Cushion sponges, hydroids and ascidians on turbid tide-swept sheltered circalittoral rock

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

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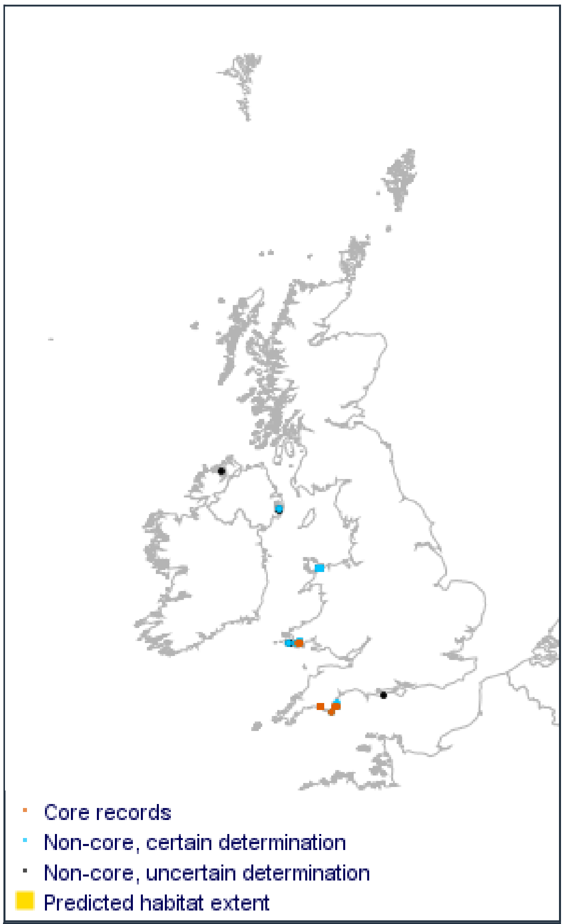

17-09-2018
Biotope distribution data provided by EMODnet Seabed Habitats (www.emodnet-seabedhabitats.eu)

Researched by John Readman **Refereed by** This information is not refereed.

Summary

UK and Ireland classification

EUNIS 2008	A4.2511	Cushion sponges, hydroids and ascidians on turbid tide-swept sheltered circalittoral rock
JNCC 2015	CR.MCR.CFaVS.CuSpH.As	Cushion sponges, hydroids and ascidians on turbid tide-swept sheltered circalittoral rock
JNCC 2004	CR.MCR.CFaVS.CuSpH.As	Cushion sponges, hydroids and ascidians on turbid tide-swept sheltered circalittoral rock
1997 Biotope		

Description

This biotope typically occurs in a mixture of turbid, full and variable salinity water, on wave-sheltered and moderately exposed bedrock or boulders. Tidal streams are typically moderately strong but may vary considerably. This biotope occurs in relatively shallow water (typically 5 m to 11 m water depth) and is dominated by cushion sponges, hydroids and ascidians. On the silty, rocky substrata, large growths of sponge are usually associated with this biotope (*Suberites ficus*, *Hymeniacidon perleve*, *Cliona celata*, *Halichondria panicea*, *Raspailia ramosa*). The tasselled form of *Amphilectus fucorum* is also notably present. Other epifauna present includes silty hydroids such as *Nemertesia antennina*, *Nemertesia ramosa*, *Plumularia setacea*, *Hydrallmania falcata* and *Halecium halecinum*. Individual colonies of dead mans fingers *Alcyonium digitatum* and plumose anemones *Metridium dianthus* may be seen attached to the tops of boulders and ridges. At some sites, whole sides of rocks may be colonized by the anemones *Sagartia elegans*, *Sagartia troglodytes* and *Actinothoe sphyrodeta*. Within crevices in the rocky substratum and at the base of boulders *Urticina felina* and *Cereus pedunculatus* may be found. Ascidians such as *Clavelina lepadiformis*, *Morchellium argus*, *Dendrodoa grossularia*, *Diplosoma listerianum* and *Distomus variolosus* may all be observed. Other ubiquitous species which may be recorded include *Polydora*, terebellid worms, *Balanus crenatus*, *Alcyonidium diaphanum* and *Asterias rubens*. (Information from Connor *et al*., 2004; JNCC, 2015).

