it used to be. There are also reports of increasing proportions of small individuals taken. Hunter *et al*. (1996) report that most male crawfish landed in Cornwall between 1963-1971 had a carapace length (CL) of 140 – 180mm, whereas in 1993-1994 most male crawfish measured between 100 and 130 mm CL, with the length distribution skewed towards the low end. For females, between 1963-1971 CL was 110-140 mm, and between 1993-1994 it was 125 – 155 mm, skewed towards the large end. It appears that the size frequency distribution of males and females was reversed during those two decades. Diving for crawfish off Cornwall virtually eliminated the species from shallow water during the 1960s (Hepper, 1977). Crawfish are not targetted directly anymore, but are still taken as bycatch (Hunter *et al*., 1996 - and reference therein: Hunter, 1994; Hepper, 1977; Eno *et al*., 1996).

Verdict: Likely to meet criterion (no measure of scale of decline found).

Threat of significant decline

There is a need to assess present and predicted future impacts from fishing, but recent studies seem to indicate continued pressure (Hunter *et al*., 1996) even if fisheries are not directly targeted at crawfish.

Verdict: Probably meets criterion.

Overall Verdict

Likely to meet the "decline" and "threat of decline" criteria and therefore should qualify as nationally important.

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6. Test feature: *Cetorhinus maximus* (Basking shark)

Basic information

A very large, plankton-feeding pelagic shark, the basking shark is the largest fish in UK waters (*ca*. 10-11 m maximum length), and the second largest in the world (Anonymous, 2001).

The following basic information on *Cetorhinus maximus* is taken from the *MarLIN* website (Pizzola, 2002).

> Phylum: Chordata (Chordates, 'spinal chord' bearing, e.g. sea squirts, fish, turtles & dolphins); Class: Chondrichthyes (Cartilaginous fish)
>
> Habitat information: Pelagic and migratory.
>
> Description: The basking shark is the largest fish in British waters growing up to 9.8m long, its size being the most obvious distinguishing feature. Smaller specimens can be identified by the stout body, moon-shaped tail and the 5 long gill slits that run from the back behind the head to round under the throat. The gill arches carry a high number of gill rakers that act as a filter to catch the plankton upon which the fish feeds. The basking shark is slate grey to black dorsally, lighter ventrally, with light patches under the snout and on the belly. Filtered water is expelled through the greatly enlarged gill slits. Basking sharks generally live in open waters but migrate towards the shore in summer, when they can be seen 'basking' , i.e., swimming slowly at the surface with the mouth wide open with the snout and dorsal fin visible above water

Application of the criteria for special importance

Proportional importance

C. maximus occurs in circumglobally, in temperate waters of the north and south Pacific and Atlantic, the Indian Ocean and the Mediterranean (temperature range 8-14^{o}C) (Compagno, 1984 cited in Gubbay, 2002; Anonymous, 2001). There are no firm estimates for the total global population or regional populations of basking sharks (Gubbay 2002).

C. maximus is a migratory species, moving into coastal waters where it is known to congregate in a few favoured areas at certain times of the year (Compagno, 1984 cited in Gubbay, 2002; Anonymous, 2001). In the UK and Irish Sea, hotspots have been identified off the coast of Cornwall and Devon, the IOM and the Isle of Arran (MCS in press cited in Gubbay, 2002). Pizzola (2002) states that it is usually sighted in summer in areas such as western Ireland, western Scotland, the Clyde area, the central Irish Sea, approaches to the Bristol Channel and the western English Channel. The species has been mainly recorded in surface waters from April to September, when mostly immature females are seen. It is thought that seasonal population movements inshore take place to feed on high abundances of zooplankton near seasonally persistent tidal fronts in coastal areas. In late summer, in the north-east Atlantic, basking sharks are thought to disperse offshore. The winter distribution and the location of pregnant females year-round remains unknown, but is thought to be in

deep water. There has been considerable variation in the numbers of sightings reported this century and in numbers taken by north-east Atlantic fisheries which indicates longer-term, perhaps cyclical changes in summer distribution patterns (Anonymous 2001).

It has been stated that although the species has a very wide global distribution, basking sharks appear to be most regularly recorded in coastal areas of the UK. This may be due to the surface feeding behaviour of Basking sharks, which enables sightings to be made within this region. The absence of surface sightings has been equated with the absence of the species, however, it may be present deeper in the water column in other regions (Anonymous 2001).

Verdict: Given its broad range, it appears unlikely to meet this criterion. However, most sightings seem to be reported from the UK – it is therefore hard to make inferences about distribution / numbers from this. Open verdict.

Rarity

Gubbay (2002) There are no firm estimates for the total global population or regional populations of basking sharks. Where observations have been made, the total number of records is usually in tens, hundreds or at most low thousands (including repeat sightings).

Verdict: Likely to meet this criterion, despite no firm knowledge about population size.

Application of the criteria for threatened / declined features

Decline

There are no fisheries independent, i.e. no CPUE (catch per unit effort), data available according to Gubbay (2002). Estimates of the total numbers removed from the NE Atlantic area during the past 50 years have been reported as 80-106 000 animals (Sims & Reid, cited in Gubbay 2002).

The Achill Island fishery (western Ireland) declined after only 10 years of peak catches. However, the decline in surfacing sharks was paralleled by a decline in zooplankton in the north-east Atlantic over the same 38 year period, so the decline may have been the result of declining food availability and consequently fewer sharks feeding in surface waters (Anonymous, 2001). The species is considered by Compagno (1984 – cited by Gubbay 2002) to be extremely vulnerable to over-fishing, and most basking shark fisheries appear to have collapsed after initial high yields. In the NE Atlantic, catches between 1964-1990s declined by 90% from peak catches in the 1960s. In 1993, it was reported that the global population of Basking sharks had dropped by 80% since the 1950s (Knickle *et al*.).

Despite lack of fisheries independent data it seems likely that significant declines have occurred in the past for the NE Atlantic area (Gubbay 2002).

Verdict: Probably meets criterion for UK waters as well as NE Atlantic.

Threat of significant decline

Basking sharks are thought to be extremely vulnerable to over-exploitation: they are long-lived with low reproductive capacity, even in terms of elasmobranchs (Compagno, 1984 cited in Gubbay, 2002). Recovery of populations has been shown to be very slow, as slow as 1% per annum (Gubbay 2002). The threat through exploitation is increased by the fact that large numbers are found concentrated in few favoured coastal areas during parts of the year (Camhi

et al., 1998, cited in Gubbay 2002). There may also be local stocks, which would be even more vulnerable (Fowler, 1996 cited in Gubbay, 2002). Fisheries statistics have shown boom-and-bust fisheries for this species in the past, e.g. Mac Nally (1976) cited in Gubbay (2002).

Capture in directed and by-catch fisheries are a potential threat to populations, although few Basking sharks are now caught commercially, except in China and Japan (Knickle *et al*.; Anonymous, 2001). Incidental catches have been recorded and may contribute to declines and prevent recovery of populations (Berrow, 1994; Fairfax, 1998 both cited in Gubbay 2002). Liver oil was traditionally the main product derived from basking sharks, but prices are now very low. Today fins are valuable in the Far East, both at first sale and dried. Meat and cartilage are also utilised, but are less valuable. A directed fishery by a small Norwegian fleet, has an annual quota in EU waters of 100 tonnes of basking shark liver. In recent years, very little or none of the quota has been taken. Future risk could possibly arise from a combination of coastal and deep-water fisheries, which may affect populations when individuals migrate to offshore deep regions where they have been traditionally protected from fisheries (Anonymous 2001).

Verdict: Meets criterion – despite the absence of a targeted fishery in UK, high fishing pressure and increases in deep water fisheries offshore means increased threat through bycatch – this species seems exceptionally vulnerable.

Additional information

C. maximus is protected under a range of international and national conservation mechanisms and convention. The global status of *C. maximus* is assessed as *Vulnerable* (A1a,d, A2d) in the 1996 IUCN Red List (Anonymous, 2001). In 1995, a Barcelona Convention Protocol added the Basking shark to its list of Threatened Species. Fishing for Basking sharks was banned in US Federal Atlantic waters in 1997. In 1998 the British Government announced a movement to protect the basking shark in UK waters, under Appendix II of CITES (The Convention on International Trade in Endangered Species of flora and fauna), and the species was added to the appendix in 2003. In 2000, AFS (American Fisheries Society) listed the population of basking sharks in the western Atlantic as *conservation dependent* (reduced but stabilized or recovering under a continuing conservation plan) and *vulnerable* in the eastern Pacific. At present, the FAO (Food and Agricultural Organization of the United Nations) is leading a plan to establish international shark fishery management strategies for a number of species, including the basking shark (Knickle *et al.*).

Overall Verdict

C. maximus qualifies as a nationally important marine feature, largely due to its vulnerability.

References

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7. Test feature: *Gadus morhua* (Cod)

Basic information

The following basic information on *Gadus morhua* is taken from the FishBase species summary website for Atlantic Cod (FishBase, 2003).

> Family: Gadidae (Cods and haddocks); Class: Actinopterygii (ray-finned fishes)
> Maximum size: 200 cm TL ; maximum published weight: 96.0 kg; maximum reported age: 25 years
> Environment: benthopelagic; oceanodromous; brackish; marine; depth range 1 – 600 m; temperate climate
> Biology: This species is widely distributed in a variety of habitats, from the shoreline down to the continental shelf. Cod form schools during the day. Cod are omnivorous; they feed at dawn or dusk on invertebrates and fish, including young cod. Cod spawn once a year. They are marketed fresh, dried or salted, smoked and frozen; they are eaten steamed, fried, broiled, boiled, microwaved and baked. The most important stocks are the Norwegian Arctic stock in the Barents Sea and the Icelandic stock. The populations around Greenland and Newfoundland have declined dramatically.

