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

Sponges, cup corals and anthozoans on shaded or overhanging circalittoral rock

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/175]. All terms and the MarESA methodology are outlined on the website (https://www.marlin.ac.uk)

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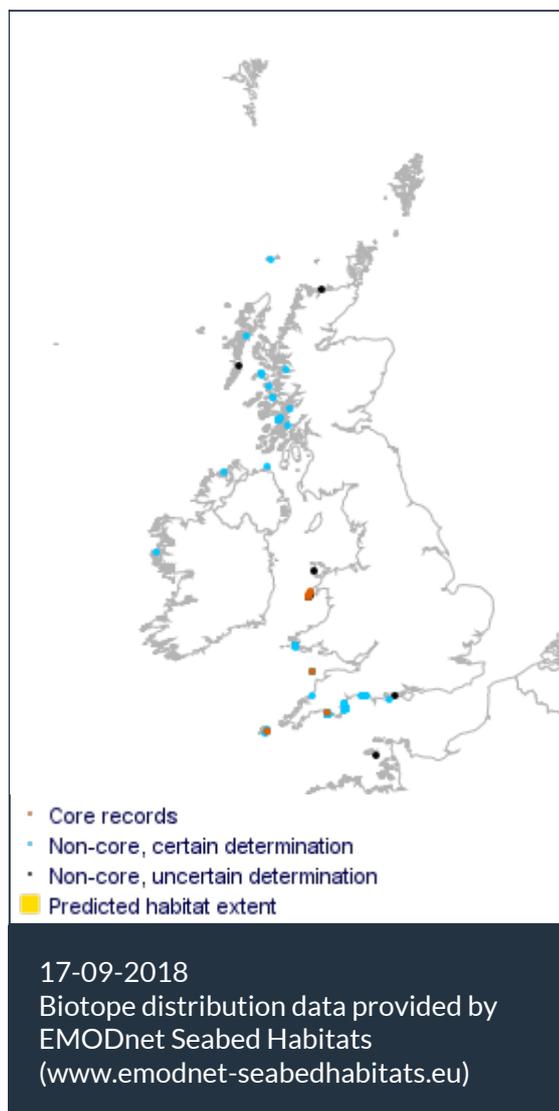
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Sponges, cup corals and anthozoans on shaded or overhanging circalittoral rock
Photographer: Keith Hiscock
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- Core records
- Non-core, certain determination
- Non-core, uncertain determination
- Predicted habitat extent

17-09-2018
Biotope distribution data provided by EMODnet Seabed Habitats (www.emodnet-seabedhabitats.eu)

Researched by	John Readman	Refereed by	Admin

Summary

☰ UK and Ireland classification

EUNIS 2008	A4.711	Sponges, cup corals and anthozoans on shaded or overhanging circalittoral rock
JNCC 2015	CR.FCR.Cv.SpCup	Sponges, cup corals and anthozoans on shaded or overhanging circalittoral rock
JNCC 2004	CR.FCR.Cv.SpCup	Sponges, cup corals and anthozoans on shaded or overhanging circalittoral rock
1997 Biotope	CR._.Cv.SCup	Sponges, cup corals and Parerythropodium coralloides on shaded or overhanging circalittoral rock

🏷 Description

This biotope occurs on shaded and overhanging rock, such as on cave walls and ceilings although there are very few records of caves in conditions not subject to wave surge (i.e. deeper circalittoral habitats) and almost all are different in species composition. There are also a few examples of

similar communities on very deep (70-100 m+) upward facing rock (in Loch Hourn) and more may be found though the use of ROVs. These often species-rich habitats are almost invariably adjacent to well-mixed turbulent water. Characteristic species include the sponges *Stryphnus ponderosus*, *Dercitus bucklandi*, *Chelonaplysilla noevus*, *Pseudosuberites* sp. and *Spongosorites* sp., the anemones *Parazoanthus* spp., the cup corals *Leptopsammia pruvoti*, *Hoplangia durotrix*, *Caryophyllia inornatus* and the soft coral *Alcyonium coralloides*. *Thymosia guernei* is sometimes present. Likely to need further splitting with analysis and data from west coast of Ireland. (Information from Connor *et al.*, 2004; JNCC, 2015).

↓ Depth range

10-20 m, 20-30 m

🏛 Additional information

-

✔ Listed By

- none -

❧ Further information sources

Search on:

G **g** **G** JNCC

Sensitivity review

Sensitivity characteristics of the habitat and relevant characteristic species

The CR.FCR.Cv biotope and its sub-biotope Cr.FCR.Cv.SpCup are defined by circalittoral shaded overhanging rock not subject to wave surge. There are few records of caves that are not subject to wave surge and almost all differ in species composition (Connor *et al.*, 2014). The biotope is characterized by a sponge community (including *Stryphnus ponderosus*, *Dercitus bucklandi*, *Chelonaplysilla noevus*, *Pseudosuberites* sp. and *Spongosorites* sp), anthozoans (such as *Parazoanthus* spp, *Leptopsammia pruvoti*, *Hoplangia durotrix*, *Caryophyllia inornatus*) and the soft coral *Alcyonium coralloides*. Given the variety and lack of information on some species, assessments may be quite general.