Depth range

0-5 m, 5-10 m, 10-20 m

Additional information

-

Listed By

- none -

Further information sources

Search on:

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Sensitivity review

Sensitivity characteristics of the habitat and relevant characteristic species

The CR.MCR.CFaVS biotope complex occurs on wave-sheltered, full or variable salinity bedrock and cobbles, subject to moderately strong to weak tidal streams and is characterized by its sponge communities comprised of species that are able to tolerate the variable salinity conditions, including *Hymeniacidon perleve*, *Suberites ficus*, *Halichondria panicea*, *Halichondria bowerbanki*, *Cliona celata* and *Leucosolenia botryoides* (Connor *et al*., 2004). The biotope complex is split between the sparse CR.MCR.CFaVS.HbowEud and the more diverse CR.MCR.CFaVS.CuSpH complex. Their sensitivities are probably similar. Therefore, they were reviewed as a group, and the resultant biotope reviews and sensitivity assessments presented separately.

CR.MCR.CFaVS.CuSpH is found in variable salinity environments and tends to occur on the upper faces of circalittoral bedrock and boulders, in sheltered sites subject to moderately strong tidal streams. It is characterized by cushion sponges such as *Hymeniacidon perleve*, *Halichondria panicea*, *Halichondria bowerbanki* and *Cliona celata* with occasional hydroid tufts of *Nemertesia antennina*, *Nemertesia ramosa* and *Plumularia setacea*. This biotope is further split into CR.MCR.CFaVS.CuSpH.As and CR.MCR.CFaVS.CuSpH.Vs (Connor *et al*., 2004). CR.MCR.CFaVS.CuSpH.As occurs in relatively shallow water (typically 5 m to 11 m water depth) and is dominated by a diverse range of cushion sponges, hydroids, and ascidians. It is characterized by large growths of sponge, with species including *Suberites ficus*, *Hymeniacidon perleve*, *Cliona celata*, *Halichondria panicea*, *Raspailia ramosa* and *Amphilectus fucorum* (previously *Esperiopsis fucorum*). Other epifauna present includes silty hydroids such as *Nemertesia antennina*, *Nemertesia ramosa*, *Plumularia setacea*, *Hydrallmania falcata* and *Halecium halecinum*. Ascidians such as *Clavelina lepadiformis*, *Morchellium argus*, *Dendrodoa grossularia*, *Diplosoma listerianum* and *Distomus variolosus* may all be observed (Connor *et al*., 2004). CR.MCR.CFaVS.CuSpH.VS is closely related to CR.MCR.CFaVS.CuSpH.As, but occurs in areas that experience more turbid, lower salinity seawater and has a lower diversity of species. *Halichondria panicea* and *Halichondria bowerbanki* almost entirely cover the bedrock. Other sponges (including *Haliclona oculata*, *Suberites ficus*, and *Leucosolenia botryoides*), various hydroids such as Eudendrium spp., *Plumularia setacea*, *Nemertesia antennina*, *Nemertesia ramosa* and various bryozoans such as *Crisularia plumosa*, *Bugulina turbinata* and *Bowerbankia pustulosa* protrude through the *Halichondria* spp. sponge growth. It is also similar to CR.MCR.CFaVS.HbowEud, although the latter lacks the diversity of hydroid species (Connor *et al*., 2004).

The biotopes host a large diversity of species. Therefore, the sensitivity is based on the important characterizing taxonomic and functional groups, that is, the hydroids and cushion sponges. The sensitivity of other species is discussed where relevant. **Please note.** The resistance, resilience and, hence, sensitivity assessments may vary with habitat and the **explanatory text for each assessment must be consulted** before use.

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, but 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), can comprise up to 40% of sponge volume, and 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 have 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. Large colonies appeared and vanished at some locations. Some large encrusting sponges went through periods of both growth and shrinkage, with considerable changes taking place from year to year. For example, *Cliona celata* colonies generally grew extremely rapidly, doubling their size or more each year, but in some years an apparent shrinkage in size also took place. In contrast, there were no obvious changes in the cover of certain unidentified thin encrusting sponges. *Cliona celata* occurs on rock and begins as boring sponge, but can become massive and lobose with rounded ridges up to 40 cm across. It can withstand sediment (Ackers *et al*., 1992). *Hymeniacidon perleve* is found in thin sheets, cushions and rarely as erect and branching. It is found from the Arctic to the Mediterranean from the littoral to the circalittoral (Ackers *et al*., 1992). *Leucosolenia botryoides* usually occurs in mixed sediments, on shells and ascidians, on horizontal rock and is often found in sea lochs. It has been recorded as half buried in mud and sediment and is found from the Arctic to the Mediterranean. (Ackers *et al*., 1992). *Suberites ficus* is encrusting to massive and lobose, firm and moderately elastic. It is found across the Arctic and Atlantic (Ackers *et al*., 1992). *Raspalia ramosa* is a branching sponge that is firm and elastic, however, the soft layer is easily rubbed from the strong axial core. It is found on sublittoral rock and boulders from moderately exposed sites to sheltered sites with some tidal current and it tolerates some silt (Ackers *et al*., 1992). *Raspailia ramosa* spawns in September (Lévi, 1956, cited from Van Soest, 2000).