Application of the criteria for special importance

Proportional importance

Global distribution: *Gadus morhua* occurs throughout the north Atlantic, from Cape Hatteras to Ungava Bay along the North American coast; along the east and west coasts of Greenland; around Iceland; and along the coasts of Europe from the Bay of Biscay to the Barents Sea (FishBase, 2003).

[It would probably be possible to obtain figures on Cod landings for a lot of these regions (quantitative data), and from those figures try to infer whether the species meets the proportional importance criterion. This was not done within the limited timeframe available as part of the Irish Sea Pilot, because there is high confidence that Cod meets the decline and threat criteria, meaning that the overall verdict in terms of whether Cod qualifies as nationally important is clear.]

Verdict: Based on its broad global distribution, unlikely to meet criterion on proportional importance.

Rarity

It is unlikely that the commercial collapse of Cod stocks would make the species meet the rarity criterion.

Verdict: Doesn't meet criterion.

Application of the criteria for threatened / declined features

Decline

Figures from IMM (1997), cited by Gubbay 2002 indicate that in the North Sea, from the beginning of the 20th century until the 1960s, annual landings of cod fluctuated between 50 000 tonnes and 100 000 tonnes. In the 1960s, landings increased and reached a maximum of 350 000 tonnes in 1972. They then declined steadily from 1981 to 1991, since when they have shown a small increase to 140 000 tonnes in 1995. Apart from 1993, all year classes from 1987 onwards have been below average. ICES (2002a) cited by Gubbay 2002 state that in the North Sea and Skagerrak, Cod stocks are outside safe biological limits, the spawning stock biomass (SSB) having declined consistently since the 1970s. Stocks are also considered outside safe biological limits West of Scotland (the SSB having declined markedly since the 1980s) and in the Irish Sea (the SSB having declined markedly between 1989 and 1990, and slightly more thereafter).

[Evidence for declines in other parts of the species' range have not been researched for this dossier, but there is ample evidence available for collapses of commercial stock in other parts of the North Atlantic, most notably the collapse of Canadian stocks on the Grand Banks in the early 1990s (e.g. see BBC news, 2002).]

Verdict: Meets criterion.

Threat of significant decline

Gubbay (2002), citing (IMM 1997), states that the indications for the North Sea are that, unless there is a significant reduction in fishing pressure, the current exploitation rate for Cod is unsustainable and that a collapse of the stock is possible. The biggest threat to Cod is through overfishing, both through directed fisheries and as bycatch in mixed fisheries where juvenile cod in particular are caught and discarded. The scale of this threat is significant: in the North Sea, the combination of high exploitation rate and the relatively old age at which cod mature (3-6 years) means that fewer than 1% of 1-year old fish are thought to survive to maturity. Landings of fish in this area consist mainly of juveniles 2-3 yrs old.

ICES (2002b), cited in Gubbay (2002) state that it is not thought that Cod is likely to go biologically extinct in UK waters, but cod stocks in national waters are now so depleted that the chance of a collapse of fishing stocks must be seriously considered. ICES has recommended to the EC and national governments that all fisheries that target cod should be closed in the North Sea, Skagerrak, Irish Sea and waters west of Scotland.

Verdict: Meets criterion.

Additional information

There is likely to be a wealth of further information available for this commercial species. No exhaustive search was carried out within the time constraints of this project, as the decline and threat of decline criteria were clearly met with the information cited in Gubbay (2002).

Overall Verdict

G. morhua qualifies as a nationally important marine feature.

References

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8. Test feature: *Lophius piscatorius* (Monkfish, Anglerfish)

Basic information

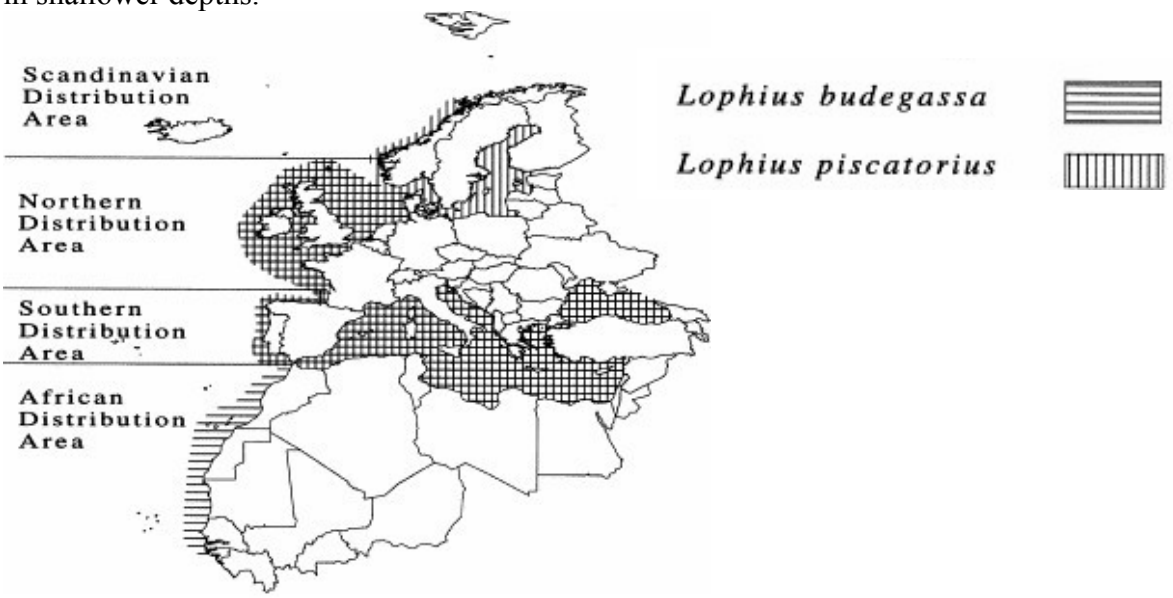
The following basic information on *Lophius piscatorius* is taken from the FishBase species summary website (FishBase, 2003).

> Family: Lophiidae (Goosefishes); Class Actinopterygii (ray-finned fishes)
> Maximum size: 200 cm SL; maximum published weight: 57.7 kg; maximum reported age: 24 years
> Environment: bathydemersal; marine; depth range 20 - 1000 m
> Biology: Occurs on sandy and muddy bottoms from the coast (below 20 m) down to depths of 1,000 m. May also be found on rocky bottoms. It lies half-buried in the sediment waiting for its prey. It attracts prey by means of its fishing filament. Feeds mainly on fishes, occasionally sea-birds. It is commercially exploited and marketed fresh and frozen; eaten steamed, sautéed, broiled, boiled, fried, microwaved and baked. It is a well-studied species in Europe and is sold without the skin and the head under the name 'queue de Lotte'.

Application of the criteria for special importance

Proportional importance

The distribution of *L. piscatorius* is described by FishBase (2003) and Pawson (1995). The species ranges from the south-western Barents Sea to the Straits of Gibraltar including the Mediterranean and Black Sea, and has been reported from Iceland and Mauritania. North Atlantic specimens attain larger sizes than those collected off West Africa and they also occur in shallower depths.



Distribution areas for *L. piscatorius* and *L. budegassa* with divisions for the North Atlantic (taken from Duarte *et al*., 2001).

Verdict: Based on distribution, unlikely to meet criterion.

Rarity

The species has been described as "common" off all coasts of Britain and Ireland (Picton and Morrow, 2002). Monk densities in an area of survey around Shetland were estimated to be 86-104 individuals per km^2, with fish being evenly distributed across seafloor (Laurenson, 1999). Pawson (1995) states that anglerfish are scarce in the eastern Channel but more abundant in the western Channel and Celtic Sea.

Verdict: Probably doesn't meet criterion.

Application of the criteria for threatened / declined features

Decline

No information was found on past declines.

Verdict: open

Threat of significant decline

Laurenson (1999) describes *L. piscatorius* as a species of considerable economic importance in local fisheries off Shetland, with economic returns significantly higher than for other species including Cod. As the species is of recent economic importance, there is little previous research into either the biology of or the fishery for the species. The study by Laurenson (1999) indicated that, compared to many other species, female Monkfish are particularly late to mature (at a length of 70cm, aged about 6-7 years). Females grow larger than males, and most of the largest fish are females. In areas with high fishing pressure it was found that the percentage of reproducing females can be very low. It is estimated that in the fishery around Shetland, 71 – 95% of the male monkfish catch is immature, while 90.8 to 100% of caught females are immature. Because of high economic returns, the species is likely to continue being targeted, but its slow growth rates and slow maturing nature, combined with the high percentages of immature fish caught in the fishery, raise serious concerns over the future sustainability of the stock.

Hislop *et al.* (2001) found that spawning grounds are likely to be in deep water (but still in depths vulnerable to new fishing technology), eggs can disperse over very large distances (100s km), and that the transition from pelagic to benthic life takes place in shallower water. Overfishing in one area may therefore have severe implications for the abundance of the species in distant areas.

Verdict: The lack of basic biological information makes the assessment of threat difficult. However, fishing pressure is unlikely to decrease and the species seems to be vulnerable to the effects of overexploitation. It is therefore deemed to meet this criterion.

Additional information

There is a lack of information even on basic biology of this species (Pawson, 1995).

Overall Verdict

Qualifies as nationally important marine feature under the "threat of significant decline" criterion.

References

Duarte, R.; Azevedo, M; Landa, J and Pereda, P. (2001) Reproduction of anglerfish (*Lophius budegassa* Spinola and *Lophius piscatorius* Linnaeus) from the Atlantic Iberian coast. *Fisheries Research* **51** 349-361

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9. Test feature: *Puffinus puffinus* (Manx Shearwater)

Basic information

The following basic information on *Puffinus puffinus* is taken from the RSPB website (RSPB, 2003).