Resilience and recovery rates of habitat

Little information on sponge longevity and resilience exists. Reproduction can be asexual (e.g. budding) or sexual (Naylor, 2011) and individual sponges are usually hermaphrodites (Hayward & Ryland, 1994). Short-lived ciliated larvae are released via the aquiferous system of the sponges and metamorphosis follows settlement. Growth and reproduction are generally seasonal (Hayward & Ryland, 1994). Rejuvenation from fragments is also considered an important form of reproduction (Fish & Fish, 1996). Some sponges are known to be highly resilience to physical damage with an ability to survive severe damage, regenerate and reorganize to function fully again, however, this recoverability varies between species (Wulff, 2006).

Marine sponges often harbour dense and diverse microbial communities, which can include bacteria, archaea and single-celled eukaryotes (fungi and microalgae), and can comprise up to 40% of sponge volume, which may have a profound impact on host biology (Webster & Taylor, 2012). Many sponges recruit annually and growth can be rapid, with a lifespan of one to several years (Ackers, 1983). However, sponge longevity and growth has been described as highly variable depending on the species and environmental conditions (Lancaster *et al.*, 2014). It is likely that erect sponges are generally longer lived and slower growing given their more complex nature than smaller encrusting or cushion sponges.

Fowler & Lafoley (1993) monitored the marine nature reserves in Lundy and the Isles Scilly and found that a number of more common sponges showed great variation in size and cover during the study period. However, Fowler & Lafoley (1993) studied the deeper water sponges in Lundy and found that the growth rates for branching sponges were irregular, but generally very slow, with apparent shrinkage in some years (notably between 1985 and 1986). Monitoring studies at Lundy (Hiscock, 1994; Hiscock, 2003; Hiscock, pers comm) suggested that growth of Axinellid sponges to be no more than about 2 mm a year (up to a height of ca 300 mm) and that all branching sponges included in photographic monitoring over a period of four years exhibited very little or no growth over the study. In addition, no recruitment of *Axinellia dissimilis* or *Axinellia infundibuliformis* was observed, although 'several more' *Axinella damicornis* were noted between in 2010 compared to 1985 during monitoring in Lundy (Hiscock, 2011). Freese (2001) studied deep cold-water sponges in Alaska. Following an experimental trawl; 46.8% of sponges exhibited damage with 32.1% having been torn loose. None of the damaged sponges displayed signs of regrowth or recovery a year after the trawl event. This was in stark contrast to early work by Freese (1999) on warm shallow sponge communities, with impacts of trawling activity being much more persistent due to the slower growth/regeneration rates of deep, cold-water sponges. Given the slow growth rates and long lifespans of the rich, diverse fauna, it is likely to take many years for deep sponge communities

to recover if adversely affected by physical damage.

Leptopsammia pruvoti is thought to be slow-growing and long-lived. Recruitment is likely to be slow for a population at the northerly limit of its distribution, with failure probably due to the water temperature being unsuitable for promoting gamete production and/or the synchrony of gamete release (Irving, 2004). Fertilized eggs have been found to survive for up to six weeks in aquaria, though planula larvae are likely to settle close to the adults within 24 hours, increasing the likelihood of it becoming detached from the rock surface (Irving, 2004). Dioecious polyps of *Leptopsammia pruvoti* in the Mediterranean have been reported to be sexually mature at 3 mm in length and brood their larvae. The maturation of spermaries took 12 months and oocytes 24 months. Optimum gonad development was reported over winter (November to January). Subsequent fertilization occurred from January to April with planulation during May and June. Seasonal variations in water temperature and photoperiod may have played an important role in regulating reproductive events. Fecundity was reported as 36–105 mature oocytes/100 mm^3 of polyp, with an embryonic incubation period of between 1–4 months (Goffredo *et al*., 2006). However, only limited local recruitment has been recorded at Lundy during more than 12 years of monitoring and there has been no observation of colonization of wrecks or new natural surfaces near to existing colonies (Jackson, 2008). Irving (2004) noted very little new recruitment to populations in south-west Britain and the number of individuals was declining. Populations were found to have lost 8% of its individual corals between 1983 and 1990 and between 1984 and 1996 part of this same population had declined by 22%. In addition to being at the northern edge of its distribution limit, a number of organisms have been identified as possibly being responsible for the decline in the adult population. In particular, it is thought that certain boring organisms are capable of weakening the attachment of the adult skeleton to the substratum (Irving, 2004). While *Leptopsammia pruvoti* is unlikely to recover from significant removal, other characterizing anthozoans present in the biotope would likely be able to recruit and replace the species, maintaining the nature of the biotope.

Caryophyllia smithii is a small (max 3 cm across) solitary coral, common within tide swept sites of the UK (Wood, 2005), and distributed from Greece (Koukouras, 2010) to the Shetland Islands and Orkney (NBN, 2015; Wilson, 1975). It was suggested by Fowler & Laffoley (1993) that *Caryophyllia smithii* was a slow growing species (0.5-1 mm in horizontal dimension of the corallum per year), which in turn suggested that inter-specific spatial competition with colonial faunal or algae species were important factors in determining local abundance of *Caryophyllia smithii* (Bell & Turner, 2000). *Caryophyllia smithii* reproduces between January and March and spawning occurs from March to June (Tranter *et al*., 1982). The pelagic stage of the larvae may last up to 10 weeks, which provides this species with a good dispersal capability (Tranter *et al*., 1982). Asexual reproduction and division are also commonly observed (Hiscock & Howlett, 1976). Bell (2002) reported that juvenile *Caryophyllia smithii* has a varied morphology that gives them an advantage in colonizing a wide range of habitats. *Caryophyllia smithii* colonized the wreck of the *Scylla* within ca one year (Hiscock *et al*., 2010), however, this may be due to the time of the vessel sinking and if removed, recovery may take several years.