Amphilectus fucorum (syn. *Esperiopsis fucorum*) is found in wide variety of situations and is distributed across the Atlantic coasts of Europe, from Norway to France (Ackers *et al*., 1992). Picton & Morrow (2015b) described *Amphilectus fucorum* as extremely polymorphic and fast growing, changing shape in just a few weeks. It may be encrusting as thin sheets or cushions, massive and lobose, or branched. Hiscock (pers comm.) noted that *Amphilectus fucorum* has been found growing on short-lived ascidian tests and has shown significant seasonal variation in abundance, suggesting this sponge is highly resilient.

Halichondria bowerbanki is polymorphic, varying from a cushion to branching and is soft and very elastic, growing on rock or other animals, even ascidian tests. It reaches its maximal development in harbours and estuaries, being very tolerant of muddy and brackish conditions (Ackers *et al*., 1992). *Halichondria panicea* is very polymorphic, varying from thin sheets, massive forms and cushions to branching. It crumbles readily and branches are brittle (breaking if bent through 20°). An opportunistic species, it is found in wide range of niches on rock or any other hard substratum (Ackers *et al*., 1992). It reaches its maximal development in harbours and estuaries, being very tolerant of muddy and brackish conditions and can be partly embedded in mud. Barthel (1986) reported that *Halichondria panicea* in the Kiel Bight went through annual cycles, with growth occurring between March and July. After July, a strong decline in mean individual weight occurred until the end of September. No change in individual weight was observed over winter, although changes in biochemical composition (condition index and protein, lipid and glycogen content) were noted. Reproductive activity occurred In August and September with young colonies appearing in early autumn. Adult *Halichondria panicea* degenerated and disintegrated after reproduction. Fish & Fish (1996), however, suggested a lifespan of about 3 years and Vethaak *et al.* (1982) reported that, unlike *Halichondria bowerbanki*, *Halichondria panicea* survives the winter in a normal, active state in the Oosterschelde. Vethaak *et al.* (1992) later reported that *Halichondria bowerbanki* goes into a dormant state below 4°C, characterized by major disintegration and loss of choanocyte chambers with many sponges surviving mild winters in more protected areas from where it can recolonize. Fell & Lewandrowski (1981) observed the population dynamics of *Halichondria* spp. within an eelgrass bed in the lower Mystic Estuary, Connecticut over a 2 year period. Large numbers of larval derived specimens developed on the eelgrass during the summer, and many of these sponges became sexually reproductive, further increasing the size of the population. However, mortality was high, and at the end of the summer, only a relatively small sponge population remained. Sexual reproduction by larva-derived specimens of *Halichondria* spp. occurred primarily after breeding by the parental generation had declined. The larva-derived sponges grew rapidly, and the percentage of specimens containing large, female reproductive elements increases with specimen size. *Halichondria* spp. exhibited an opportunistic life strategy with a ‘high rate of turnover’. Sutherland (1981) investigated the fouling community in North Carolina, the US using short and long-term plates to observe recruitment to artificial surfaces. *Halichondria* assemblages recruited sporadically between June/July and end of October in some years but were not observed in others. Thomassen & Riisgard (1995) described a number of studies looking at the growth rates of *Halichondria* spp. with rates of between 1% and 3.3% of total volume per day.