> General description: A small shearwater, it has long straight slim wings, and is black above and white below. It flies with a series of rapid stiff-winged flaps followed by long glides on stiff straight wings over the surface of the sea, occasionally banking or 'shearing'. It breeds in colonies in the UK, on offshore islands where it is safe from rats and other ground predators. Birds leave their nest sites in July, to migrate to the coast of South America, where they spend the winter, returning in late February and March. The species feeds on fish, especially herrings, sardines and sprats.
> Breeding habitat: Grassy tops of islands, remote headlands and scree.
> Wintering and passage habitat: open sea

Application of the criteria for special importance

Proportional importance

P. puffinus is a migratory species which breeds in the UK during the summer and winters in the tropics on the east coast of South America. Manx shearwaters breed at high densities, at just a few colonies in the North Atlantic. The UK and Ireland support over 93% of the breeding population, with the remaining small numbers breeding in North America, Iceland, Faroes and France. GB alone supports almost 83% of the breeding population (Stroud *et al*., 2001). Atlantic Frontier waters (the area west of Scotland) are of high importance for this species, as 22% of the global population breed there (Reid *et al*., 2001).

Verdict: Meets criterion.

Rarity

Breeds only at few sites, but occurs in very high densities at those sites (Stroud *et al*., 2001).

Verdict: Open verdict – insufficient information available.

Application of the criteria for threatened / declined features

Decline

P. puffinus is known to have become extinct on islands where it used to breed, after the introduction of rats. It is difficult to judge, however, whether overall numbers have changed. On the islands in South-West Wales, no major changes are likely to have occurred during the 20th Century. On the Calf of Man and on Lundy, the species became extremely rare or absent after the introduction of rats (Stroud *et al*., 2001).

Verdict: Open verdict – insufficient information available.

Threat of significant decline

Manx shearwaters have been rated as very vulnerable to the effects of oil pollution (Webb *et al*., 1995 cited in Reid *et al*., 2001; Webb *et al*., 1990), as they spend a lot of time at sea and sometimes gather in large rafts on the sea when feeding. With high percentages of the global population concentrated in small geographical areas for part of the year, the potential effects of an oil spill could be severe. The Atlantic Frontier area, which is important for many species of seabirds including Manx Shearwater, is an area subject to oil and gas exploration (Reid *et al*, 2001).

Verdict: possibly meets criterion.

Additional information

No additional information researched, as the overall verdict is clear. It is likely that more information is available.

Overall Verdict

P. puffinus qualifies as nationally important under the "proportional importance" criterion.

References

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10. Test feature: *Halichoerus grypus* (Grey seal)

Basic information

The following basic information on *Halichoerus grypus* is taken from the *MarLIN* website (Edwards, 2003).

> Phylum: Chordata (Chordates, 'spinal chord' bearing, e.g. sea squirts, fish, turtles & dolphins); Class: Mammalia (Mammals)
>
> Habitat information: Halichoerus grypus feeds in inshore benthic habitats, on a wide variety of fishes and invertebrates. Grey seals use remote islands, bays and caves as 'haul out' areas to give birth to their pups or between foraging trips for food. The main breeding sites are shown on the above map.
>
> Description: The grey seal is a medium sized, robust bodied, seal with a rectangular horse-like head and small widely separated eyes. The nostrils form a W-pattern due to them being parallel and wide apart. They have a long muzzle, wide at the end, with a fleshy area around the whiskers that obscures the lower jaw. In adult males the top of the muzzle is convex, whereas in adult females and pups it is flat. Adults can grow up to 2.3 m long, with newborn pups being ca 1 m long. Adult males are much bigger and heavier than females, have a bigger broader head and are also darker in colour. The coat is dark grey on the back and light grey underneath and has irregular pattern of spots or blotches.

Application of the criteria for special importance

Proportional importance

Grey seals are are among the rarest seals in the world. They are found on both sides of the north Atlantic Ocean, separated into three reproductively-isolated populations. The western Atlantic population is centred in the Canadian Maritime provinces, and is distributed from north Labrador down to New England, individuals occasionally wandering as far south as Virginia. The eastern Atlantic population is found mostly around the coasts of the United Kingdom and Ireland, as well as on the coasts of the Faroe Islands, Iceland, Norway, and northwestern Russia as far as the White Sea. Smaller groups are also found on the French, Dutch and German coasts, and wandering individuals have been found as far south as Portugal. A third population of grey seals is located in the Baltic Sea (Seal Conservation Society, 2001).

The majority of the East Atlantic stock breeds around Great Britain and Ireland. The UK population represents about 40% - 45% of the world population, and 95% of the EU population (JNCC 2002; Seal Conservation Society, 2001; Hiby *et al*., 1992), with earlier sources estimating that more than two thirds of world population occur in British Waters (ICES 1977 cited by Harwood 1978).

Verdict: Meets criterion, though at threshold. Definitely more than half of regional population in UK, though probably just under 50% of global population.

Rarity

H. grypus is a globally rare species (Seal Conservation Society, 2001; Hiby *et al*., 1992), though it is unlikely to meet the rarity criterion for UK waters. In 1989, the total British population was estimated to be 86 000 individuals, 79 000 of which occurred in Scotland (Harwood *et al*., 1991).

Verdict: Doesn't meet criterion.

Application of the criteria for threatened / declined features

Decline

There is strong evidence for past significant decline in the Baltic Sea stock. The Baltic Sea grey seal population is listed as Endangered on the IUCN Red List, as an Appendix II species under the Bonn Convention and as an Appendix III species under the Bern Convention (Seal Conservation Society, 2001).

In 1989, the total British population was estimated to be 86 000 individuals, 79 000 of which occurred in Scotland (Harwood *et al*., 1991). There were reports of population increases pre-1970s and during the 1970s. One reason cited was abandonment of human settlements on offshore Islands off Scotland. More increases (6-7% annually) were predicted for the future (Harwood & Prime, 1978; Harwood, 1978). Hiby *et al*. (1992) reported an increase of 7.3% in the British population between 1989 and 1990.

In the 1980s, phocine distemper virus caused mass mortality in harbour seals (*Phoca vitulina*) across the North Sea and the Baltic Sea, with up to 17 000 individuals dying in 1988-1989 (Osterhaus, 1990). Grey seal populations were infected but suffered far less mortality, as they showed a stronger immune response to the virus (Duignan *et al*., 1997). The Seal Conservation Society (2001) reports hundreds of adults dying and a 12% increase in mortality in grey seal pups throughout the global range as a result of the virus outbreak in 1988.

Verdict: No evidence found for significant past decline in UK. Doesn't meet criterion.

Threat of significant decline

Conflicts between seals and fishermen have been reported frequently, with calls for culls of grey seals by fishing interests who claim that seal predation is the reason behind reduced fish stocks and that a reduction in the number of grey seals would result in an increase in the amount of commercially landed fish. Grey seals can act as hosts to the codworm parasite, and calls have also been made to cull grey seals by those who believe that such a cull would reduce the codworm infestation in cod and flatfish stocks. The last organised fisheries-related cull in the United Kingdom took place in 1983, the series of being terminated due to public opinion (Seal Conservation Society, 2001; Northridge, 1988). According to the Seal Conservation Society (2001), illegal shooting of grey seals is still known to take place throughout their range.

The species can also be affected by oil spills. Moulting grey seals in Shetland, for example, showed signs of acute respiratory distress, possibly caused by the ingestion of hydrocarbons, after the Braer oil spill in 1993. Frequent oil contamination of grey seals caused by drifting marine pollutants is a severe problem in the Froan breeding area off central Norway, annual

surveys there showing that 30-60% of pups become oil-fouled during their first month of life. Disturbance and entanglement in marine debris are additional problems encountered throughout the grey seal's range (Seal Conservation Society, 2001).

Grey seals have suffered increasing numbers of outbreaks of phocine distemper virus in recent years (Kennedy, 1998), though they suffer far less mortality than other species such as the harbour seal (*Phoca vitulina*) (Duignan *et al*., 1997). There is concern that the outbreaks are linked to increasing levels of pollution. Fish-eating seals occupy high trophic levels in the aquatic food chain, and accumulate high levels of contaminants including polychlorinated biphenyls (PCBs), polychlorinated dibenzo-*p*-dioxins (PCDDs), and polychlorinated dibenzofurans (PCDFs). Immunotoxicological studies on the harbour seal *Phoca vitulina* have shown that complex mixtures of environmental contaminants including PCBs, PCDFs, and PCDDs may represent a real immunotoxic risk to free-ranging seals (Van Loveren *et al*., 2000). If the same is true for grey seals, increasing levels of pollution may lead to a future increase in mortality from disease. There have been recent reports of increasing numbers of diseased grey seals being picked up by rescue centres on W coast of GB & Ireland (Seal Conservation Society, 2001).

Verdict: Probably meets criterion (possible increasing susceptibility to distemper virus).

Additional information

No additional information was researched.

Overall Verdict

H. grypus should qualify as a nationally important marine feature because of the high proportion of the regional population (Eastern Atlantic stock) occurring in UK waters.

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11. Test feature: *Callophyllis cristata* (Red seaweed)

Basic information

A red seaweed that is epiphytic on *Laminaria* (Irvine, 1983).

Application of the criteria for special importance

Proportional importance

Distribution is circumpolar, restricted to northeast of British Isles, from Shetland to Northumberland, in North Atlantic from British Isles, Denmark and New Jersey Northwards, also in northern Pacific (Irvine, 1983).

In Britain, it has been recorded in Sea Lochs on the west coast of Scotland, Orkney, and Shetland, with records extending southwest to the Calf of Man, Pen Llŷn and Pembrokeshire, and a single record from the Farne Islands on the English east coast (all records from the MNCR database held at JNCC).

Verdict: ?

Rarity

No information found.
Verdict: ?

