



# MarLIN

## Marine Information Network

Information on the species and habitats around the coasts and sea of the British Isles

# *Cerianthus lloydii* and other burrowing anemones in circalittoral muddy mixed sediment

MarLIN – Marine Life Information Network  
Marine Evidence-based Sensitivity Assessment (MarESA) Review

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**Please note.** This MarESA report is a dated version of the online review. Please refer to the website for the most up-to-date version [<https://www.marlin.ac.uk/habitats/detail/1091>]. All terms and the MarESA methodology are outlined on the website (<https://www.marlin.ac.uk>)

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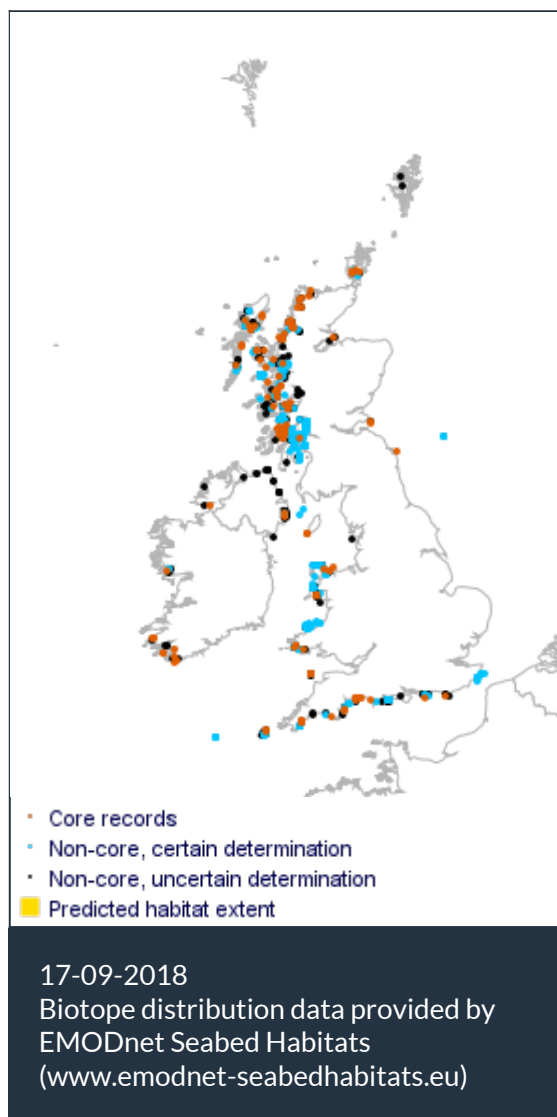
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*Cerianthus lloydii* and other burrowing anemones in circalittoral muddy mixed sediment

Photographer: Keith Hiscock  
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17-09-2018

Biotope distribution data provided by EMODnet Seabed Habitats ([www.emodnet-seabedhabitats.eu](http://www.emodnet-seabedhabitats.eu))

Researched by Frances Perry      Referred by Admin

## Summary

### ☰ UK and Ireland classification

EUNIS 2008    A5.441

*Cerianthus lloydii* and other burrowing anemones in circalittoral muddy mixed sediment

JNCC 2015    SS.SMx.CMx.CIloMx

*Cerianthus lloydii* and other burrowing anemones in circalittoral muddy mixed sediment

JNCC 2004    SS.SMx.CMx.CIloMx

*Cerianthus lloydii* and other burrowing anemones in circalittoral muddy mixed sediment

1997 Biotope

### 🔍 Description

Circalittoral plains of sandy muddy gravel may be characterized by burrowing anemones such as *Cerianthus lloydii*. Other burrowing anemones such as *Cereus pedunculatus*, *Mesacmaea mitchellii* and *Aureliania heterocera* may be locally abundant. Relatively few conspicuous species are

found in any great number in this biotope but typically they include ubiquitous epifauna such as *Asterias rubens*, *Pagurus bernhardus* and *Liocarcinus depurator* with occasional terebellid polychaetes such as *Lanice conchilega* and also the clam *Pecten maximus*. *Ophiura albida* may be frequent in some areas, and where surface shell or stones are present ascidians such as *Ascidiella aspersa* may occur in low numbers. (Information from Connor *et al.*, 2004; JNCC, 2015).

### ↓ Depth range

5-10 m, 10-20 m, 20-30 m

### Additional information

-

### ✓ Listed By

- none -

### Further information sources

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## Sensitivity review

### Sensitivity characteristics of the habitat and relevant characteristic species

The plains of sandy muddy gravel within SS.SMx.CMx.CIloMx are relatively sparse in species. This biotope is characterized by burrowing anemones of which *Cerianthus lloydii*, is the most abundant species. Other conspicuous species found in this biotope are mobile scavengers and predators including *Callionymus lyra*, *Pagurus bernhardus* and *Asterias rubens*. Within the sub-biotope SS.SMx.CMx.CIloMx.Nem, the substratum includes more cobbles and pebbles, and the hydroids *Nemertesia* spp. have a high abundance and are characterizing species for this sub-biotope, in addition to *Cerianthus lloydii*. *Nemertesia* spp. as well as some of the other hydroids can only attach themselves to a solid substratum, which is why they are missing from SS.SMx.CMx.CIloMx. SS.SMx.CMx.CIloMx.Nem has greater species diversity than SS.SMx.CMx.CIloMx. Therefore, the sensitivity of this biotope is based on the important characterizing species *Cerianthus lloydii*. The mobile scavengers probably forage over a greater range than this biotope and are not assessed specifically. The sensitivity of hydroids is mentioned where relevant to SS.SMx.CMx.CIloMx.Nem.

### Resilience and recovery rates of habitat

Little evidence was found to support this resilience assessment for *Cerianthus lloydii*. MES (2010) suggested that the genus *Cerianthus* would be likely to have a low recovery rate following physical disturbance based on long-lifespan and slow growth rate. No specific evidence was cited to support this conclusion. The MES (2010) review also highlighted that there were gaps in information for this species and that age at sexual maturity and fecundity is unknown although the larvae are pelagic (MES 2010). No empirical evidence was found for recovery rates following perturbations for *Cerianthus lloydii*. This species has limited horizontal mobility and re-colonization via adults is unlikely (Tillin & Tyler-Walters, 2014).