Resilience assessment. Deepwater sponges are likely to be longer lived but have slower growth and reproduction rates. Freese (2001) reported no recovery a year after a deep, cold water trawl event and long-term recovery was indeterminate but was considered likely to take many years. This conclusion is supported by monitoring work carried out in Lundy that found slow growth and limited reproduction of deep water sponges (Fowler & Laffoley, 1993; Hiscock, 2011). While limited recovery of *Leptopsammia pruvoti* has been noted around Lundy (possible due to being close to its northerly distribution limit), other anthozoans would probably replace this species if lost and

the nature of the biotope would not be changed. Growth and recruitment for other cup corals, whilst slow, is likely to be comparable or more rapid than that of the deep water sponges. Based on the resilience of the sponges, if the community were significantly or completely removed from the habitat (resistance of 'None' or 'Low') resilience is assessed as '**Low**' (recovery within 10-25 years). If resistance is assessed as 'Medium' then resilience is assessed as '**Medium**' (recovery within 2-10 years).   A lack of species specific evidence for the sponges results in a 'Low' confidence score.

⚓ Hydrological Pressures

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

Berman *et al.* (2013) monitored sponge communities off Skomer Island, UK over three years with all characterizing sponges for this biotope assessed. Seawater temperature, turbidity, photosynthetically active radiation and wind speed were all recorded during the study. It was concluded that, despite changes in species composition, primarily driven by the non-characterizing *Hymeraphia, Stellifera* and *Halicnemia patera*, no significant difference in sponge density was recorded in all sites studied. Morphological changes most strongly correlated with a mixture of water visibility and temperature. In addition, Goodwin *et al.* (2013) found little evidence to suggest that rising seawater temperatures (ca 1-2°C) had an effect on subtidal benthic assemblages in Northern Ireland between pre-1986 and post-2006 surveys. However, significant effects were noted in rarer species at the edge of the biogeographic ranges (Goodwin *et al.*, 2013).

Whilst *Dercitus bucklandi* is found from the Celtic Sea to southern Europe (Ackers *et al.*, 1992), the sponge is recorded as far north as the Outer Hebrides. *Chelonaplysilla noevusis* is found from the British Isles to the Mediterranean and the Canary Isles. *Stryphnus ponderosus* is found from Norway to southern Europe (Ackers *et al.*, 1992). *Parazoanthus anguicomus* is found across many parts of the north-east Atlantic and is probably widespread in deep water off the continental shelf. In the British Isles, it is found from western Ireland to northern Scotland (Manuel, 1988), with scattered records across the south-west of England (NBN, 2015). *Parazoanthus axinellae* is a more southerly distributed species and is found from the south-west coasts of the British Isles to the Mediterranean (Manuel, 1988). *Leptopsammia pruvoti* is commonly found in sea caves and under overhangs throughout the Mediterranean basin and along European coasts from Portugal to southern England (Goffredi *et al.*, 2006), while, *Hoplangia durotrix* is found from north and south coasts of Devon to Mediterranean and Canary Isles (Manuel, 1988).

Sensitivity assessment. All the characterizing sponges have been reported from the north to the south of the British Isles (NBN, 2015). A number of the characterizing species have a southerly distribution. Given the variety of characterizing species, decline or loss of some species may not have a significant effect on the nature of the biotope. Resistance is assessed as **'High'**, resilience as **'High'** and the biotope is '**Not sensitive**' at the benchmark level.

Temperature decrease (local)	Medium	Medium	Medium
	Q: Medium A: Low C: Medium	Q: Low A: Low C: Low	Q: Low A: Low C: Low

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concluded that, despite changes in species composition, primarily driven by the non-characterizing *Hymeraphia, Stellifera* and *Halicnemia patera*, no significant difference in sponge density was recorded in all sites studied. Morphological changes most strongly correlated with a mixture of water visibility and temperature. In addition, Goodwin *et al.* (2013) found little evidence to suggest that rising seawater temperatures (ca 1-2°C) had an effect on subtidal benthic assemblages in Northern Ireland between pre-1986 and post-2006 surveys. However, significant effects were noted in rarer species at the edge of the biogeographic ranges (Goodwin *et al.*, 2013).

All the characterizing sponges have been reported from the north to the south of the British Isles (NBN, 2015). Whilst *Dercitus bucklandi* is found from the Celtic Sea to southern Europe (Ackers *et al.*, 1992), Records exists of the sponge being found as far north as the Outer Hebrides. *Chelonaplysilla noevusis* is found from the British Isles to the Mediterranean and the Canary Isles. *Stryphnus ponderosus* is found from Norway to southern Europe (Ackers *et al.*, 1992*). Parazoanthus anguicomus* is found across many parts of the north-east Atlantic and is probably widespread in deep water off the continental shelf. In the British Isles, it is found from western Ireland to northern Scotland (Manuel, 1988), with scattered records across the south-west of England (NBN, 2015). *Parazoanthus axinellae* is a more southerly distributed species and is found from the south-west coasts of the British Isles to the Mediterranean (Manuel, 1988). *Leptopsammia pruvoti* is commonly found in sea caves and under overhangs throughout the Mediterranean basin and along European coasts from Portugal to southern England (Goffredi *et al.*, 2006). H*oplangia durotrix* is found from north and south coasts of Devon to Mediterranean and Canary Isles (Manuel, 1988)

Sensitivity assessment. There is evidence of sponge mortality at extremely low temperatures in the British Isles. Combined with evidence that a number of the species in this biotope have a mainly southern distribution, some mortality is likely. The circalittoral nature of the biotope may afford some resistance to short-lived temperature events. Therefore, resistance is assessed as '**Medium'** with a resilience of '**Medium'** and sensitivity is assessed as '**Medium**' at the benchmark level.