Application of the criteria for threatened / declined features

Decline

No information found.
Verdict: ?

Threat of significant decline

No information found.
Verdict: ?

Additional information

No information found.

Overall Verdict

Insufficient information found to reach a verdict.

References

Irvine, L. M. (1983) Seaweeds of the British Isles. Vol I Rhodophyta, Part 2A Cryptonemiales (*sensu stricto*), Palmariales, Rhododymeniales. British Museum (Natural History) London

12. Test feature: *Ostrea edulis* (Native oyster) beds

Basic information

The following basic information is adapted from the description for *Limaria hians* beds (SS.IMX.FaMx.Ost) in the 1997 Marine biotope classification for Britain and Ireland, (Connor *et al.*, 1997), modified slightly to reflect minor changes that will appear in the equivalent biotope (SS.SMX.IMX.Ost) in the revised sublittoral sediment section of the classification system, due for completion in 2004 (Connor *et al.*, in prep.).

> Physical habitat: *Ostrea edulis* beds occur in shallow sandy mud with shells and gravel, in depths ranging from 0 to 20m, in saline (30-35ppt) conditions and in areas which are shelterd from wave action and tidal streams.
>
> Biotope description and characterising species: Dense beds of the oyster *O. edulis* can occur on muddy fine sand or sandy mud. There may be considerable quantities of dead oyster shell making up a substantial portion of the substratum. The clumps of dead shells and oysters can support large numbers of *Ascidiella aspersa* and *Ascidiella scabra*. Sponges such as *Halichondria bowerbanki* may also be present. Several conspicuously large polychaetes, such as *Chaetopterus variopedatus* and terebellids, as well as additional suspension-feeding polychaetes such as *Myxicola infundibulum* and *Sabella pavonina* may be important in distinguishing this biotope, whilst the Opisthobranch *Philine aperta* may also be frequent in some areas. A turf of seaweeds such as *Plocamium cartilagineum*, *Nitophyllum punctatum* and *Spyridia filamentosa* may also be present.

Application of the criteria for special importance

Proportional importance

Native, flat oyster beds are sparsely distributed and are recorded from the River Crouch in east England; Dawlish Warren, the Dart estuary and the River Fal in the south west England; Milford Haven in Wales; Loch Ryan in Scotland; Strangford Lough, Lough Foyle, and the west coast of Ireland. (Tyler-Walters, 2001). Insufficient information was found to assess the global distribution of this biotope.

Verdict: There is insufficient information to assess whether *O. edulis* beds fulfil this criterion.

Rarity

O. edulis, the main component of the biotope, is not listed as nationally rare or scarce by Sanderson (1996). This does not mean that the biotope of which it is the main component wouldn't qualify as rare.

Verdict: There was insufficient time available to assess whether *O. edulis* beds fulfil this criterion.

Application of the criteria for threatened / declined features

Decline

In the 18th and 19th Centuries, there were extensive native oyster beds in the southern North Sea and in the English Channel. During the 19th and 20th Centuries these declined significantly as a result of heavy exploitation (Gubbay, 2002). UK Landings of *O. edulis* fell from 40 million in 1920 to 3 million in the 1960s, and have never recovered (Edwards, 1997, cited in Gubbay, 2002). Rapid declines in native oyster populations were the result of overexploitation as demand increased with improving rail links in the 19th Century (Anonymous, 1999). The northern population of *O. edulis* was extirpated and the southern population declined significantly (Korringa, 1952, cited in Gubbay 2002).

Verdict: Meets criterion. Would also meet criterion at species level.

Threat of significant decline

Further threat to remaining native oyster beds exists in the form of water pollution (e.g. TBT – Rees *et al*., 2001 cited in Gubbay, 2002); introduced alien species such as *Crepidula fornicata*, which can degrade suitable oyster habitat, and the American oyster drill *Urosalpinx cinerea*. The Pacific oyster *Crassostrea gigas* has spread from cultivation into the wild and may pose a threat by invading the ecological niche of *O. edulis* (Drinkwaard, 1999; Reise, 1998; Nehring 1998 all cited in Gubbay 2002).

The following table is based on the *MarLIN* sensitivity review for *O. edulis* beds (Tyler-Walters 2001). Rows that are not relevant were deleted. Please refer to the *MarLIN* website for details on how the sensitivity assessment was carried out, and the benchmarks that were used.

Physical factors				
	Sensitivity	**Recoverability**	**Species Richness**	**Evidence / Confidence**
Substratum Loss	High	Very low	Major Decline	Moderate
Smothering	High	Very low	Major Decline	Moderate
Increase in suspended sediment	Low	Very high	No Change	Low
Decrease in suspended sediment	Low	Very high	No Change	Low
Desiccation	Low	High	Decline	Very low
Increase in emergence regime	Low	High	Decline	Very low
Decrease in emergence regime	Not sensitive*	Not Relevant	Not Relevant	Very low
Increase in water flow rate	Intermediate	Low	Major Decline	Very low
Decrease in water flow rate	Not Relevant	Not Relevant	Not Relevant	Not Relevant

Increase in temperature	Low	High	Minor Decline	Low
Decrease in temperature	Intermediate	Low	Major Decline	Moderate
Increase in turbidity	Low	Very high	Minor Decline	Low
Decrease in turbidity	Not sensitive*	Not Relevant	No Change	Very low
Increase in wave exposure	High	Very low	Decline	Low
Decrease in wave exposure	Not sensitive	Not Relevant	No Change	Low
Noise	Not sensitive	Not Relevant	No Change	High
Visual presence	Not sensitive	Not Relevant	No Change	High
Abrasion and physical disturbance	Intermediate	High	Decline	Low
Displacement	Low	Very high	Minor Decline	Low
Chemical factors				
	Sensitivity	**Recoverability**	**Species Richness**	**Evidence / Confidence**
Synthetic compound contamination	High	Very low	Major Decline	Moderate
Heavy metal contamination	Intermediate	Low	Decline	Moderate
Hydrocarbon contamination	Intermediate	Moderate	Decline	Low
Radionuclide contamination	Insufficient information	Not Relevant	Insufficient Information	Not Relevant
Changes in nutrient levels	Not sensitive*	Not Relevant	No Change	Low
Increase in salinity	Not Relevant	Not Relevant	Not Relevant	Not Relevant
Decrease in salinity	Low	High	Decline	Moderate
Changes in oxygenation	Low	High	Decline	Low
Biological factors				
	Sensitivity	**Recoverability**	**Species Richness**	**Evidence / Confidence**
Introduction of microbial pathogens / parasites	High	Very low	Major Decline	High

Introduction of non-native species	High	Very low	Decline	High
Extraction of key or important characterizing species	High	Very low	Major Decline	High
Extraction of important species	Not Relevant	Not Relevant	Not Relevant	Not Relevant

Verdict: Meets criterion.

Additional information

No further information was researched.

Overall Verdict

O. edulis beds qualify as nationally important.

References

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13. Test feature: File shell *Limaria hians* beds

Basic information

The following basic information is adapted from the description for *Limaria hians* beds (SS.IMX.FaMx.Lim) in the 1997 Marine biotope classification for Britain and Ireland, (Connor *et al.*, 1997), modified slightly to reflect minor changes that will appear in the equivalent biotope (SS.SMX.IMX.Lim) in the revised sublittoral sediment section of the classification system, due for completion in 2004 (Connor *et al.*, in prep.).

> Physical habitat: *Limaria hians* beds are found in mixed sediments (mixed muddy sandy gravel) in areas sheltered from wave exposure, but often with strong tidal streams. Salinity may be full or variable (18-35ppt). The biotope occurs in the shallow infralittoral (5-10m), down to depths of 30m. The presence of *L. hians* leads to a consolidated bed being formed from the substratum through byssus-bound debris.
>
> Biotope description and characterising species: Mixed muddy gravel and sand often in tide-swept narrows in the entrances or sills of sealochs with beds or 'nests' of *L. hians*. The File Shells form woven 'nests' or galleries from byssus and fragments of seaweeds so that the animals themselves cannot be seen from above the seabed. *Modiolus modiolus* sometimes occur at the same sites lying over the top of the *L. hians* bed. Other fauna associated with this biotope include echinoderms (*Ophiothrix fragilis*, *Ophiocomina nigra* and *Asterias rubens*), *Buccinum undatum*, mobile crustaceans (e.g. *Pagurus bernhardus*), *Alcyonium digitatum* and hydroids such as *Plumularia setacea*, *Kirchenpaueria pinnata* and *Nemertesia* spp. Sometimes red seaweeds such as *Phycodrys rubens* occur if the beds are in shallow enough water. *Alcyonium digitatum* may be present in low abundances.

Application of the criteria for special importance

Proportional importance

Within the UK, the biotope is found off the west coast of Scotland and Northern Ireland (Tyler-Walters, 2002). No information was found on the global distribution of this biotope or the global population of its main characterising species *L. hians*.

Verdict: There is insufficient information to assess whether *L. hians* beds fulfil this criterion.

Rarity

L. hians is not present on nationally rare and scarce list (Sanderson, 1996), though this does not mean that the biotope don't fulfil the criterion.

Verdict: There was insufficient time available to assess whether, using available information, the biotope fulfils this criterion.

Application of the criteria for threatened / declined features

Decline

It has been suggested that *Limaria hians* beds are, once established, relatively stable unless affected by human impacts or storms (Tyler-Walters, 2002). There have been recent reports that the abundance of *Limaria hians* has declined nationally, especially in the Clyde Sea and off the Isle of Man, probably due to scallop dredging over the past 30 years (Hall-Spencer & Moore, 2000b cited in Tyler-Walters, 2002; Clyde Forum, 2002). There have been reports of near local extinction of *Limaria hians* in the Clyde Sea (Hall-Spencer & Moore, 2000). Furthermore, there is evidence of past (1980s) decline which occurred in the population of file shells off the coast of northern Ireland and in Mulroy Bay. This was ascribed to TBT contamination (Minchin *et al*, 1987).