Hydroids exhibit rapid rates of recovery from disturbance through repair, asexual reproduction, and larval colonization. Sparks (1972) reviewed the regeneration abilities and rapid repair of injuries. Fragmentation of the hydroid provides a route for short distance dispersal, for example, each fragmented part of *Sertularia cupressina* can regenerate itself following damage (Berghahn & Offermann, 1999). New colonies of the same genotype may, therefore, arise from damage to existing colonies (Gili & Hughes, 1995). Many hydroid species also produce dormant, resting stages that are very resistant of environmental perturbation (Gili & Hughes 1995). Colonies can be removed or destroyed; however, the resting stages may survive attached to the substratum and provide a mechanism for rapid recovery (Kosevich & Marfenin, 1986; Cornelius, 1995a). The lifecycle of hydroids typically alternates between an attached solitary or colonial polyp generation and a free-swimming medusa generation. Planulae larvae produced by hydroids typically metamorphose within 24 hours and crawl only a short distance away from the parent plant (Sommer, 1992). Gametes liberated from the medusae (or vestigial sessile medusae) produce gametes that fuse to form zygotes and develop into free-swimming planula larvae (Hayward & Ryland, 1994) and are present in the water column between 2-20 days (Sommer, 1992). Rafting on floating debris as dormant stages or reproductive adults (or on ships hulls or in ship ballast water), together with their potentially long lifespan, may have allowed hydroids to disperse over a wide area in the long-term and explain the near cosmopolitan distributions of many hydroid species (Cornelius, 1992; Boero & Bouillon 1993). Hydroids are potential fouling organisms; rapidly colonizing a range of substrata placed in marine environments and are often the first organisms to colonize available space in settlement experiments (Gili & Hughes, 1995). For example, hydroids were reported to colonize an experimental artificial reef within less than 6 months, becoming

abundant in the following year (Jensen *et al.*, 1994). In similar studies, *Obelia* spp. recruited to the bases of reef slabs within three months and the slab surfaces within six months of the slabs being placed in the marine environment (Hatcher, 1998). Cornelius (1992) stated that *Obelia* spp. could form large colonies within a matter of weeks. In a study of the long-term effects of scallop dredging in the Irish Sea, Bradshaw *et al.* (2002) noted that hydroids increased in abundance, presumably because of their regeneration potential, good local recruitment and ability to colonize newly exposed substratum quickly. Cantero *et al.* (2002) describe fertility of *Obelia dichotoma*, *Kirchenpaureria pinnata*, *Nemertesia ramosa* in the Mediterranean as being year-round, whilst it should be noted that higher temperatures may play a factor in this year round fecundity.

Bradshaw *et al.* (2002) observed that reproduction in *Nemertesia antennina* occurred regularly, with three generations per year. In addition, the presence of adults stimulated larval settlement, so that where adults remained, reproduction was likely to result in local recruitment. Hayward & Ryland (1994) stated that medusae release in *Obelia dichotoma* occurred in summer.

The hydroids that are present within SS.SMx.CMx.CIloMx.Nem include *Halecium halecinum*, *Nemertesia antennina*, and *Nemertesia ramosa*. *Halecium halecinum* is an erect hydroid growing up to 25 cm and is found on stones and shells in coastal areas. It is widely distributed in the Atlantic and is present from Svalbard to the Mediterranean (Hayward & Ryland, 1994; Palerud *et al.*, 2004; Medel *et al.*, 1998). *Nemertesia antennina* grows up to 25 cm is found attached to shells and stones on sandy bottoms from the shallow sublittoral into deeper waters offshore, and is recorded in the northeast Atlantic, from at least the Faroes, the Barents Sea and Iceland south through Mauritania to southern Africa, including the Mediterranean, Azores and Madeira. *Nemertesia ramosa* grows up to 15 cm, is found inshore to deeper water and is common throughout the British Isles, and is distributed from Iceland to north-west Africa (Hayward & Ryland, 1994).

**Resilience assessment.** The characterizing species of interest are the burrowing anemone *Cerianthus lloydii* and the hydroid, *Nemertesia antennina*. However, their presence strongly affects the designation of the biotope. Hydroids, including *Nemertesia antennina*, are likely to recover from damage very quickly. Based on the available evidence, resilience for the hydroid species assessed is 'High' (recovery within two years) for any level of perturbation (where resistance is 'None', 'Low', 'Medium' or 'High'). Therefore, the ability of both SS.SMx.CMx.CIloMx and SS.SMx.CMx.CIloMx.Nem to recover will depend on the ability of *Cerianthus lloydii* to recover. However, there is very little information regarding the resilience of *Cerianthus lloydii*. A resilience of 'Medium' (2 – 10 years) is suggested for all resistance levels (where resistance is 'None', 'Low', 'Medium') based on expert judgement. Confidence in this assessment is 'Low', due to the lack of direct evidence for the characterizing species.

**Note.** The resilience and the ability to recover from human-induced pressures is a combination of the environmental conditions of the site, the frequency (repeated disturbances versus a one-off event) and the intensity of the disturbance. Recovery of impacted populations will always be mediated by stochastic events and processes acting over different scales including, but not limited to, local habitat conditions, further impacts and processes such as larval-supply and recruitment between populations. Full recovery is defined as the return to the state of the habitat that existed prior to impact. This does not necessarily mean that every component species has returned to its prior condition, abundance or extent but that the relevant functional components are present and the habitat is structurally and functionally recognizable as the initial habitat of interest. It should be noted that the recovery rates are only indicative of the recovery potential.



	Resistance	Resilience	Sensitivity
<b>Temperature increase (local)</b>	<b>High</b> Q: Low A: Medium C: Medium	<b>High</b> Q: High A: High C: High	<b>Not sensitive</b> Q: Low A: Medium C: Medium

*Cerianthus lloydii* adults are locally abundant in many localities on all coasts of the British Isles and in some areas are common on the shore. This species occurs on all western coasts of Europe from Greenland and Spitzbergen south to Biscay. Larvae, but not adults, have been recorded from the Mediterranean. There is no further information available on the temperature tolerance of *Cerianthus lloydii*.

In a review of the ecology of hydroids, Gili & Hughes (1995) report that temperature is a critical factor stimulating or preventing reproduction and that most species have an optimal temperature for reproduction. However, limited evidence for thermal thresholds and thermal ranges were available for the characterizing species recorded in this biotope. Berrill (1949) reported that growth in *Obelia commissularis* (syn. *dichotoma*) was temperature dependent but ceased at 27°C. Hydranths did not start to develop unless the temperature was less than 20°C and any hydranths under development would complete their development and rapidly regress at ca 25°C. Berrill (1948) reported that *Obelia* species were absent from a buoy in July and August during excessively high summer temperatures in Booth Bay Harbour, Maine, USA. Berrill (1948) reported that the abundance of *Obelia* species and other hydroids fluctuated greatly, disappearing and reappearing as temperatures rose and fell markedly above and below 20°C during this period. The upwelling of cold water (8-10°C colder than surface water) allowed colonies of *Obelia* sp. to form in large numbers. Cantero *et al.* (2002) describe the presence and year-round fertility of *Obelia dichotoma*, *Kirchenpaureria pinnata*, *Nemertesia ramosa* and *Halecium spp.* in the Mediterranean, indicating probable tolerance to temperature increases at the benchmark level.