Gaino *et al.* (2010) observed reproduction within two communities of *Hymeniacidon perlevis (syn. Hymeniacidon perleve).* The onset of gametogenesis seemed to be triggered by environmental parameters, amongst which the water temperature constituted the most relevant factor statistically. It was reported that differentiation and growth of the sexual elements were asynchronous, with reproduction lasting five months for the females and three months for the males in the Mar Piccolo di Tarant, Italy, from the end of spring to the late summer. Afterwards, the sponges disappeared with no recovery evident up to the end of monitoring (an additional five months up to late winter 2007). Biggs & Brendan (2013) studied the effects of consolidation of rubble by sponges for coral recruitment over four years in Curaçao, the Caribbean using *Aplysina cauliformis*, *Aplysina* spp., and *Niphates erecta*. They estimated conservatively that if 50% of the total volume of an individual were harvested to seed rubble piles, it would take roughly 1.5 to 3.5 years to replace, depending on the species.

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). Although colonies may be removed or destroyed, the resting stages may survive attached to the substratum and provide a mechanism for rapid recovery (Cornelius, 1995a; Kosevich & Marfenin, 1986). 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 that develop into free-swimming planula larvae (Hayward & Ryland, 1994) that are present in the water column between 2-20 days (Sommer, 1992). It has also been suggested that 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 therefore classed as 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* species 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. It was also observed that the presence of adults stimulates larval settlement. Therefore, if any adults remain, reproduction is likely to result in local recruitment. Hayward & Ryland (1994) stated that medusae release in *Obelia dichotoma* occurred in summer. 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.

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). *Kirhchenpaueria pinnata* has pinnate stems clustered on branched basal stolon which are commonly 3-10 cm. It is found on stones, algae and in pools from MLW to sublittoral, and is common off all British coasts and is present from Svalbard to Mediterranean (Hayward & Ryland, 1994; Palerud *et al.*, 2004). *Nemertesia anteninna* 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 and 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).

Sea squirts (ascidians) are simultaneously hermaphroditic, sessile filter feeding chordates. Whilst the adults do not have a backbone, their free swimming, short-lived, ascidian larvae possess a notochord which is lost during metamorphosis into its sessile form. Solitary ascidians are discrete creatures which do not fuse with others (unlike colonial ascidians), but may still form dense beds (e.g. up to 5000 individuals/m^2 for *Ciona intestinalis*) (Naylor, 2011). *Ciona intestinalis* reaches sexual maturity at a body height of ca 2.5-3 cm, with one to two generations per year and longevity of ca 1.5 years (Fish & Fish, 1996). Spawning has been reported as more or less year round in temperate conditions for both *Ciona intestinalis* (Yamaguchi, 1975, Caputi *et al*., 2015; MBA, 1957) and *Ascidia mentula* (Fish & Fish, 1996). *Dendrodoa grossularia* is a small solitary ascidian 1.5-2 cm in diameter (Millar, 1954). Settlement occurs from April-June, by the following summer individuals reach their maximum size. Life expectancy is expected to be 18-24 months. Sexual maturity is reached within the second year of growth and the release of gametes occurs from spring-autumn, with peaks in early spring and another in late summer. Gamete release is reduced at temperatures above 15°C and totally suppressed above ca. 20°C (Millar, 1954). Kenny & Rees (1994) observed *Dendrodoa grossularia* was able to recolonize rapidly following aggregate dredging. Following experimental dredging of a site off the English coast, which extracted an area of 1-2 m wide and 0.3-0.5 m deep, *Dendrodoa grossularia* was able to recolonize and attained 40% of pre-dredge abundance and 23% of biomass within 8 months. This recover rate combined with the ability of this species to reach sexual maturity within its first year suggests that *Dendrodoa grossularia* can recover from disturbance events within 2 years.

Sebens (1985; 1986) described the recolonization of epifauna on vertical rock walls. Rapid colonizers such as encrusting corallines, encrusting bryozoans, amphipods and tubeworms recolonized within 1-4 months. Ascidians such as *Dendrodoa carnea*, *Molgula manhattensis* and *Aplidium* spp. achieved significant cover in less than a year, and, together with *Halichondria panicea*, reached pre-clearance levels of cover after 2 years. A few individuals of *Alcyonium digitatum* and *Metridium senile* colonized within 4 years (Sebens, 1986) and would probably take longer to reach pre-clearance levels.