Salinity increase (local)	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

The biotope occurs in full salinity, circalittoral environments and an increase at the benchmark level (40 ppt or greater) is unlikely. However, hypersaline water is likely to sink to the seabed and the biotope could be affected by hypersaline effluents (brines). Ruso *et al.* (2007) reported that changes in the community structure of soft sediment communities due to desalinisation plant effluent in Alicante, Spain. In particular, in close vicinity to the effluent, where the salinity reached 39 psu, the community of polychaetes, crustaceans and molluscs was lost and replaced by one dominated by nematodes. Roberts *et al.* (2010b) suggested that hypersaline effluent dispersed quickly but was more of a concern at the seabed and in areas of low energy where widespread alternations in the community of soft sediments were observed. In several studies, echinoderms and ascidians were amongst the most sensitive groups examined (Roberts *et al.*, 2010b).

Nevertheless, '**No evidence'** for the characterizing species in hypersaline conditions was found.

Salinity decrease (local)	Low	Low	High
	Q: Low A: NR C: NR	Q: Low A: Low C: Low	Q: Low A: Low C: Low

The biotope occurs in full salinity, circalittoral environments and a decrease at the benchmark

level to variable salinity (18-35 ppt) is unlikely. The sponges *Stryphnus ponderosus*, *Dercitus bucklandi*, *Chelonaplysilla noevus* and the anthozoans *Parazoanthus anguicomus*, *Parazoanthus axinellae*, *Leptopsammia pruvoti* and *Hoplangia durotrix* have only been recorded as occurring in full salinity biotopes (Connor *et al.*, 2004). Therefore, whilst there is no specific evidence for salinity tolerance in the characterizing species, resistance is likely to be **'Low'**. Hence, resilience is assessed as **'Low'** and sensitivity as **'High'**.

Water flow (tidal current) changes (local)	Medium	Medium	Medium
	Q: Low A: NR C: NR	Q: Low A: Low C: Low	Q: Low A: Low C: Low

Riisgard *et al.* (1993) discussed the low energy cost of filtration for sponges and concluded that passive current-induced filtration may be insignificant for sponges. Pumping and filtering occur in choanocyte cells that generate water currents in sponges using flagella (De Vos *et al.*, 1991). In flume experiments, Hiscock (1983) noted that the tentacles of *Caryophyllia smithii* were displaced by currents over ca 0.5 m/s but withdrawn at 0.75 m/s and took several hours to re-emerge after cessation of strong flow. Hiscock (1983) noted that *Caryophyllia smithii* was most abundant is semi-exposed and sheltered habitats. The other cup corals (*Balanophyllia regia*, *Hoplangia durotrix* and *Leptopsammia pruvoti*) were recorded from weak and very weak tidal streams in cave and overhang biotopes (Connor *et al.*, 2004).

Sensitivity assessment. The biotope (CR.FCR.Cv) and its sub-biotope (CR.FCR.Cv.SpCup) are characterized by low energy (moderate to negligible tidal flows (0-1.5 m/sec) and a significant increase would probably result in a fundamental change to the nature of the community, such as an increase in the abundance of bryozoan and hydroid turfs, and hence reclassification would be required. A decrease in water flow is probably 'not relevant' as the biotopes occur in weak or negligible flow. However, an increase in the flow of 0.1-0.2 m/s (the benchmark level) may increase the abundance of bryozoan turfs and reduce the abundance of cup corals, especially in caves and overhangs that otherwise experience negligible flow. Therefore, a precautionary resistance of **'Medium'** is suggested to represent minor changes in the community. Hence, resilience is assessed as **'Medium'** and sensitivity as **'Medium'** at the benchmark level. Nevertheless, Connor *et al.* (2004) noted that the species composition varies between records of the biotope, which may imply subtle differences in community with local environmental parameters such as water flow and turbidity.

Emergence regime changes	Not relevant (NR)	Not relevant (NR)	Not relevant (NR)
	Q: NR A: NR C: NR	Q: NR A: NR C: NR	Q: NR A: NR C: NR

Changes in emergence are **'Not relevant'** to this biotope as it is restricted to fully subtidal/circalittoral condition. The pressure benchmark is relevant only to littoral and shallow sublittoral fringe biotopes.

Wave exposure changes (local)	High	High	Not sensitive
	Q: Low A: NR C: NR	Q: High A: High C: High	Q: Low A: Low C: Low

This biotope is defined as occurring in caves and gullies that are not subject to wave surge. Wave action is attenuated with depth, and the depth at which the biotopes occur and their aspect to incoming waves offer resistance to wave effects. For example, these biotopes (CR.FCR.Cv and CR.FCR.CV.SpCup) occur in a range of wave exposures from very exposed to sheltered conditions, and yet, are not subject to wave surge. Therefore, they probably occur in areas of circalittoral rock

and caves protected from the direct effect of wave action.