**Sensitivity assessment.** At the level of the benchmark, a change in temperature is unlikely to have a negative impact on the biotope. Therefore, both the resistance and resilience are assessed as 'High', and sensitivity is assessed as 'Not sensitive' at the benchmark level.

<b>Temperature decrease (local)</b>	<b>High</b> Q: Low A: Medium C: Medium	<b>High</b> Q: High A: High C: High	<b>Not sensitive</b> Q: Low A: Medium C: Medium
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*Cerianthus lloydii* adults are locally abundant in many localities on all coasts of the British Isles and in some areas are common on the shore. This species occurs on all western coasts of Europe from Greenland and Spitzbergen south to Biscay. No further information is available on the temperature tolerance of *Cerianthus lloydii*.

Orejas *et al.* (2012) describe the feeding ecology of *Obelia dichotoma* in an Arctic environment (Kongsfjorden, Svalbard) which experiences temperatures of 1-5°C (Beszczynska-Möller & Dye, 2013). Palerud *et al.* (2004) also describe the presence of *Obelia dichotoma*, *Halecium Halecinum* and *Nemertesia* sp. in Svalbard. This suggests that the characterizing hydroids are probably tolerant of the lowest temperatures they are likely to encounter in Britain and Ireland of ca 4°C (Beszczynska-Möller & Dye, 2013). It should be noted that growth rates are reduced at low temperatures. Berrill (1949) reported that for *Obelia*, stolons grew, under optimal nutritive conditions, at less than 1 mm in 24 hrs at 10-12°C, 10 mm in 24 hrs at 16-17°C, and as much as 15-20 mm in 24 hrs at 20°C.

**Sensitivity assessment.** All species assessed are present in northern/boreal habitats and are

unlikely to be affected at the benchmark level. Resistance has been assessed as **'High'**, and resilience as **'High'**. Therefore, sensitivity has been assessed as **'Not sensitive'** at the benchmark level.

<b>Salinity increase (local)</b>	No evidence (NEv)	Not relevant (NR)	No evidence (NEv)
	Q: NR A: NR C: NR	Q: NR A: NR C: NR	Q: NR A: NR C: NR

No evidence was found for osmoregulation by *Cerianthus lloydii*. *Cerianthus lloydii* is recorded in biotopes with variable salinity regimes (18-40 psu) such as SS.SMx.CMx.ClloModHo but most records occur in full salinity. Studies on hydroids, in general, have found that prey capture rates may be affected by salinity and temperature (Gili & Hughes, 1995) although no evidence was found for *Nemertesia antennina*. However, due to the lack of evidence for the characterizing species within this biotope an assessment of **'No evidence'** has been given.

<b>Salinity decrease (local)</b>	No evidence (NEv)	Not relevant (NR)	No evidence (NEv)
	Q: NR A: NR C: NR	Q: NR A: NR C: NR	Q: NR A: NR C: NR

No evidence was found for osmoregulation by *Cerianthus lloydii*. *Cerianthus lloydii* is recorded in biotopes with variable salinity regimes (18-40 psu) such as SS.SMx.CMx.ClloModHo but most records occur in full salinity. Due to the lack of evidence for the characterizing species within this biotope an assessment of **'No evidence'** has been given.

<b>Water flow (tidal current) changes (local)</b>	High	High	Not sensitive
	Q: Low A: NR C: NR	Q: High A: High C: High	Q: Low A: Low C: Low

Evidence for the effect of changes in water flow on *Cerianthus lloydii* is unavailable. This species is recorded from biotopes with a wide range of water flow regimes, from very weak to strong flow (Connor *et al.*, 1997b). Therefore, it is likely to have a high tolerance to changes in water flow regimes.

The characteristic hydroids are typically found in places of low to moderate water movement, although Hayward & Ryland (1995a) note that the abundant communities occur in narrow straits and headlands that may experience high levels of water flow. Hydroids can bend passively with water flow to reduce drag forces to prevent detachment and enhance feeding (Gili & Hughes, 1995). Hydroid growth form also varies to adapt to prevailing conditions, allowing species to occur in a variety of habitats (Gili & Hughes, 1995). Flow rates are an important factor for feeding in hydroids, and prey capture rates are higher in areas of greater turbulence (Gili & Hughes, 1995). The capture rate of zooplankton by hydroids is correlated with prey abundance (Gili & Hughes, 1995), thus prey availability can compensate for sub-optimal flow rates. Water movements are also important to hydroids to prevent siltation, which can cause death (Round *et al.*, 1961). Tillin & Tyler-Walters (2014) suggest that the range of flow speeds experienced by biotopes in which hydroids are found indicate that a change (increase or decrease) in the maximum water flow experienced by mid-range populations for the short periods of peak spring tide flow would not have negative effects on this ecological group.

**Sensitivity assessment.** This biotope is recorded from moderately strong to very weak flow and wave exposed to very wave sheltered conditions from 5 m to 30 m depth. The biotope probably experiences wave mediated flow in its more shallow examples while tidal flow is more important in



its deeper examples. The biotope probably would not occur in areas subject to both strong flow and wave action, nor in areas subject to very weak flow and shelter from wave action. Therefore, the biotope probably experiences a range of water flow and/or wave mediated flow between the extremes cited above. Therefore, a change in the flow of 0.1-0.2 m/s is probably not significant and a resistance and resilience are assessed as '**High**' so that sensitivity is assessed as '**Not sensitive**'.

<b>Emergence regime changes</b>	<b>Not relevant (NR)</b> Q: NR A: NR C: NR	<b>Not relevant (NR)</b> Q: NR A: NR C: NR	<b>Not relevant (NR)</b> Q: NR A: NR C: NR
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This biotope does not occur in the intertidal, and consequently an increase in emergence is considered '**Not relevant**' to this biotope.

<b>Wave exposure changes (local)</b>	<b>High</b> Q: Low A: NR C: NR	<b>High</b> Q: High A: High C: High	<b>Not sensitive</b> Q: Low A: Low C: Low
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No evidence for the effect of changes in wave exposure on *Cerianthus lloydii* was available. However, it is recorded from extremely wave sheltered to wave exposed sites (Connor *et al.*, 1997b). Jackson (2004) reported that *Nemertesia ramosa* was intolerant of high wave exposure and only found in sheltered areas. Faucci & Boero (2000) recorded hydroid communities at two sites of different wave exposure and recorded the presence of *Obelia dichotoma* and *Halecium* spp. in both the exposed and sheltered sites, but only found *Kirchenpaueria* sp. in the sheltered site.