Verdict: There is evidence that decline has occurred in the past - meets criterion.

Threat of significant decline

L. hians, the main characterising species of this biotope, is extremely sensitive to the effects of benthic fishing gear, e.g. scallop dredges (Hall-Spencer & Moore, 2000).

The following table is based on the *MarLIN* sensitivity review for *L. hians* beds (Tyler-Walters 2002). Rows that are not relevant were deleted. An additional column has been added in attempting to estimate the degree of exposure of the biotope to a given factor, in order to be able to assess the threat of decline to the biotope due to each given factor. This information is probably not complete. Please refer to the *MarLIN* website for details on how the sensitivity assessment was carried out, and the benchmarks that were used.

Physical factors					
	Sensitivity	**Recoverability**	**Species Richness**	**Evidence / Confidence**	**Degree of exposure (Column not from *MarLIN*)**
Substratum Loss	High	High	Major Decline	High	?
Smothering	Intermediate	High	Decline	Low	possibly high (fishing gear)
Increase in suspended sediment	Low	Low	Minor Decline	Low	possibly high (fishing gear)
Decrease in suspended sediment	Low	Low	Minor Decline	Low	?
Increase in water flow rate	High	High	Major Decline	Low	?
Decrease in water flow rate	Intermediate	High	Decline	Very low	?
Increase in temperature	Low	Very high	Minor Decline	Low	? Global warming?

Decrease in temperature	Low	Very high	Minor Decline	Low	?
Increase in turbidity	Low	Very high	Decline	Low	possibly high (fishing gear)
Decrease in turbidity	Low	Very high	Decline	Low	?
Increase in wave exposure	High	High	Major Decline	Low	?
Decrease in wave exposure	Not sensitive	Not Relevant	No Change	Low	?
Abrasion and physical disturbance	High	High	Major Decline	High	probably high (fishing gear)
Displacement	Low	Immediate	No Change	Low	?
Chemical factors					
	Sensitivity	**Recoverability**	**Species Richness**	**Evidence / Confidence**	**Degree of exposure (Column not from *MarLIN*)**
Synthetic compound contamination	High	High	Major Decline	High	Exposure to TBT high in past
Heavy metal contamination	Low	Very high	Minor Decline	Very low	?
Hydrocarbon contamination	Insufficient information	Insufficient information	Insufficient Information	Not Relevant	?
Radionuclide contamination	Insufficient information	Not Relevant	Insufficient Information	Not Relevant	?
Changes in nutrient levels	Intermediate	Very high	Decline	Low	?
Decrease in salinity	Intermediate	High	Decline	Low	?
Changes in oxygenation	Insufficient information	Not Relevant	Insufficient Information	Not Relevant	?
Biological factors					
	Sensitivity	**Recoverability**	**Species Richness**	**Evidence / Confidence**	**Degree of exposure (Column not from *MarLIN*)**
Introduction of microbial pathogens / parasites	Low	Very high	No Change	Low	?
Introduction of non-native species	Insufficient information	Not Relevant	Insufficient Information	Not Relevant	?

Extraction of key or important characterizing species	High	High	Major Decline	High	?

Verdict: The biotope "*L. hians* beds" meets this criterion - fishing activity continues to pose a threat to *L. hians* which is the fundamental component of this biotope, therefore posing a threat of decline of the current extent of the biotope.

Additional information

No additional information was found within the time available.

Overall Verdict

File Shell (*Limaria hians*) beds should qualify as nationally important marine features because of the continued threat posed by mobile fishing gear, and because of evidence of past decline in the extent of the habitat.

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14. Test feature: *Sabellaria spinulosa* encrusted circalittoral rock

Basic information

The following basic information is adapted from the description for *Sabellaria spinulosa* encrusted circalittoral rock (CR.MCR.CSab.Sspi) in the 1997 Marine biotope classification for Britain and Ireland, (Connor *et al.*, 1997), modified to reflect changes that will appear in the equivalent biotope (CR.MCR.CSab.Sspi) in the revised circalittoral rock section of the classification system, due for completion in 2004 (Connor *et al.*, in prep.). From this point forward, this biotope is referred to as Sspi in this dossier.

> Physical habitat: *S. spinulosa* encrusted circalittoral rock occurs on bedrock, boulders and cobbles in areas of full salinity with relatively strong wave exposure and sometimes moderately strong tidal streams. The biotope occurs in depths of 10 – 50m.
>
> Biotope description and characterising species: This biotope is typically found encrusting the upper faces of wave-exposed and moderately wave-exposed circalittoral bedrock, boulders and cobbles subject to strong/moderately strong tidal streams in areas with high turbidity. The crusts formed by the sandy tubes of the polychaete worm *Sabellaria spinulosa* may even completely cover the rock, binding the substratum together to form a crust. A diverse fauna may be found attached to, and sometimes obscuring the crust, often reflecting the character of surrounding biotopes. Bryozoans such as *Flustra foliacea*, *Pentapora foliacea* and *Alcyonidium diaphanum*, anemones such as *Urticina felina* and *Sagartia elegans*, the polychaete *Pomatoceros triqueter*, *Alcyonium digitatum*, the hydroid *Nemertesia antennina* and echinoderms such as *Asterias rubens* and *Crossaster papposus* may all be recorded within this biotope.

Note that *S. spinulosa* can form reef structures on sublittoral sediments, where it acts to stabilise the sediment, thereby forming a physical habitat for a range of infaunal species to inhabit. *Sabellaria spinulosa* reefs on sublittoral sediments were not well described in the 1997 version of the biotope classification (Connor *et al.,* 1997), where the closest biotope code was SS.CMX.SSpiMx. In the revised classification system (Connor *et al.* in prep.), the biotope description of the equivalent biotope "*Sabellaria spinulosa* on stable circalittoral mixed sediment" (SS.SBR.POR.SspiMx, henceforth referred to as SspiMx) has been expanded and improved. This description was not available at the time of carrying out the criteria testing (Lieberknecht *et al.* 2004) and the research for this dossier. However, a summary of the new description for SspiMx is included below for information.

> Physical habitat: SspiMx occurs in full salinity on mixed sediments of sandy mud, muddy sand with gravel pebbles and cobbles, in areas of moderately exposed to sheltered wave exposure and strong to moderately strong tidal streams. The biotope has been recorded from depths of 10 to 30 m.
>
> Biotope description and characterising species: The biotope is characterised by the tube-building polychaete *Sabellaria spinulosa* at high abundances on mixed sediment. This species typically forms loose agglomerations of tubes forming a low lying matrix of sand, gravel, mud and tubes on the seabed. Infauna comprise typical sublittoral polychaete species such as *Protodorvillea kefersteini*, *Pholoe synophthalmica, Harmothoe* spp, *Scoloplos armiger*, *Mediomastus fragilis*, *Lanice conchilega* and

cirratulids, together with the bivalve *Abra alba,* and tube building amphipods such as *Ampelisca* spp. The epifauna comprise a variety of bryozoans including *Flustra foliacea*, *Alcyonidium diaphanum* and *Cellepora pumicosa*, in addition to calcareous tubeworms, pycnogonids, hermit crabs and amphipods. The reefs formed by *Sabellaria* consolidate the sediment and allow the settlement of other species not found in adjacent habitats leading to a diverse community of epifaunal and infauna species. The development of such reefs is assisted by the settlement behaviour of larval *Sabellaria* which are known to selectively settle in areas of suitable sediment and particularly on existing *Sabellaria* tubes.

Application of the criteria for special importance

Proportional importance

S. spinulosa has a widespread distribution in the NE Atlantic, encompassing the whole of the British Isles, including Shetland and the Mediterranean, although it is limited to areas with high levels of suspended sediment (Holt *et al.,* 1998).

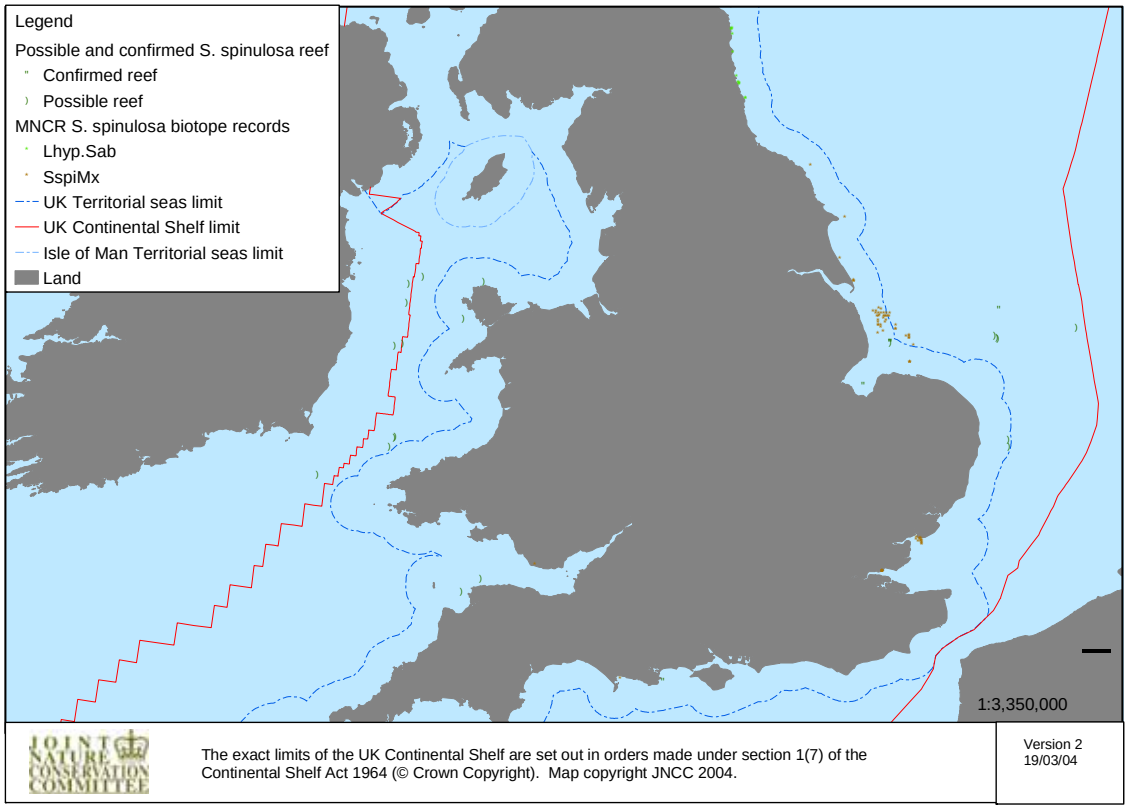
True *S. spinulosa* reefs, however, are much more limited in distribution, as the species often occurs only as small numbers of individuals (Holt *et al*., 1998). Examples of the reef habitat have been described in the mouth of the Wash, the Bristol Channel, and in the southern North Sea (German coast) (Holt *et al*., 1998; Anonymous).