A significant increase in wave action in their locality may result in a fundamental change to the nature of the biotope and hence reclassification. However, an increase in wave exposure at the benchmark level (a 3-5% change in significant wave height) is unlikely to alter the biotope. Therefore, resistance is as '**High**', resilience as '**High**', and the biotope is assessed as '**Not sensitive**' at the benchmark level.

⚗ Chemical Pressures

	Resistance	Resilience	Sensitivity
Transition elements & organo-metal 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

Whilst some sponges, such as *Cliona* spp. have been used to monitor heavy metals by looking at the associated bacterial community (Marques *et al.*, 2007; Bauvais *et al.*, 2015), no literature on the effects of transition element or organo-metal pollutants on the characterizing sponges could be found.

Nevertheless, this pressure is **Not assessed** but evidence is presented where available.

Hydrocarbon & PAH 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.

Oil pollution is mainly a surface phenomenon its impact upon circalittoral turf communities is likely to be limited. However, as in the case of the *Prestige* oil spill off the coast of France, high swell and winds can cause oil pollutants to mix with the seawater and potentially negatively affect sub-littoral habitats (Castège *et al.*, 2014). Filter feeders are highly sensitive to oil pollution, particularly those inhabiting the tidal zones which experience high exposure and show correspondingly high mortality, as are bottom dwelling organisms in areas where oil components are deposited by sedimentation (Zahn *et al.*, 1981).

Zahn *et al.* (1981) found that *Tethya lyncurium* concentrated BaP (benzo[a]pyrene)to 40 times the external concentration and no significant repair of DNA was observed in the sponges, which, in higher animals, would likely lead to cancers. As sponge cells are not organized into organs the long-term effects are uncertain (Zahn *et al.*, 1981).

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**' was found.

Introduction of other substances	Not Assessed (NA)	Not assessed (NA)	Not assessed (NA)
	Q: NR A: NR C: NR	Q: NR A: NR C: NR	Q: NR A: NR C: NR

This pressure is **Not assessed**.

De-oxygenation	Low	Low	High
	Q: Medium A: Low C: Medium	Q: Low A: Low C: Low	Q: Low A: Low C: Low

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) suggested possible adverse effects on marine species below 4 mg/l and probable adverse effects below 2 mg/l.

Hiscock & Hoare (1975) reported an oxycline forming in the summer months (Jun-Sep) in a quarry lake (Abereiddy, Pembrokeshire) from close to full oxygen saturation at the surface to <5% saturation below ca 10 m. No sponges were recorded at depths below 10 - 11 m. Demosponges maintained under laboratory conditions can tolerate hypoxic conditions for brief periods, (Gunda & Janapala, 2009) investigated the effects of variable dissolved oxygen (DO) levels on the survival of the marine sponge, *Haliclona pigmentifera*. Under hypoxic conditions (1.5-2.0 ppm O_2), *Haliclona pigmentifera* with intact ectodermal layers and subtle oscula survived for 42 ± 3 days. Sponges with prominent oscula, foreign material, and damaged pinacoderm exhibited poor survival (of 1-9 days) under similar conditions. Complete mortality of the sponges occurred within 2 days under anoxic conditions (<0.3 ppm O_2). Shiaparelli *et al.* (2007) described the decline of *Leptopsammia pruvoti* by 85% of specimens following an anoxic event caused by decomposing mucilage. Bell (2002) reported that an oxycline at Lough Hyne (<5% surface concentration) limited vertical colonization by *Caryophillia smithii*.

Sensitivity assessment. Whilst some sponges have demonstrated tolerance to short-term hypoxic events, it is likely that significant mortality to the biotope community would occur. Given the low energy nature of biotope, recovery to typical oxygen levels is likely to be protracted. Therefore, resistance is assessed as '**Low**', resilience as '**Low**' and sensitivity assessed as '**High**' at the benchmark level.

Nutrient enrichment	Not relevant (NR)	Not relevant (NR)	Not sensitive
	Q: NR A: NR C: NR	Q: NR A: NR C: NR	Q: NR A: NR C: NR

This pressure relates to increased levels of nitrogen, phosphorus and silicon in the marine environment compared to background concentrations. The benchmark is set at compliance with WFD criteria for good status, based on nitrogen concentration (UKTAG, 2014).

'**Not sensitive**' at the pressure benchmark that assumes compliance with good status as defined by the WFD.

Organic enrichment	High	High	Not sensitive
	Q: Low A: NR C: NR	Q: High A: High C: High	Q: Low A: Low C: Low

Organic enrichment leads to organisms no longer being limited by the availability of organic carbon. The consequent changes in ecosystem function can lead to the progression of eutrophic symptoms (Bricker *et al.*, 2008), changes in species diversity and evenness (Johnston & Roberts, 2009) and decreases in dissolved oxygen and uncharacteristic microalgae blooms (Bricker *et al.*, 1999, 2008). Indirect adverse effects associated with organic enrichment include increased turbidity, increased suspended sediment and the increased risk of deoxygenation. Rose & Risk (1985) described an increase in the abundance of the sponge *Cliona delitrix* in an organically polluted section of Grand Cayman fringing reef affected by the discharge of untreated faecal sewage. De Goeij *et al.* (2008) used ^{13}C to trace the fate of dissolved organic matter in the coral reef sponge *Halisarca caerulea.* Biomarkers revealed that the sponge incorporated dissolved organic matter through both bacteria mediated and direct pathways, suggesting that it feeds, directly and indirectly, on dissolved organic matter.