**Sensitivity assessment.** This biotope is recorded from moderately strong to very weak flow and wave exposed to very wave sheltered conditions from 5 m to 30 m depth. The biotope probably experiences wave mediated flow in its more shallow examples while tidal flow is more important in its deeper examples. The biotope probably would not occur in areas suggest to both strong flow and wave action, nor in areas subject to very weak flow and shelter from wave action. Therefore, the biotope probably experiences a range of water flow and/or wave mediated flow between the extremes cited above. Storms may mobilise the surface of the substratum and may explain the sparse fauna. Nevertheless, 3-5% change in significant wave height is unlikely to be significant within this biotope. Therefore, resistance has been assessed as '**High**', resilience as '**High**' and the biotope is probably '**Not sensitive**' at the benchmark level.

## Chemical Pressures

	Resistance	Resilience	Sensitivity
<b>Transition elements &amp; organo-metal contamination</b>	<b>Not Assessed (NA)</b> Q: NR A: NR C: NR	<b>Not assessed (NA)</b> Q: NR A: NR C: NR	<b>Not assessed (NA)</b> Q: NR A: NR C: NR

This pressure is **Not assessed** but evidence is presented where available.

<b>Hydrocarbon &amp; PAH contamination</b>	<b>Not Assessed (NA)</b> Q: NR A: NR C: NR	<b>Not assessed (NA)</b> Q: NR A: NR C: NR	<b>Not assessed (NA)</b> Q: NR A: NR C: NR
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This pressure is **Not assessed** but evidence is presented where available.

**Synthetic compound contamination**

Not Assessed (NA)

Q: NR A: NR C: NR

Not assessed (NA)

Q: NR A: NR C: NR

Not assessed (NA)

Q: NR A: NR C: NR

This pressure is **Not assessed** but evidence is presented where available.

**Radionuclide contamination**

No evidence (NEv)

Q: NR A: NR C: NR

Not relevant (NR)

Q: NR A: NR C: NR

No evidence (NEv)

Q: NR A: NR C: NR

No evidence.

**Introduction of other substances**

Not Assessed (NA)

Q: NR A: NR C: NR

Not assessed (NA)

Q: NR A: NR C: NR

Not assessed (NA)

Q: NR A: NR C: NR

This pressure is **Not assessed**.

**De-oxygenation**

Low

Q: High A: High C: Medium

High

Q: High A: High C: High

Low

Q: High A: High C: Medium

In general, respiration in most marine invertebrates does not appear to be significantly affected until extremely low concentrations are reached. For many benthic invertebrates, this concentration is about 2 ml/l (Herreid, 1980; Rosenberg *et al.*, 1991; Diaz & Rosenberg, 1995). Cole *et al.* (1999) suggest possible adverse effects on marine species below 4 mg/l and probable adverse effects below 2mg/l.

Hydroids mainly inhabit environments in which the oxygen concentration exceeds 5 ml/l (Gili & Hughes, 1995). Diaz & Rosenberg (1995) noted that anemones include species that were reported to be particularly tolerant of hypoxia (e.g. *Cerianthus* sp and *Epizoanthus erinaceus*). A major hypoxic event due a pycnocline in the Gulf of Trieste resulted in a mass mortality of benthos between 12 and 26<sup>th</sup> September 1983 (Stachowitsch, 1992), during which the oxygen levels fell below 4.2 mg/l, became anoxic, and hydrogen sulphide and ammonia were released (Faganeli *et al.*, 1985). Amongst the epifauna, the even hypoxia resistant polychaetes and bivalves died after 4-5 days and the only organism to survive after one week were the anemones *Cerianthus* sp and *Epizoanthus erinaceus*, the gastropods *Aporrhais pespelecani* and *Trunculariopsis trunculus* and the siphonulid *Sipunculus nudis* (Stachowitsch, 1992).

**Sensitivity assessment.** The above evidence suggests that *Cerianthus lloydii* would probably survive for a week at or below 2 mg O<sub>2</sub>/l while the hydroids would probably be reduced to just resting stages. Therefore, a resistance of '**Low**' is recorded to represent the probable significant mortality of hydroids in the community. However, the hydroids would recover rapidly, so that resilience is likely to be '**High**' and sensitivity '**Low**'.

**Nutrient enrichment**

Not relevant (NR)

Q: NR A: NR C: NR

Not relevant (NR)

Q: NR A: NR C: NR

Not sensitive

Q: NR A: NR C: NR

No information was available on the effect of nutrient enrichment on *Cerianthus lloydii*. Witt *et al.* (2004) found that the hydroid *Obelia* sp. was more abundant in a sewage disposal area in the Weser estuary (Germany), which experienced sedimentation of 1 cm for more than 25 days. It

should be noted that another hydroid (*Sertularia cupressina*) was reduced in abundance when compared with unimpacted reference areas. As suspension feeders, an increase in organic content at the benchmark is likely to be of benefit to the characterizing hydroids. However, there is no direct evidence for the characterizing hydroid species *Nemertesia anteninna*.

**Sensitivity assessment.** Little evidence was found on which to base an assessment. However, the biotope is assessed as '**Not sensitive**' at the pressure benchmark of compliance with good status as defined by the WFD.

<b>Organic enrichment</b>	<b>Low</b>	<b>Medium</b>	<b>Medium</b>
	Q: High A: Medium C: Medium	Q: Low A: Medium C: Medium	Q: Low A: Medium C: Medium

Borja *et al.* (2000) and Gittenberger & van Loon (2011) in the development of the AZTI Marine Biotic Index (AMBI) index to assess disturbance (including organic enrichment) both assigned *Cerianthus lloydii* to their Ecological Group I, 'species very sensitive to organic enrichment and present under unpolluted conditions (initial state)'. The basis for their assessment and relation to the pressure benchmark is not clear (Tillin & Tyler-Walters, 2014).

Witt *et al.* (2004) found that the hydroid *Obelia* spp. was more abundant in a sewage disposal area in the Weser estuary (Germany) which experienced sedimentation of 1 cm for more than 25 days. It should be noted that another hydroid (*Sertularia cupressina*) was reduced in abundance when compared with unimpacted reference areas. As suspension feeders, an increase in organic content at the benchmark is likely to be of benefit to the characterizing hydroids.

**Sensitivity assessment.** At the pressure benchmark, which refers to enrichment rather than gross organic pollution, this biotope is considered to have a '**Low**' resistance and hence, '**Medium**' resilience. Therefore, sensitivity is assessed as '**Medium**'.

## A Physical Pressures

	Resistance	Resilience	Sensitivity
<b>Physical loss (to land or freshwater habitat)</b>	<b>None</b>	<b>Very Low</b>	<b>High</b>
	Q: High A: High C: High	Q: High A: High C: High	Q: High A: High C: High

All marine habitats and benthic species are considered to have a resistance of '**None**' to this pressure and to be unable to recover from a permanent loss of habitat; resilience is '**Very Low**'. Sensitivity within the direct spatial footprint of this pressure is, therefore '**High**'. Although no specific evidence is described, confidence in this assessment is 'High', due to the incontrovertible nature of this pressure.