No further information was found on the international extent of either Sspi or SspiMx.

Verdict: Open. There seems to be little information on international extent of either habitat.

Rarity

The species *S. spinulosa* is described as "naturally common" in UK waters, however, it usually occurs as solitary individuals or in small groups, or sometimes in seasonal crusts a few cm thick on the seabed. These crusts are broken up in winter storms and, like the individuals and small groups, are not considered to be the same as *S. spinulosa* reefs. The occurrence of reefs is a lot more restricted (Holt *et al*., 1998; Anonymous, 2001). Well developed, stable *S. spinulosa* reefs are thought to be relatively unusual (Holt *et al*, 1998).



Known and potential sites for *Sabellaria spinulosa* reefs, based on data from the MNCR database (map by C. Turnbull).

Verdict: The *S. spinulosa* reefs (SspiMx) probably meet the criterion.

Application of the criteria for threatened / declined features

Decline

In the UK, *S. spinulosa* reefs have almost certainly suffered widespread and long lasting damage due to bottom fishing, e.g. in Morecambe Bay where reefs were present in the 1950s. It is believed that *S. spinulosa* reefs are associated with the occurrence of the pink shrimp *Pandalus montagui,* and fishermen have used *S. spinulosa* clumps in trawls as indications of good fishing grounds (Anonymous, 2001). Recovery of the reefs is not possible while the fishery activities persist in the area. The likelihood of recovery is unknown, though recent surveys suggest that recovery of *S. spinulosa* reefs has not occurred in Morecambe Bay despite the cessation of fishing many years ago, either due to lack of larval supply or to permanent / ongoing alterations to the habitat (Anonymous, 2001).

Outside UK waters, a marked decline has also been documented in the German Wadden Sea since the 1920s, from 17 known major reef structures to just 1 remaining known site at present, thought to be the result of physical disturbance from shrimp trawling. Areas previously dominated by *S.* reefs are now dominated by *Mytilus edulis* and sand-dwelling amphipods (Anonymous; Anonymous, 2001; Riesen & Reise, 1982 and Reise & Schubert, 1987 both cited in Jones *et al*, 2000).

Verdict: S. spinulosa reefs meet the criterion.

Threat of significant decline

S. spinulosa reefs often occur in areas which are of value for marine gravel extraction. Direct damage would be heavy and there is little knowledge of recovery. It is likely that damage to adjacent populations of *S. spinulosa* by resulting sediment plumes would not be particularly high, but this has to be demonstrated clearly, and it has been pointed out that damage to associated fauna and flora on biodiverse reefs may be more significant (Anonymous, 2001). Information on recovery potential is lacking, and needs to be addressed in research (Holt *et al*., 1998). Studies in the Bristol Channel showed that within a proposed licence area for aggregate dredging, up to 60% by volume of dredged samples consisted of *S. spinulosa* (Anonymous, 2001).

There have been no studies to determine the longevity of individual worms or of the reef structures as a whole. *Sabellaria alveolata* may live for up to nine years, and it is thought that *S. spinulosa* may be similarly long lived. As empty tubes provide suitable substratum for the settlement of larvae, it is thought that the lifespan of colonies may by far exceed the lifespan of individual worms (Anonymous 2001).

The following table is based on the *MarLIN* sensitivity review for *S. spinulosa* encrusted circalittoral rock (Jackson 2000). Rows that are not relevant were deleted. An additional column has been added in attempting to estimate the degree of exposure of the biotope to a given factor, in order to be able to assess the threat of decline to the biotope due to each given factor. This information is probably not complete. Please refer to the *MarLIN* website for details on how the sensitivity assessment was carried out, and the benchmarks that were used.

Physical factors					
	Sensitivity	**Recoverability**	**Species Richness**	**Evidence / Confidence**	**Degree of exposure (Column not from *MarLIN*)**
Substratum Loss	High	High	Major Decline	High	potentially high – aggregate extraction
Smothering	High	High	Major Decline	High	potentially high – aggregate extraction
Suspended sediment	Low	Very high	Minor Decline	Moderate	potentially high – aggregate extraction
Desiccation	Low	Very high	Minor Decline	Low	unlikely
Changes in emergence regime	High	High	Major Decline	Low	unlikely
Changes in water flow rate	Intermediate	High	Minor Decline	Low	?
Changes in temperature	Low	Very high	Minor Decline	Moderate	?
Changes in turbidity	Low	Very high	Minor Decline	Low	?

Changes in wave exposure	Intermediate	High	Decline	Low	?
Noise	Not sensitive	Not Relevant	No Change	Low	?
Visual presence	Not sensitive	Not Relevant	No Change	High	?
Abrasion and physical disturbance	Intermediate	High	Decline	Low	potentially high – aggregate extraction; fisheries
Displacement	High	High	Decline	High	?
Chemical factors					
	Sensitivity	**Recoverability**	**Species Richness**	**Evidence / Confidence**	**Degree of exposure (Column not from *MarLIN*)**
Synthetic compound contamination	Low	High	Decline	Moderate	?
Heavy metal contamination	Insufficient information	Insufficient information	Insufficient Information	Not Relevant	?
Hydrocarbon contamination	Insufficient information	Insufficient information	Insufficient Information	Not Relevant	?
Radionuclide contamination	Insufficient information	Insufficient information	Insufficient Information	Not Relevant	?
Changes in nutrient levels	Low	Very high	Minor Decline	Moderate	?
Changes in salinity	Intermediate	High	Decline	Low	?
Changes in oxygenation	Insufficient information	Insufficient information	Insufficient Information	Not Relevant	?
Biological factors					
	Sensitivity	**Recoverability**	**Species Richness**	**Evidence / Confidence**	**Degree of exposure (Column not from *MarLIN*)**
Introduction of microbial pathogens / parasites	Insufficient information	Insufficient information	Insufficient Information	Not Relevant	?
Introduction of non-native species	Insufficient information	Insufficient information	Insufficient Information	Not Relevant	?
Extraction of important species	Low	Very high	Minor Decline	Low	?

Verdict: The *S. spinulosa* reefs (SspiMx) meet the criterion, but there is insufficient evidence to suggest that Sspi would meet the criterion.

Additional information

For this dossier, the initial assessment unit was the Sspi biotope described in the basic information section above. During the research on this biotope, it became clear that while Sspi may not fulfil the criteria for nationally important marine feature, another habitat characterised by *S. spinulosa*, namely *S. spinulosa* "reefs", probably would. There seemed to be no clear definition in the available literature as to what does and doesn't constitute a *S. spinulosa* "reef" (the definition for SspiMx included in the basic information section above was not yet available), and different literature sources often describe slightly different entities, making the assessment difficult.

Overall Verdict

It was concluded from the work carried out for this dossier that *S. spinulosa* reefs meet the criteria for nationally important marine features, but there is insufficient evidence that the biotope initially being considered (Sspi) would meet the criteria.

An important aspect emerging from this dossier, in terms of how to practically apply the criteria, was the conclusion that any entity found to meet the criteria should be listed as nationally important, even if that entity differs in definition from the feature originally under consideration (see Lieberknecht *et al.,* 2004, for more details).

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15. Test feature: *Modiolus modiolus* (Horse mussel) beds

Basic information

The Horse mussel *Modiolus modiolus* is a bivalve mollusc found off all British coasts, forming extensive beds off the northern and western coasts. It is found either part buried in soft sediments or attached to hard substrata. It can form extensive beds or reefs, which provide habitat for rich diversity of other species. It is most commonly found in the subtidal up to a depth of 280m, though it may extend to lower shore rockpools and laminarian holdfasts. Modiolus beds may also play a significant role in channelling primary production to the benthos, moving biomass from water column to sediment through pseudofaeces (bentho-pelagic coupling) – i.e. may be very important in secondary production (Tyler-Walters, 2001).

Juvenile mussels are very vulnerable to predation by crabs and starfish, and during the first years energy is invested in growth rather than reproduction. Growth is rapid in the first 4-6 years. Mussels larger than 45-60 mm can only be preyed upon by very large crabs and starfish, and large horse mussels are thought to have no large natural predators, and adult growth is very slow (Tyler-Walters, 2001).