Sensitivity assessment. The above evidence suggests that resistance to this pressure is '**High**'. Therefore, resilience is assessed as '**High**' and the biotope is assessed as **'Not sensitive'** at the benchmark level.

Ħ Physical Pressures

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

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

If rock were 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. Therefore, resistance to the pressure is considered '**None**', and resilience '**Very low**'. Sensitivity has been assessed as '**High**'.

Physical change (to another sediment type)	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 biotopes occurring on bedrock.

Habitat structure changes - removal of substratum (extraction)	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

The species characterizing this biotope are epifauna or epiflora occurring on rock and would be

sensitive to the removal of the habitat. However, extraction of rock substratum is considered unlikely and this pressure is considered to be '**Not relevant'** to hard substratum habitats.

Abrasion/disturbance of the surface of the substratum or seabed	Low	Low	High
	Q: High A: Low C: Medium	Q: Low A: Low C: Low	Q: Low A: Low C: Low

Van Dolah *et al.* (1987) studied the effects on sponges and corals of one trawl event over a low-relief hard bottom habitat off Georgia, US. The densities of individuals taller than 10 cm of three species of sponges in the trawl path and in adjacent control area were assessed by divers and were compared before, immediately after and 12 months after trawling. Of the total number of sponges remaining in in the trawled area, 32% were damaged. Most of the affected sponges were the barrel sponges *Cliona* spp., whereas *Haliclona oculta* and *Ircina campana* were not significantly affected. The abundance of sponges had increased to pre-trawl densities, or greater, 12 months after trawling.

Tilmant (1979) found that, following a shrimp trawl in Florida, the US, over 50% of sponges, including *Neopetrosia*, *Spheciospongia*, *Spongia* and *Hippiospongia*, were torn loose from the bottom. Highest damage incidence occurred to the finger sponge *Neopetrosia longleyi*. Size did not appear to be important in determining whether a sponge was affected by the trawl. Recovery was ongoing, but not complete 11 months after the trawl, although no specific data relating to the sponges are provided. Freese (2001) studied deep cold-water sponges in Alaska a year after a trawl event. 46.8% of sponges exhibited damage with 32.1% having been torn loose. None of the damaged sponges displayed signs of regrowth or recovery. This was in stark contrast to early work by Freese (1999) on warm shallow sponge communities, with impacts of trawling activity being much more persistent due to the slower growth/regeneration rates of deep, cold-water sponges. Given the slow growth rates and long lifespans of the rich, diverse fauna, it is likely to take many years for deep sponge communities to recover if adversely affected by physical damage.

Boulcott & Howell (2011) conducted experimental Newhaven scallop dredging over a circalittoral rock habitat in the sound of Jura, Scotland and recorded the damage to the resident community. Whilst the faunal crusts were surprisingly resistant to abrasion, the sponge *Pachymatisma johnstoni* was highly damaged by the experimental trawl. Picton & Goodwin (2007) noted that in their survey of sponges in Northern Ireland, that dredge damage was associated with a decline in sponge community and biomass. Coleman *et al.* (2013) described a 4 year study on the differences between a commercially potted area in Lundy with a no-take zone. No significant difference in *Axinellid* populations was observed. The authors concluded that the study indicated that lighter abrasion pressures, such as potting, were far less damaging than heavier gears, such as trawls.

Murillo *et al.* (2012) monitored sponge communities over 3 years, primarily composed of *Geoda* spp. and the characterizing *Stryphnus ponderosus*. It was noted that the average biomass per hectare swept was 2.7 times greater in lightly and untrawled grounds than in moderately trawled grounds and more than 100 times greater than the sponge biomass on heavily trawled grounds.

Sensitivity assessment. Whilst some of the characterizing sponges can be quite elastic, abrasion pressures, especially by heavy gears, have been shown to cause significant damage to the sessile epifaunal sponges. The presence of these biotopes (CR.FCR.CV and Cv.SpCup) on cave walls and ceiling, and overhangs may protect the habitat from trawling, it may be impacted by mooring chains or abraded by anthropogenic debris. Therefore, a precautionary resistance of **Low** is suggested. Hence, resilience is assessed as '**Low'** and sensitivity as '**High'.**

Penetration or disturbance of the substratum subsurface	Not relevant (NR)	Not relevant (NR)	Not relevant (NR)
	Q: NR A: NR C: NR	Q: NR A: NR C: NR	Q: NR A: NR C: NR

The species characterizing this biotope group are epifauna or epiflora occurring on rock, which is resistant to subsurface penetration. The assessment for abrasion at the surface only is, therefore, considered to equally represent sensitivity to this pressure. This pressure is thought '**Not Relevant'** to hard rock biotopes

Changes in suspended solids (water clarity)	High	High	Not sensitive
	Q: Low A: NR C: NR	Q: High A: High C: High	Q: Low A: Low C: Low

Whilst many sponges are disadvantaged by sedimentation (as would be expected, being sessile filter feeders), many examples exist of sponges adapting to sediment presence (Bell *et al.*, 2015; Schönberg, 2015) and many encrusting sponges appear to be able to survive in highly sedimented conditions, and, in fact, many species prefer such habitats (Bell & Barnes, 2001; Bell & Smith, 2004). Castric-Fey & Chassé (1991) conducted a factorial analysis of the subtidal rocky ecology near Brest, France and rated the distribution of species in varying turbidity (corroborated by the depth at which laminarians disappeared). *Cliona celata* and *Stelligera rigida* were classed as indifferent to turbidity, *Tethya citrina*, *Pachymatisma johnstonia* and *Polymastia boletiformis* (as *Polymastia robusta*) had a slight preference for clearer water, while *Dysidea fragilis*, *Polymastia mamillaris*, and *Raspailia ramosa* had a strong preference for turbid water.