<b>Physical change (to another seabed type)</b>	<b>None</b>	<b>Very Low</b>	<b>High</b>
	Q: High A: High C: High	Q: High A: High C: High	Q: High A: High C: High

If rock was replaced with sediment, this would represent a fundamental change to the physical character of the biotope and the species would be unlikely to recover. The biotope would be lost.

**Sensitivity assessment.** The resistance to this change is '**None**', and the resilience is assessed as 'Very low' due to the permanent nature of a change in the substratum. The biotope is assessed to

have a **'High'** sensitivity to this pressure at the benchmark.

#### Physical change (to another sediment type)

**None**

Q: Low A: NR C: NR

**Very Low**

Q: High A: High C: High

**High**

Q: Low A: Low C: Low

*Cerianthus lloydii* is found in a very wide range of substrata (Tillin & Tyler-Walters, 2014), but only dominates the fauna in the mixed substrata biotope described in this biotope. A change in Folk class from mixed to coarse or sandy mud substrata would result in loss of the biotope, even though population of *Cerianthus lloydii* could remain. *Nemertesia antennina* and other hydroids are only found attached to large pebbles and cobbles within SS.SMx.CMx.CIlOMx.Nem. A reduction in the presence of cobbles and pebbles due to a change in sediment type would also reduce the abundance of the characteristic hydroids.

**Sensitivity assessment.** A change in the substratum by one Folk class would result in the loss of the biotope. Therefore, a resistance of **'None'** is recorded. As resilience is **'Very low'** (the pressure is a permanent change), sensitivity is, therefore, **'High'**.

#### Habitat structure changes - removal of substratum (extraction)

**None**

Q: Low A: NR C: NR

**Low**

Q: Medium A: Low C: Low

**High**

Q: Low A: Low C: Low

Resistance is assessed as **'None'** based on expert judgment but supported by the literature relating to the position of these species on or within the seabed. At the pressure benchmark, the exposed sediments are considered suitable for recolonization almost immediately following extraction. Recovery will be mediated by the scale of the disturbance and the suitability of the sedimentary habitat. Recovery is most likely to occur via larval recolonization. Resilience is probably **'Low'**, so that sensitivity is assessed as **'High'**.

#### Abrasion/disturbance of the surface of the substratum or seabed

**Medium**

Q: Low A: Medium C: Medium

**Medium**

Q: Low A: Medium C: Medium

**Medium**

Q: Low A: Medium C: Medium

No direct evidence was found to assess the sensitivity *Cerianthus lloydii* to surface abrasion. The burrowing life habit of the species specifically assessed would confer some protection from surface disturbance although individuals would be more exposed when close to the surface feeding. *Cerianthus lloydii* inhabits a soft tube, which can be up to 40 cm long and is permanently buried. The anemone can move freely within the tube and can retract swiftly if required (Tillin & Tyler-Walters, 2014).

The available evidence indicates that hydroids can be entangled and removed by abrasion. Drop down video surveys of Scottish reefs exposed to trawling showed that visual evidence of damage to bryozoans and hydroids on rock surfaces was generally limited and restricted to scrape scars on boulders (Boulcott & Howell, 2011). The study showed that damage is incremental with damage increasing with the frequency of trawls rather than a blanket effect occurring on the pass of the first trawls.

Re-sampling of grounds that were historically studied (from the 1930s) indicates that some species have increased in areas subject to scallop fishing (Bradshaw *et al.*, 2002). This study also found

(unquantified) increase in abundance of tough stemmed hydroids including *Nemertesia* spp.; its morphology may have prevented excessive damage. Bradshaw *et al.* (2002) suggested that as well as having high resistance to abrasion pressures, *Nemertesia* spp. have benthic larvae that could rapidly colonize disturbed areas with newly exposed substrata close to the adult. Hydroids may also recover rapidly as the surface covering of hydrorhizae may remain largely intact, from which new uprights are likely to grow. In addition, the resultant fragments of colonies may be able to develop into new colonies.

Hydroid colonies were still present in the heavily fished area, albeit at lower densities than in the closed area. This may largely be because the Isle of Man scallop fishery is closed from 1<sup>st</sup> June to 31<sup>st</sup> October (Andrews *et al.*, 2011), so at the time the samples were taken for the study in question, the seabed had been undredged for at least 3.5 months. The summer period is also the peak growing/breeding season for many marine species. (Bradshaw *et al.*, 2003)

**Sensitivity assessment.** Abrasion at the surface only is considered likely to damage and remove epiphytic species. *Cerianthus lloydii* has the ability to retract into its tube. However, there is the possibility of the tube being damaged, which could affect the health of the organism. The resistance of the biotope is assessed as '**Medium**', although the significance of the impact for the bed will depend on the spatial scale of the pressure footprint. Resilience is assessed as '**Medium**' (2-10 years), and sensitivity is assessed as '**Medium**'.

#### Penetration or disturbance of the substratum subsurface

**Low**

Q: Low A: Medium C: Medium

**Medium**

Q: Low A: Medium C: Medium

**Medium**

Q: Low A: Medium C: Medium

Penetration and or disturbance of the substratum would result in similar results as abrasion or removal of this biotope. Damage to *Cerianthus lloydii* would be greater within this pressure, as their ability to retract within their tubes would be limited.

**Sensitivity assessment.** The resistance of the biotope is assessed as '**Low**', although the significance of the impact for the bed will depend on the spatial scale of the pressure footprint. Resilience is assessed as '**Medium**', and sensitivity is assessed as '**Medium**'.

#### Changes in suspended solids (water clarity)

**High**

Q: Low A: NR C: NR

**High**

Q: High A: High C: High

**Not sensitive**

Q: Low A: Low C: Low

An increase in suspended sediment may have a deleterious effect on the suspension feeding community. It is likely to clog their feeding apparatus to some degree, resulting in a reduced ingestion over the benchmark period and, subsequently, a decrease in growth rate (Jackson, 2004). As the hydroids capture small prey in suspension (Gili & Hughes, 1995), a reduction in feeding efficiency could potentially lead to a reduction in overall biomass.

No evidence on the effect of a change in turbidity on *Cerianthus lloydii* could be found. *Nemertesia ramosa* is a passive suspension feeder, extracting seston from the water column. Increased siltation may clog up the feeding apparatus, requiring energetic expenditure to clear. Recovery is likely to take only a few days. (Jackson, 2004). A decrease in suspended sediment is likely to benefit the community associated with this biotope. The suspension feeders may be able to feed more efficiently due to a reduction in time and energy spent cleaning feeding apparatus. Over the course of the benchmark, the hydroids may increase in abundance.

**Sensitivity assessment.** No directly relevant evidence was found to assess the effect of pressure. Resistance to this pressure is assessed as '**High**' as an increase in turbidity may influence feeding and growth rates but not result in mortality of adults. Resilience is assessed as '**High**' (by default) and the biotope is assessed as '**Not sensitive**' to changes in turbidity at the benchmark level.