Holt *et al*. (1998) describe various types of modiolus beds, which can be infaunal or semi-infaunal. Semi-infaunal *M. modiolus* beds occur in various gradations of density and thickness, and have been described as "reefs" – it seems the majority of *M. modiolus* "reefs" fall into the semi-infaunal category. Mounds of pseudofaeces accumulate, with living mussels forming an irregularly clumped layer over the mounds. Infaunal *M. modiolus* beds usually occur on coarser ground and in strong currents, where the mussels bind together banks of gravel and live as nested infauna within the coarse deposit. Infaunal *M. modiolus* beds can form mounds which in the Bay of Fundy have had reported dimensions of up to 3m height and 100s of metres in length. The best examples of infaunal *M. modiolus* beds in the UK can be found off the north-east coast of the Isle of Man, where *M. modiolus* form mounds with steep faces up to 1m in height. Similar areas have been found off Codling Bank, Ireland. Epifaunal *M. modiolus* can also occur in clumps and carpets which couldn't be described as "biogenic reefs", these can be widespread.

The most recent version of the marine habitat classification (Connor *et al.* in prep.) describes four different biotopes which constitute *M. modiolus* beds. Their titles, codes and descriptions are shown below:

1. *Modiolus modiolus* beds on open coast circalittoral mixed sediment
(SS.SBR.SMus.ModMx, henceforth ModMx)

Physical Habitat: occurs in full salinity conditions in areas of muddy gravel and sand with shells and stones, in depths of 50 – 100m. This biotope occurs in areas which are sheltered from wave exposure, but with moderately strong tidal streams.

Biotope description and characterising species: Muddy gravels and coarse sands in deeper water of continental seas may contain venerid bivalves with beds of *M. modiolus*. The clumping of the byssus threads of the *M. modiolus* creates a stable

habitat that attracts a very rich infaunal community with a high density of polychaete species including *Glycera lapidum*, *Paradoneis lyra*, *Aonides paucibranchiata*, *Laonice bahusiensis*, *Protomystides bidentata*, *Lumbrineris* spp., *Mediomastus fragilis* and syllids such as *Exogone* spp. and *Sphaerosyllis* spp. Bivalves such as *Spisula elliptica*, *Timoclea ovata* and other venerid species are also common. Brittlestars such as *Amphipholis squamata* may also occur with this community.

2. *Modiolus modiolus* beds with *Chlamys varia,* sponges, hydroids and bryozoans on slightly tide-swept very sheltered circalittoral mixed substrata
(SS.SBR.SMus.ModCvar, henceforth ModCvar)

Physical description: Occurs in areas of full salinity, on pebble, gravel and shells on sandy mud sediments, in depths ranging from 5-30m. This biotope occurs in areas which are sheltered from wave exposure, but where tidal streams may range from weak to strong.

Biotope description and characterising species: Dense *M. modiolus* beds, covered by hydroids and bryozoans, on soft gravelly, shelly mud with pebbles in areas of slight or moderate tidal currents. The variable scallop (*Chlamys varia*) is frequently found in large numbers amongst the *M. modiolus* shells. Hydroids such as *Halecium* spp. and *Kirchenpaueria pinnata* and ascidians such as *Ascidiella aspersa*, *Corella parallelogramma* and *Ciona intestinalis* may be amongst those present. The echinoderms *Ophiothrix fragilis* and *Antedon bifida* are often frequent in this biotope as is the encrusting polychaete *Pomatoceros triqueter*.

3. *Modiolus modiolus* beds with hydroids and red seaweeds on tide-swept circalittoral mixed substrata (SS.SBR.SMus.ModT, henceforth ModT)

Physical habitat: ModT occurs in areas of full salinity, between 5 and 50m depth, on cobbles, pebbles and shells, where wave exposure is very sheltered to very exposed and tidal streams are strong or moderately strong.

Biotope description and characterising species: *M. modiolus* beds on mixed substrata (cobbles, pebbles and coarse muddy sediments) in moderately strong currents or wave exposed areas, typically on the open coast but also in tide-swept channels of marine inlets. *Ophiothrix fragilis* are often common in this biotope along with the calcareous tubes of *Pomatoceros triqueter*, anemones such as *Alcyonium digitatum* and *Urticina felina* and hydroids such as *Abietinaria abietina* and *Sertularia argentea*. *Buccinum undatum* may also be important and in some areas the clam *Chlamys varia* may be frequent but not in the same abundances as in ModCvar. It is likely that the infauna is very rich.

4. *Modiolus modiolus* beds with fine hydroids and large solitary ascidians on very sheltered circalittoral mixed substrata
(SS.SBR.SMus.ModHAs, henceforth ModHAs)

Physical habitat description: ModHAs is found in full salinity conditions, between 5 and 30 m depth, on boulders, cobbles and shells on muddy sediment, in areas of weak tidal streams and low wave exposure.

Biotope description and characterising species: Beds or scattered clumps of *M. modiolus* in generally sheltered conditions with only slight tidal movement. Typically occurs in sealochs and the Shetland voes. Brittlestars *Ophiothrix fragilis* and *Ophiocomina nigra*, as well as *Ophiopholis aculeata* are often frequent, sometimes forming a dense bed as described in OphMx. The queen scallop *Aequipecten opercularis* is often present in moderate abundances. Large solitary ascidians (*Ascidiella aspersa*, *Corella parallelogramma, Dendrodoa grossularia*) and fine hydroids (*Kirchenpaueria pinnata*) are present attached to the mussel shells. Decapods such as hermit crabs (*Pagurus bernhardus*) and spider crabs (*Hyas araneus*) are typically present. Coralline algal crusts may be found on the mussel shells, with some red seaweeds in shallower water such as *Phycodrys rubens*. Little information on the infaunal component is given here although it is likely that it is very rich and may highlight more subtle differences in the *M. modiolus* biotopes.

Application of the criteria for special importance

Proportional importance

The horse mussel has been recorded from the White sea and Norway, off the Faroes and Iceland, south to the Bay of Biscay and occasionally North Africa. It occurs in the western Atlantic from Labrador to North Carolina, and in the Pacific ocean along the west coast of America and Canada from the Bering Sea to California, and along the Asian coast from the Bering Sea to Japan (review by Tyler-Walters, 2001).

In Britain and Ireland, the species is found off all coasts, though extensive beds are most common off the north and west and absent south of the Irish Sea and Humber estuary (review by Tyler-Walters, 2001).

In terms of the mussel bed biotopes ModCvar used to be found in Strangford Lough where the *M. modiolus* beds were well developed. The biotope has also been recorded off the Lleyn Peninsula in North Wales. ModT is typified by examples off the north-west Lleyn Peninsula in North Wales and off Co. Down, Northern Ireland (Connor *et al.* in prep.).

Verdict: Based on its broad distribution, the species does not meet criterion. Not enough information was available on the global distribution of the biotope to enable a verdict to be reached.

Rarity

The species is not listed as rare or scarce by Sanderson (1996).

The biotope may meet this criterion, but insufficient recent data on it's distribution was found to carry out an assessment.

Verdict The species probably doesn't meet criterion. No verdict reached on the biotope.

Application of the criteria for threatened / declined features

Decline

Fishing, particularly using trawls and dredges for scallops and queen scallops, is known to have caused widespread and long-lasting damage to *M. modiolus* beds off the south-east of the Isle of Man and in Strangford Lough (where beds have been virtually destroyed). Effects include flattening clumps of *M. modiolus* causing fatalities, and loss of much of the associated epifauna, especially emergent types such as *Alcyonium digitatum*. Fishing impacts are likely to be occurring on *M. modiolus* beds elsewhere. *M. modiolus* has until now been taken for consumption only on a very small scale in a few localities (Anonymous, 2001; D. Erwin, pers comm; Jones, 1951 cited in Jones *et al*., 2000). The conservation status of *M. modiolus* beds was recently assessed as "significantly declined" in the UK, though not significantly declined in quality where still present (Jones *et al*., 2000).

Verdict: M. modiolus beds meet the criterion for decline. It is possible that the species would also meet this criterion.

Threat of significant decline

The Horse mussel has a generation time of 5-10 years, with an age at maturity of 3-8 years. The life span of the horse mussel is long, with mussels over 25 years common in British populations and maximum ages thought likely to be well over 50 years (Tyler-Walters, 2001a). *M. modiolus* may be susceptible to a rise in water temperatures as a result of global warming, as it is a northern species (Jones *et al*., 2000 and references therein). As a filter feeding organism, it is also thought to be very sensitive to oil pollution (Dethlefsen, 1978 and Lees & Driskell, 1981 both cited in Jones *et al*., 2000).

The following table is based on the *MarLIN* sensitivity review for *M. modiolus* (Tyler-Walters, 2001a). Rows that are not relevant were deleted. An additional column has been added in attempting to estimate the degree of exposure of the species to a given factor. This information is probably not complete. Please refer to the *MarLIN* website for details on how the sensitivity assessment was carried out, and the benchmarks that were used. The table refers to adult *M. modiolus* only, as insufficient information was available to cover aspects of larval sensitivity and recoverability.

Physical factors				
Click factor name to view rationale	**Sensitivity**	**Recoverability**	**Evidence / Confidence**	**Degree of exposure (Column not from *MarLIN*)**
Substratum Loss	High	Low	Moderate	potentially high
Smothering	Intermediate	Low	Very low	potentially high
Increase in suspended sediment	Low	Immediate	Low	potentially high
Decrease in suspended sediment	Low	Immediate	Low	?
Desiccation	High	Low	High	low
Increase in emergence regime	High	Low	Moderate	low
Decrease in emergence regime	Not sensitive	Not Relevant	Not Relevant	low

Increase in water flow rate	Intermediate	Low	Low	?
Decrease in water flow rate	Intermediate	Low	Moderate	?
Increase in temperature	Intermediate	Low	Very low	?
Decrease in temperature	Not sensitive	Not Relevant	Low	?
Increase in turbidity	Low	Very high	Moderate	potentially high
Decrease in turbidity	Not sensitive	Not Relevant	Very low	?
Increase in wave exposure	Intermediate	Low	Very low	?
Abrasion and physical disturbance	Intermediate	Low	Low	potentially high
Displacement	Low	Very high	Very low	?
Chemical factors				
	Sensitivity	**Recoverability**	**Evidence / Confidence**	**Degree of exposure (Column not from *MarLIN*)**
Synthetic compound contamination	Intermediate	Very low	Very low	?
Heavy metal contamination	Low	Very high	Very low	?
Hydrocarbon contamination	Low	Very high	Low	?
Radionuclide contamination	Insufficient information	Not Relevant	Not Relevant	?
Changes in nutrient levels	Low	Very high	Low	?
Decrease in salinity	High	Low	Moderate	?
Changes in oxygenation	Low	Very high	Moderate	?
Biological factors				
	Sensitivity	**Recoverability**	**Evidence / Confidence**	**Degree of exposure (Column not from *MarLIN*)**
Introduction of microbial pathogens / parasites	Low	Very high	Low	?
Introduction of non-native species	Insufficient information	Not Relevant	Not Relevant	?
Extraction of this species	High	Low	Moderate	?
Extraction of other species	Intermediate	Low	High	?