Bell & Turner (2000) studied populations of *Caryophyllia smithii* at three sites of differing sedimentation regime in Lough Hyne, Ireland. Calyx size was largest at the site of least sedimentation and smallest at the site of most sedimentation. In contrast, the height of individuals was greatest at the site of most sedimentation and smallest at the site of least sedimentation. The height of individuals correlated with the level of surrounding sediment. High density was correlated with high sedimentation and depth (Bell & Turner, 2000).

Sensitivity assessment. CR.FCR.Cv occurs on bedrock in the circalittoral and is unlikely to experience highly turbid conditions. From the evidence presented above, the characterizing species tolerate some siltation and a change at the benchmark level is unlikely to cause mortality. Resistance is recorded as '**Hig**h', resilience as '**High**' and the biotope is '**Not sensitive**' at the benchmark level.

Smothering and siltation rate changes (light)	High	High	Not sensitive
	Q: Low A: NR C: NR	Q: High A: High C: High	Q: Low A: Low C: Low

Despite sediment being considered to have a negative impact on suspension feeders (Gerrodette & Flechsig 1979), many encrusting sponges appear to be able to survive in highly sedimented conditions, and, in fact, many species prefer such habitats (Bell & Barnes, 2001; Bell & Smith, 2004). However, Wulff (2006) described mortality in three sponge groups following four weeks of complete burial under sediment; 16% of *Amphimedon* biomass died compared with 40% and 47% in *Iotrochota* and *Aplysina* respectively. The complete disappearance of the 'sponges associated' with the sea squirt *Ascidiella aspersa* in the Black Sea near the Kerch Strait was attributed to siltation (Terent'ev, 2008 cited in Tillin & Tyler-Walters, 2014). It should also be noted that some of the characterizing sponges are likely to be buried in 5 cm of sediment deposition.

The cup corals tend to be small (approx. <3 cm height from the seabed) and would therefore likely be inundated in a "light" sedimentation event. However, Bell & Turner (2000) reported *Caryophyllia smithii* was abundant at sites of "moderate" sedimentation (7 mm ± 0.5 mm) in Lough Hyne. It is, therefore, possible that the cup corals would have some resistance to periodic sedimentation. Bell (2002) reported that juvenile *Caryophyllia smithii* are morphologically variable and initially undergo rapid growth with tall and thin forms in deeper, sheltered, relatively sedimented conditions near Lough Hyne, Ireland. It was concluded that this was to escape the thin layer of sediment present.

Sensitivity assessment. Whilst the biotope experiences negligible water movement and smothering would likely damage a number of characterizing species, CR.FCR.Cv and CR.FCR.Cv.SpCup occur on shaded overhanging rock, cave walls and ceilings and would, therefore, be protected from burial. The biotope is defined as being protected from wave surge and, being low energy, increased scour is unlikely to occur. Resistance at the benchmark has been assessed as '**High**', resilience as '**High**' and the biotope is assessed as **'Not sensitive'** at the benchmark level.

Smothering and siltation rate changes (heavy)	High	High	Not sensitive
	Q: Low A: NR C: NR	Q: High A: High C: High	Q: Low A: Low C: Low

Despite sediment being considered to have a negative impact on suspension feeders (Gerrodette & Flechsig 1979), many encrusting sponges appear to be able to survive in highly sedimented conditions, and, in fact, many species prefer such habitats (Bell & Barnes, 2001; Bell & Smith, 2004). However, Wulff (2006) described mortality in three sponge groups following four weeks of complete burial under sediment; 16% of *Amphimedon* biomass died compared with 40% and 47% in *Iotrochota* and *Aplysina* respectively. The complete disappearance of the 'sponges associated' with the sea squirt *Ascidiella aspersa* in the Black Sea near the Kerch Strait was attributed to siltation (Terent'ev, 2008 cited in Tillin & Tyler-Walters, 2014). It should also be noted that some of the characterizing sponges are likely to be buried in 5 cm of sediment deposition.

The cup corals tend to be small (approx. <3 cm height from the seabed) and would therefore likely be inundated in a "light" sedimentation event. However, Bell & Turner (2000) reported *Caryophyllia smithii* was abundant at sites of "moderate" sedimentation (7 mm ± 0.5 mm) in Lough Hyne. It is, therefore, possible that the cup corals would have some resistance to periodic sedimentation. Bell (2002) reported that juvenile *Caryophyllia smithii* are morphologically variable and initially undergo rapid growth with tall and thin forms in deeper, sheltered, relatively sedimented conditions near Lough Hyne, Ireland. It was concluded that this was to escape the thin layer of sediment present.