#### Smothering and siltation rate changes (light)

**Medium**

Q: **Medium** A: **Low** C: **Low**

**Medium**

Q: **Low** A: **Medium** C: **Medium**

**Medium**

Q: **Low** A: **Low** C: **Low**

In normal accretion, *Cerianthus lloydii* keeps pace with the accretion and, as a result, develops burrows much larger than the animal itself (Schäfer, 1972; Bromley, 2012). Schäfer (1972) reported that an increase in depositional rate led to an avoidance behaviour in *Cerianthus lloydii*. The organism ceases tube building activity and instead the animal bunches its tentacles and intrudes its way up to the new surface, where it establishes a new burrow. However, no information on the depth of material through which it can burrow was given.

In general, it appears that hydroids are sensitive to silting (Boero, 1984; Gili & Hughes, 1995) and the decline of beds in the Wadden Sea have been linked to environmental changes including siltation. Round *et al.*, 1961 reported that the hydroid *Sertularia* (now *Amphisbetia*) *operculata* died when covered with a layer of silt after being transplanted to sheltered conditions. Boero (1984) suggested that deepwater hydroid species develop upright, thin colonies that accumulate little sediment, while species in turbulent water movement were adequately cleaned of silt by water movement. Hughes (1977) found that maturing hydroids that had been smothered with detritus and silt lost most of the hydrocladia and hydranths. After one month, the hydroids were seen to have recovered but although neither the growth rate nor the reproductive potential appeared to have been affected, the viability of the planulae may have been affected. *Nemertesia ramosa* is an upright hydroid with a height of up to 15 cm. The colony structure is fairly tough and flexible. Smothering with 5 cm of sediment may cover over some individuals; others may just have the lower section of the main stem covered (Hayward & Ryland, 1994).

**Sensitivity assessment.** *Cerianthus lloydii* will actively burrow up through sediment that has smothered the entrance to its burrow. The thickness of sediment through which *Cerianthus lloydii* is able to burrow is not known. Smothering by 5 cm of sediment is likely to cause some mortality of *Cerianthus lloydii*. It may be possible for fully grown adults to burrow through the sediment, however, the confidence in this assessment is low. This pressure will also influence the hydroid species within SS.SMx.CMx.CIlloMx.Nem. Given the information available, the resistance to this pressure is considered to be '**Medium**', as is the resilience, and sensitivity is assessed as '**Medium**' at the benchmark.

#### Smothering and siltation rate changes (heavy)

**Low**

Q: **Low** A: **NR** C: **NR**

**Medium**

Q: **Low** A: **Medium** C: **Medium**

**Medium**

Q: **Low** A: **Low** C: **Low**

In normal accretion, *Cerianthus lloydii* keeps pace with the accretion and, as a result, develops burrows much larger than the animal itself (Schäfer, 1972; Bromley, 2012). Schäfer (1972) reported that an increase in depositional rate led to an avoidance behaviour in *Cerianthus lloydii*. The organism ceases tube building activity and instead the animal bunches its tentacles and intrudes its way up to the new surface, where it establishes a new burrow. However, no information on the depth of material through which it can burrow was given.

In general, it appears that hydroids are sensitive to silting (Boero, 1984; Gili & Hughes, 1995) and

the decline of beds in the Wadden Sea have been linked to environmental changes including siltation. Round *et al.* (1961) reported that the hydroid *Sertularia* (now *Amphisbetia*) *operculata* died when covered with a layer of silt after being transplanted to sheltered conditions. Boero (1984) suggested that deepwater hydroid species develop upright, thin colonies that accumulate little sediment, while species in turbulent water movement were adequately cleaned of silt by water movement. Hughes (1977) found that maturing hydroids that had been smothered with detritus and silt lost most of the hydrocladia and hydranths. After one month, the hydroids were seen to have recovered but although neither the growth rate nor the reproductive potential appeared to have been affected, the viability of the planulae may have been affected. *Nemertesia ramosa* is an upright hydroid with a height of up to 15 cm and *Nemertesia antennina* grows up to 25 cm (Hayward & Ryland, 1994). The colony structure is fairly tough and flexible. Smothering with 30 cm of sediment will completely cover all individuals.

**Sensitivity assessment.** *Cerianthus lloydii* will actively burrow up through sediment that has smothered the entrance to its burrow. The thickness of sediment through which *Cerianthus lloydii* is able to burrow is not known. However, at a maximum body length of 15 cm, a deposit of 30 cm is a considerable amount of sediment to burrow through. The level of energy expenditure needed to burrow through this amount of sediment may be too much for some individuals, and there will be a higher change of asphyxia due to the amount of time the organisms are buried. For these reasons smothering by 30 cm of sediment is likely to cause mortality of a large proportion of *Cerianthus lloydii*. At this pressure benchmark, the hydroid species within SS.SMx.CMx.CIloMx.Nem will all be totally smothered, which will result in their death. Given the information available, the resistance to this pressure is considered to be '**Low**', the resilience is probably '**Medium**', and sensitivity is assessed as '**Medium**' at the benchmark.

<b>Litter</b>	<b>Not Assessed (NA)</b> Q: NR A: NR C: NR	<b>Not relevant (NR)</b> Q: NR A: NR C: NR	<b>Not assessed (NA)</b> Q: NR A: NR C: NR
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Not assessed.

<b>Electromagnetic changes</b>	<b>No evidence (NEv)</b> Q: NR A: NR C: NR	<b>Not relevant (NR)</b> Q: NR A: NR C: NR	<b>No evidence (NEv)</b> Q: NR A: NR C: NR
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No evidence.

<b>Underwater noise changes</b>	<b>Not relevant (NR)</b> Q: NR A: NR C: NR	<b>Not relevant (NR)</b> Q: NR A: NR C: NR	<b>Not relevant (NR)</b> Q: NR A: NR C: NR
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Species characterizing this habitat do not have hearing perception but vibrations may cause a response. However, noise, as defined by the pressure, is probably 'Not relevant'.

<b>Introduction of light or shading</b>	<b>No evidence (NEv)</b> Q: NR A: NR C: NR	<b>Not relevant (NR)</b> Q: NR A: NR C: NR	<b>No evidence (NEv)</b> Q: NR A: NR C: NR
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No evidence.

**Barrier to species movement**

Not relevant (NR)

Q: NR A: NR C: NR

Not relevant (NR)

Q: NR A: NR C: NR

Not relevant (NR)

Q: NR A: NR C: NR

Not relevant – this pressure is considered applicable to mobile species, e.g. fish and marine mammals rather than seabed habitats. Physical and hydrographic barriers may limit propagule dispersal. But propagule dispersal is not considered under the pressure definition and benchmark.