In terms of the biotope (*M. modiolus* beds rather than the species), recovery potential of physically damaged beds is thought to be low, although few studies have been carried out to verify this (Anonymous, 2001). The resilience of *M.* beds to deposition of dredge spoil is not known, though it is thought possible that the mussels can keep up with low rates of sediment accretion (Jones *et al*. 2000). *M. modiolus* beds are likely to be badly damaged by any other physical impacts, such as aggregate extraction, trenching and pipe/cable-laying, dumping of spoil/cuttings, or use of jack-up drilling rigs. *M. modiolus* is known to accumulate contaminants such as heavy metals in spoil disposal areas but the effects on condition, reproduction and mortality rates are unknown (Anonymous, 2001).

The following table is based on the *MarLIN* sensitivity review for *Modiolus modiolus* beds with hydroids and red seaweeds on tide-swept circalittoral mixed substrata (Tyler-Walters, 2001b). Rows that are not relevant were deleted. Please refer to the *MarLIN* website for details on how the sensitivity assessment was carried out, and the benchmarks that were used. The table refers to adult *M. modiolus* only, as insufficient information was available to cover aspects of larval sensitivity and recoverability.

Physical Factors					
	Intolerance	**Recoverability**	**Sensitivity**	**Species Richness**	**Evidence / Confidence**
Substratum Loss	High	Very low	Very High	Major Decline	High
Smothering	Intermediate	Low	High	Decline	Low
Increase in suspended sediment	Low	Very high	Very Low	Decline	Low
Decrease in suspended sediment	Low	Immediate	Not sensitive	Decline	Moderate
Increase in water flow rate	Intermediate	Low	High	Decline	Moderate
Decrease in water flow rate	Intermediate	Low	High	Decline	Low
Increase in temperature	Intermediate	Low	High	Decline	Moderate
Decrease in temperature	Tolerant	Not Relevant	Not sensitive	Decline	Very low
Increase in turbidity	Low	High	Low	Minor Decline	Moderate
Decrease in turbidity	Low	High	Low	Minor Decline	Very low
Increase in wave exposure	Intermediate	Low	High	Decline	Low
Decrease in wave exposure	Tolerant	Not Relevant	Not sensitive	Decline	Low
Abrasion & physical disturbance	High	Low	High	Decline	Moderate
Displacement	Intermediate	Low	High	Decline	Low
Chemical Factors					
Click factor name to view rationale	**Intolerance**	**Recoverability**	**Sensitivity**	**Species Richness**	**Evidence / Confidence**
Synthetic compound contamination	High	Very low	Very High	Major Decline	Very low

Heavy metal contamination	Low	High	Low	No Change	Very low
Hydrocarbon contamination	Intermediate	High	Low	Minor Decline	Low
Changes in nutrient levels	Low	Very high	Very Low	Minor Decline	Very low
Decrease in salinity	High	Very low	Very High	NR	Moderate
Changes in oxygenation	Intermediate	High	Low	Decline	Low
Biological Factors					
Click factor name to view rationale	**Intolerance**	**Recoverability**	**Sensitivity**	**Species Richness**	**Evidence / Confidence**
Introduction of microbial pathogens/parasites	Low	Very high	Very Low	No Change	Low
Extraction of key or important characterizing species	High	Very low	Very High	Major Decline	Low
Extraction of important species	High	Very low	Very High	Major Decline	Low

Verdict: Modiolus modiolus beds meet the criterion. The species may also meet the criterion.

Additional information

It was found that there is a lack of consistency in the definition and scale of units referred to as "habitats" in the literature. For example, when researching *M. modiolus* beds, information was found for the species *Modiolus modiolus*, as well as *Modiolus* "reefs" and *Modiolus* "beds" – but with no precise definition given for the "reefs" and "beds". Attempting to research the status of a clearly defined biotope complex, biotope or set of biotopes (such as in this instance) can, therefore, be problematic. Given that the biotope classification has very recently been revised, some of the units to be assessed will be newly defined entities, with little existing literature referring to precisely these entities.

Overall verdict

Modiolus modiolus beds meet the criteria for decline and threat of decline, and therefore qualify as nationally important marine features.

The species, as well as the habitat, is likely to meet the criteria for nationally important marine features, as it has declined in the past. The species was included on the provisional list of nationally important marine features (Lieberknecht *et al.*, 2004), as well as the habitat. However, in terms of necessary conservation action, it may be most appropriate to target action at the habitat level, and it may therefore not be necessary or appropriate to list both the species and the habitat as nationally important.

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16. Test feature: Estuaries

Basic information

Estuaries have been defined as

"a semi-enclosed coastal body of water which has a free connection to the open sea and within which sea water is measurably diluted with fresh water derived from land drainage" (Pritchard 1952) or;

"an inlet of the sea reaching into a river valley as far as the upper limit of tidal rise" (Fairbridge 1980).

Application of the criteria for special importance

Proportional importance

The UK coastline has a particularly large number of estuaries, especially compared to the rest of temperate and Mediterranean Europe. On a global scale, estuaries are a rare resource (Buck, 1993). England on its own contains more than one fifth of the whole western European estuarine resource (English Nature, 1994). The estuaries review (Davidson *et al*., 1991) identified 155 estuaries around the whole of the British coastline. Half are in England and almost a third are in Scotland. Britain has more estuarine habitat than anywhere else in Europe, with almost 28% of the total estuarine area (intertidal and subtidal) of the North Sea shores and western Europe falling within UK territory. The estuaries review measured the total estuarine area in Britain as 530 000 ha, of which 41.8% is subtidal and 58.2% intertidal. The largest European estuarine areas is the Wadden Sea, which totals 764 000 ha in surface area. Put together, the estuaries of Britain and the Wadden Sea account for over 70% of the estuarine area of western Europe.

UK estuaries are of international importance as feeding / breeding / overwintering grounds of migratory birds (Evans *et al*., 1991).

Davidson *et al*. (1991) point out that in SW England, mean surface air temperatures in winter are 10% warmer than in the Wadden Sea area, thus making those estuarine habitats less likely to suffer from the effects of severe frosts. In addition, tidal ranges in GB tend to be a lot bigger, making the regularity of emersion/immersion regimes on UK tidal flats less dependent on weather conditions than in other parts of Europe.

Verdict: Despite the fact that the UK contains more estuarine habitat than any other western European country, Estuaries do not meet the criterion for proportional importance, as the threshold is at 50% of the total resource.

Rarity

Though estuaries only make up 2% of the land mass of Britain, they are more numerous than in any other western European country.

Verdict: Estuaries do not meet the criterion for rarity.

Application of the criteria for threatened / declined features

Decline

Davidson *et al*. (1991) present ample evidence for the decline of estuaries in the UK. The Estuaries Review collected information on over 250 different types of human activity taking place on British estuaries in 1989. Amongst other things, they found that in 1989, 85% of UK estuaries had artificial embankments restricting the flow of the tide, and that 18 million people (a third of the British population) lived in urban areas situated around estuaries, creating intense pressures on nearby estuarine environments.

In some estuaries, humans have removed all, or almost all, the intertidal wildlife habitats. Intense levels of human development (ports, urban & industrial development), and the widespread discharge of effluents produced by these developments, have led to intense levels of pollution in estuaries and to the perception of estuarine flats as wasteland suitable for waste-disposal and land claim. More recently, recreational use has put pressures on those estuarine areas which are still less developed and more pristine.

Land claim was identified as the key conservation issue for British Estuaries. About a third of all British intertidal estuarine habitat and about half the saltmarsh has been re-claimed as land since Roman times. Land claim has affected at least 85% of British estuaries, removing over 25% of intertidal land from many estuaries, and over 80% in estuaries such as the Blyth (Suffolk), the Tees and the Tyne. Overall, almost 25% of the overall area of British estuaries has been lost, at a rate of 0.2-0.7% per year over the last 200 years.

Verdict: Estuaries meet the criterion for decline.

Threat of significant decline

As well as having suffered decline in the past, Estuaries (like many other wetlands) are under continuous and long-term threat of further damage and destruction (Davidson *et al*., 1991).

The activities that have caused past decline, as described by Davidson *et al*. (1991) are ongoing, therefore there is a continued threat to UK estuaries. The authors outlined development proposals for UK estuaries which were under consideration at the start of the 1990s. Major construction projects, such as brand new 4-runway international airports with all their additional necessary transport infrastructure, are still being proposed for estuarine areas today (e.g. see BBCi, 2003).

Verdict: Estuaries meet the criterion for threat of significant decline.

Additional information

Many parts of the British estuarine resource have been notified as SSSI's. Britain has international obligations for the conservation of estuarine habitats and wildlife under Ramsar, and the Birds Directive (Davidson *et al*., 1991).

Overall Verdict

Estuaries meet the criteria for decline and thread of decline and therefore qualify as nationally important marine features.

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