Sensitivity assessment. Whilst the biotope experiences negligible water movement and smothering would likely damage a number of characterizing species, CR.FCR.Cv and CR.FCR.Cv.SpCup occur on shaded overhanging rock, cave walls and ceilings and would, therefore, be protected from burial, except in examples at the base of walls. The biotope is defined as being protected from wave surge and, being low energy, increased scour is unlikely to occur. Therefore, resistance at the benchmark has been assessed as '**High**', resilience as '**High**' and the biotope is assessed as **'Not sensitive'** at the benchmark level.

Litter	Not Assessed (NA)	Not relevant (NR)	Not assessed (NA)
	Q: NR A: NR C: NR	Q: NR A: NR C: NR	Q: NR A: NR C: NR

Not assessed.

Electromagnetic changes	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 found.

Underwater noise changes	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

Whilst no evidence could be found for the effect of noise or vibrations on the characterizing species of these biotopes, it is unlikely that these species have the facility for detecting or noise vibrations. The pressure is considered to be '**Not relevant**' to this biotope.

Introduction of light or shading	High Q: Medium A: Low C: Medium	High Q: High A: High C: High	Not sensitive Q: Medium A: Low C: Medium

Jones *et al.* (2012) compiled a report on the monitoring of sponges around Skomer Island and found that many sponges, particularly encrusting species, preferred vertical or shaded bedrock to open, light surfaces. However, it is possible that this relates to decreased competition with algae. Whilst no evidence could be found for the effect of light on the characterizing species of these biotopes, it is unlikely that these species would be impacted. As a circalittoral biotope, a decrease in light is unlikely to be important, and an increase at the benchmark level is unlikely to be significant, as growth ceases for a number of red algae (such as *Chrondrus crispus*) below ca 1.0 μmol m^{-2}I^{-1} (ca 50 Lux).

Sensitivity assessment: Resistance to this pressure is assessed as '**High**' and resilience as '**High**'. This biotope is therefore considered to be '**Not sensitive**' at the benchmark level.

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

Barriers and changes in tidal excursion are '**Not relevant**' to biotopes restricted to open waters.

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)	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.

Introduction or spread of invasive non-indigenous species	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'** of Invasive Non-Indigenous Species (INIS) was found for this biotope. Due to the constant risk of new invasive species, the literature for this pressure should be revisited.

Introduction of microbial pathogens	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

Cerrano *et al.* (2006) described 'severe reduction' of the zoanthid *Parazoanthus axinellae* in the Ligurian Sea from an average colony size of 14.24 ± 5.79 cm^2 to 1.97±0.27 cm^2 over three years, with greatest loss attributed to a 'summer disease' associated with warm water and the massive proliferation of a cyanobacterium of the genus *Porphyrosiphon*. The encrusting sponge *Crambe crambe* rapidly colonized the abandoned substrata.

Gochfeld *et al.* (2012) found that diseased sponges hosted significantly different bacterial assemblages compared to healthy sponges, with diseased sponges also exhibiting a significant decline in sponge mass and protein content. Sponge disease epidemics can have serious long-term effects on sponge populations, especially in long-lived, slow-growing species (Webster, 2007). Numerous sponge populations have been brought to the brink of extinction including cases in the Caribbean with 70-95% disappearance of sponge specimens (Galstoff,1942), the Mediterranean (Vacelet,1994; Gaino *et al.*,1992). Decaying patches and white bacterial film were reported in *Haliclona oculata* and *Halichondria panicea* in North Wales, 1988-89, (Webster, 2007). Specimens of *Cliona* spp. have exhibited blackened damage since 2013 in Skomer. Preliminary results have shown that clean, fouled and blackened *Cliona* all have very different bacterial communities. The blackened *Cliona* are effectively dead and have a bacterial community similar to marine sediments. The fouled *Cliona* have a very distinct bacterial community which may suggest a specific pathogen caused the effect (Burton, pers comm; Preston & Burton, 2015).

Whilst evidence of sponge and anthozoan mortality due to disease exists, '**No evidence'** for the characterizing species in the British Isles was found.

Removal of target species	Not relevant (NR)	Not relevant (NR)	Not relevant (NR)
	Q: NR A: NR C: NR	Q: NR A: NR C: NR	Q: NR A: NR C: NR

No evidence of targeted removal (i.e. by commercial activties) of the characterizing species could found and the pressure is '**Not relevant'** to this biotope group.

Removal of non-target species	Low	Low	High
	Q: Low A: NR C: NR	Q: Low A: Low C: Low	Q: Low A: Low C: Low

The characteristic species probably compete for space within the biotope, so that loss of one species would probably have little if any effect on the other members of the community. However, it should be noted that several of the characteristic species can be epibiotic. Removal of the characteristic epifauna due to by-catch, while unlikely, could remove a proportion of the biotope and change the biological character of the biotope. These direct, physical impacts are assessed through the abrasion and penetration of the seabed pressures. The sensitivity assessment for this pressure considers any biological/ecological effects resulting from the removal of non-target species on this biotope. Whilst a large proportion of the sponge community is likely to be affected by abrasion events, there is some debate as it the level of effects depending on the size of the sponge and the type of abrasion effect (see Freese *et al.*, 1999, 2001; Coleman *et al.*, 2013).

Sensitivity assessment. Therefore, if a proportion of the resident community is removed as by-catch, resistance is assessed as '**Low**', resilience as **'Low'** and sensitivity assessed as **'High'.**

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