**Death or injury by collision**

Not relevant (NR)

Q: NR A: NR C: NR

Not relevant (NR)

Q: NR A: NR C: NR

Not relevant (NR)

Q: NR A: NR C: NR

Not relevant' to seabed habitats. NB. Collision by grounding vessels is addressed under 'surface abrasion.

**Visual disturbance**

Not relevant (NR)

Q: NR A: NR C: NR

Not relevant (NR)

Q: NR A: NR C: NR

Not relevant (NR)

Q: NR A: NR C: NR

Not relevant.

** Biological Pressures**

Resistance

Resilience

Sensitivity

**Genetic modification & translocation of indigenous species**

No evidence (NEv)

Q: NR A: NR C: NR

Not relevant (NR)

Q: NR A: NR C: NR

No evidence (NEv)

Q: NR A: NR C: NR

Habitat restoration projects may translocate stock to re-populate areas of suitable habitat (Elsäßer *et al.*, 2013). No evidence was found for detrimental effects arising from this practice in the habitat, although there is potential for the movement of pathogens and non-indigenous, invasive species.

**Introduction or spread of invasive non-indigenous species**

No evidence (NEv)

Q: NR A: NR C: NR

Not relevant (NR)

Q: NR A: NR C: NR

No evidence (NEv)

Q: NR A: NR C: NR

There was 'No evidence' regarding known invasive species posing a threat to this biotope.

**Introduction of microbial pathogens**

No evidence (NEv)

Q: NR A: NR C: NR

Not relevant (NR)

Q: NR A: NR C: NR

No evidence (NEv)

Q: NR A: NR C: NR

No evidence was available on the effect of microbial pathogens on *Cerianthus lloydii*. Hydroids exhibit astonishing regeneration and rapid recovery from injury (Sparks, 1972) and the only inflammatory response is active phagocytosis (Tokin & Yarcheva, 1959; 1961, as cited in Sparks, 1972). No record of diseases in the characterizing hydroids could be found.

**Sensitivity assessment.** There was insufficient information to assess the effect of this pressure on the biotope. Therefore, an assessment of 'No evidence' has been given.



**Removal of target species**

Not relevant (NR)

Q: NR A: NR C: NR

Not relevant (NR)

Q: NR A: NR C: NR

Not relevant (NR)

Q: NR A: NR C: NR

**Sensitivity assessment.** None of the characterizing species within this biotope are currently directly targeted in the UK and hence this pressure is considered to be 'Not relevant'.

**Removal of non-target species**

Medium

Q: Low A: Medium C: Medium

Medium

Q: Low A: Medium C: Medium

Medium

Q: Low A: Medium C: Medium

Direct, physical impacts from harvesting are assessed through the abrasion and penetration of the seabed pressures. The characterizing species within this biotope could easily be incidentally removed from this biotope as by-catch when other species are being targeted. The loss of these species and other associated species would decrease species richness and negatively impact on the ecosystem function.

**Sensitivity assessment.** Removal of a large percentage of the characterizing species would alter the character of the biotope. The resistance to removal is 'Low' due to the easy accessibility of the biotopes location and the inability of these species to evade collection. The resilience is 'Medium' with recovery only being able to begin when the harvesting pressure is removed altogether. This gives an overall sensitivity score of 'Medium'.

## Bibliography

- Andrews J.W., B.A.R., Holt T.J., 2011. Isle of Man Queen Scallop Trawl and Dredge Fishery. MSC assessment report. pp.
- Berghahn, R. & Offermann, U., 1999. Laboratory investigations on larval development, motility and settlement of white weed (*Sertularia cupressina* L.) - in view of its assumed decrease in the Wadden Sea. *Hydrobiologia*, **392** (2), 233-239.
- Berrill, N.J., 1948. A new method of reproduction in *Obelia*. *Biological Bulletin*, **95**, 94-99.
- Berrill, N.J., 1949. The polymorphic transformation of *Obelia*. *Quarterly Journal of Microscopical Science*, **90**, 235-264.
- Beszczynska-Möller, A., & Dye, S.R., 2013. ICES Report on Ocean Climate 2012. In *ICES Cooperative Research Report*, vol. 321 pp. 73.
- Boero, F., 1984. The ecology of marine hydroids and effects of environmental factors: a review. *Marine Ecology*, **5**, 93-118.
- Borja, A., Franco, J. & Perez, V., 2000. A marine biotic index to establish the ecological quality of soft-bottom benthos within European estuarine and coastal environments. *Marine Pollution Bulletin*, **40** (12), 1100-1114.
- Boulcott, P. & Howell, T.R.W., 2011. The impact of scallop dredging on rocky-reef substrata. *Fisheries Research* (Amsterdam), **110** (3), 415-420.
- Bradshaw, C., Collins, P. & Brand, A., 2003. To what extent does upright sessile epifauna affect benthic biodiversity and community composition? *Marine Biology*, **143** (4), 783-791.
- Bradshaw, C., Veale, L.O., Hill, A.S. & Brand, A.R., 2002. The role of scallop-dredge disturbance in long-term changes in Irish Sea benthic communities: a re-analysis of an historical dataset. *Journal of Sea Research*, **47**, 161-184.
- Bromley, R.G., 2012. *Trace Fossils: Biology, Taxonomy and Applications*: Routledge.
- Cantero, Á.L.P., Carrascosa, A.M.G. & Vervoort, W., 2002. *The benthic hydroid fauna of the Chafarinas Islands (Alborán Sea, western Mediterranean)*: Nationaal Natuurhistorisch Museum.
- Cole, S., Codling, I.D., Parr, W. & Zabel, T., 1999. Guidelines for managing water quality impacts within UK European Marine sites. *Natura 2000 report prepared for the UK Marine SACs Project*. 441 pp., Swindon: Water Research Council on behalf of EN, SNH, CCW, JNCC, SAMS and EHS. [UK Marine SACs Project.], <http://www.ukmarinesac.org.uk/>
- Connor, D., Allen, J., Golding, N., Howell, K., Lieberknecht, L., Northen, K. & Reker, J., 2004. The Marine Habitat Classification for Britain and Ireland Version 04.05 JNCC, Peterborough. ISBN 1 861 07561 8.
- Connor, D.W., Brazier, D.P., Hill, T.O., & Northen, K.O., 1997b. Marine biotope classification for Britain and Ireland. Vol. 1. Littoral biotopes. *Joint Nature Conservation Committee, Peterborough, JNCC Report no. 229, Version 97.06., Joint Nature Conservation Committee, Peterborough, JNCC Report No. 230, Version 97.06.*
- Cornelius, P.F.S., 1992. Medusa loss in leptolid Hydrozoa (Cnidaria), hydroid rafting, and abbreviated life-cycles among their remote island faunae: an interim review.
- Cornelius, P.F.S., 1995a. *North-west European thecate hydroids and their medusae. Part 1. Introduction, Laodiceidae to Haleciidae*. Shrewsbury: Field Studies Council. [Synopses of the British Fauna no. 50]
- Diaz, R.J. & Rosenberg, R., 1995. Marine benthic hypoxia: a review of its ecological effects and the behavioural responses of benthic macrofauna. *Oceanography and Marine Biology: an Annual Review*, **33**, 245-303.
- Elsäßer, B., Fariñas-Franco, J.M., Wilson, C.D., Kregting, L. & Roberts, D., 2013. Identifying optimal sites for natural recovery and restoration of impacted biogenic habitats in a special area of conservation using hydrodynamic and habitat suitability modelling. *Journal of Sea Research*, **77**, 11-21.
- Faganeli, J., Avlin, A., Fanuko, N., Malej, A., Turk, V., Tušnik, P., Vrišer, B. & Vuković, A., 1985. Bottom layer anoxia in the central part of the Gulf of Trieste in the late summer of 1983. *Marine Pollution Bulletin*, **16**(2), 75-78.
- Gili, J-M. & Hughes, R.G., 1995. The ecology of marine benthic hydroids. *Oceanography and Marine Biology: an Annual Review*, **33**, 351-426.
- Gittenberger, A. & Van Loon, W.M.G.M., 2011. Common Marine Macrozoobenthos Species in the Netherlands, their Characteristics and Sensitivities to Environmental Pressures. GiMaRIS report no 2011.08. DOI: [10.13140/RG.2.1.3135.7521](https://doi.org/10.13140/RG.2.1.3135.7521)
- Hatcher, A.M., 1998. Epibenthic colonization patterns on slabs of stabilised coal-waste in Poole Bay, UK. *Hydrobiologia*, **367**, 153-162.
- Hayward, P.J. & Ryland, J.S. 1994. *The marine fauna of the British Isles and north-west Europe. Volume 1. Introduction and Protozoans to Arthropods*. Oxford: Clarendon Press.
- Hayward, P.J. & Ryland, J.S. (ed.) 1995a. *The marine fauna of the British Isles and north-west Europe. Volume 2. Molluscs to Chordates*. Oxford Science Publications. Oxford: Clarendon Press.
- Herreid, C.F., 1980. Hypoxia in invertebrates. *Comparative Biochemistry and Physiology Part A: Physiology*, **67** (3), 311-320.
- Hughes, R.G., 1977. Aspects of the biology and life-history of *Nemertesia antennina* (L.) (Hydrozoa: Plumulariidae). *Journal of the Marine Biological Association of the United Kingdom*, **57**, 641-657.
- Jackson, A. 2004. *Nemertesia ramosa*, A hydroid. In Tyler-Walters H. and Hiscock K. (eds) *Marine Life Information Network: Biology and Sensitivity Key Information Reviews* [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 02/03/16] Available from: <http://www.marlin.ac.uk/species/detail/1318>

- Jensen, A.C., Collins, K.J., Lockwood, A.P.M., Mallinson, J.J. & Turnpenny, W.H., 1994. Colonization and fishery potential of a coal-ash artificial reef, Poole Bay, United Kingdom. *Bulletin of Marine Science*, **55**, 1263-1276.
- JNCC, 2015. The Marine Habitat Classification for Britain and Ireland Version 15.03. (20/05/2015). Available from <https://mhc.jncc.gov.uk/>
- JNCC, 2015. The Marine Habitat Classification for Britain and Ireland Version 15.03. (20/05/2015). Available from <https://mhc.jncc.gov.uk/>
- Kosevich, I.A. & Marfenin, N.N., 1986. Colonial morphology of the hydroid *Obelia longissima* (Pallas, 1766) (Campanulariidae). *Vestnik Moskovskogo Universiteta Seriya Biologiya*, **3**, 44-52.
- Medel, M., García, F. & Vervoort, W., 1998. The family Haleciidae (Cnidaria: Hydrozoa) from the Strait of Gibraltar and nearby areas. *Zoologische Mededeelingen*, **72**, 29-50.
- MES, 2010. *Marine Macrofauna Genus Trait Handbook*. Marine Ecological Surveys Limited. <http://www.genustrait handbook.org.uk/>
- Orejas, C., Rossi, S., Peralba, À., García, E., Gili, J.M. & Lippert, H., 2012. Feeding ecology and trophic impact of the hydroid *Obelia dichotoma* in the Kongsfjorden (Spitsbergen, Arctic). *Polar biology*, **36** (1), 61-72.
- Palerud, R., Gulliksen, B., Brattegard, T., Sneli, J.-A. & Vader, W., 2004. The marine macro-organisms in Svalbard waters. A catalogue of the terrestrial and marine animals of Svalbard. *Norsk Polarinstitutt Skrifter*, **201**, 5-56.
- Rosenberg, R., Hellman, B. & Johansson, B., 1991. Hypoxic tolerance of marine benthic fauna. *Marine Ecology Progress Series*, **79**, 127-131.
- Round, F.E., Sloane, J.F., Ebling, F.J. & Kitching, J.A., 1961. The ecology of Lough Ine. X. The hydroid *Sertularia operculata* (L.) and its associated flora and fauna: effects of transference to sheltered water. *Journal of Ecology*, **49**, 617-629.
- Schäfer, H., 1972. *Ecology and palaeoecology of marine environments*, 568 pp. Chicago: University of Chicago Press.
- Sommer, C., 1992. Larval biology and dispersal of *Eudendrium racemosum* (Hydrozoa, Eudendriidae). *Scientia Marina*, **56**, 205-211. [Proceedings of 2nd International Workshop of the Hydrozoan Society, Spain, September 1991. Aspects of hydrozoan biology (ed. J. Bouillon, F. Cicognia, J.M. Gili & R.G. Hughes).]
- Sparks, A., 1972. *Invertebrate Pathology Noncommunicable diseases*: Elsevier.
- Stachowitsch, M., 1992b. Benthic communities: eutrophication's memory mode. In *The Response of marine transitional systems to human impact: problems and perspectives for restoration* Proceedings of an International Conference, Bologna, Italy, 21-24 March, 1990, (ed. R.A. Vollenweider, R. Marchetti, & R. Viviani), pp.1017-1028. Amsterdam: Elsevier.
- Tillin, H. & Tyler-Walters, H., 2014. Assessing the sensitivity of subtidal sedimentary habitats to pressures associated with marine activities. Phase 2 Report – Literature review and sensitivity assessments for ecological groups for circalittoral and offshore Level 5 biotopes. JNCC Report No. 512B, 260 pp. Available from: [www.marlin.ac.uk/publications](http://www.marlin.ac.uk/publications)
- Witt, J., Schroeder, A., Knust, R. & Arntz, W.E., 2004. The impact of harbour sludge disposal on benthic macrofauna communities in the Weser estuary. *Helgoland Marine Research*, **58** (2), 117-128.