Resilience assessment: Whilst fecundity, longevity and maturation are poorly understood in sponges, several reports indicate that cushion sponges are shorter lived and faster growing than erect sponges. *Halichondria* spp. are reported to be fast growing, with some examples considered fouling. It is probable that other sponges considered would not recover quite as quickly but are likely to be highly resilient to moderate decline. The hydroids that characterize this biotope are likely to recover from damage very quickly. Based on the available evidence, recovery of the hydroid species is likely within two years for any level of perturbation (where resistance is 'None', 'Low', 'Medium' or 'High'). Depending on the season of the impact and level of damage, recovery could occur within six months. Sebens (1985, 1986) found that ascidians such as *Dendrodoa carnea*, *Molgula manhattensis and Aplidium spp.* achieved significant cover in less than a year, and, together with *Halichondria panicea*, reached pre-clearance levels of cover after 2 years. Therefore, if the community is removed or significantly damaged (resistance of 'None' or 'Low') resilience is assessed as '**Medium**' (recovery within 2-10 years). However, if resistance is assessed as **'Medium'** then resilience will be assessed as '**High**' (recovery within 2 years).

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.

Hydrological Pressures

	Resistance	Resilience	Sensitivity

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

All characterizing sponges (*Cliona celata, Halichondria bowerbanki, Halichondria panacea, Hymeniacidon perleve, Leucosolenia botryoides, Suberites ficus, Raspailia ramosa, Amphilectus fucorum*) are widely distributed across the coasts of the British Isles and are all found from the Channel Isles to northern Scotland (NBN, 2015).

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).

Lemoine *et al.* (2007) studied the effects of thermal stress on the holobiont of the sponge *Halichondria bowerbanki* collected from Virginia, USA. Whilst no apparent change in density or diversity of symbionts was detected over the range of temperatures (29 °C, 30 °C and 31 °C), the presence of particular symbionts was temperature dependent. Barthel (1986) reported that reproduction and growth in *Halichondria panicea* in the Kiel Bight were primarily driven by temperature, with higher temperatures corresponding with the highest growth.

Cantero *et al.* (2002) described 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 figure.

For the ascidian *Dendrodoa grossularia*, gamete release occurs from spring-autumn, with peaks in early spring and another in late summer. Gamete release is reduced at temperatures above 15°C and totally suppressed above ca 20°C (Millar, 1954). No information was found on the upper temperature threshold of mature *Dendrodoa grossularia*. Whilst widespread throughout the British Isles (NBN, 2015), a dramatic increase in temperature may cause mortality.

Sensitivity assessment: The important characterizing species are distributed to the north and south of the British Isles and unlikely to be sensitive to change at the benchmark level. Therefore, resistance is assessed as '**High**', resilience as '**High'** and the biotope is assessed as '**Not Sensitive'** at the benchmark level.

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

All characterizing sponges (*Cliona celata, Halichondria bowerbanki Halichondria panacea, Hymeniacidon perleve, Leucosolenia botryoides, Suberites ficus, Raspailia ramosa, Amphilectus fucorum*) are widely distributed across the coasts of the British Isles and are all found from the Channel Isles to northern Scotland (NBN, 2015). 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 visibility and temperature.

Some sponges exhibit morphological strategies to cope with winter temperatures e.g. *Halichondria bowerbanki* goes into a dormant state below 4°C, characterized by major disintegration and loss of choanocyte chambers with many sponges surviving mild winters in more protected areas from where it can recolonize (Vethaak *et al*., 1992).

Crisp et al. (1964) observed the effects of an unusually cold winter (1962-3) on the marine life in Britain, including Porifera in North Wales. Whilst difficulty in distinguishing between mortality and delayed development was noted, Crisp *et al*. found that *Pachymastia johnstonia* and *Halichondria panicea* were wholly or partly killed by frost and several species appeared to be missing including *Amphilectus fucorum*. Others, including *Hymeniacidon perleve*, were unusually rare and a few species, including *Polymastia boletiformis*, were not seriously affected. Barthel (1986) reported that *Halichondria panicea* in the Kiel Bight degenerated and disintegrated after reproduction before winter, however, young colonies were observed from September.

Palerud *et al*. (2004) described the presence of the characterizing hydroids *Halecium Halecinum* and *Nemertesia* sp. in Svalbard, suggesting that these 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). *Dendrodoa grossularia* has been recorded as an abundant component of benthic fauna in Nottinghambukta, Svalbard (Różycki & Gruszczyński, 1991).

Sensitivity assessment: There is evidence of sponge mortality at extreme low temperatures in the British Isles. Given this evidence, it is likely that a cooling of 5°C for a month could potentially affect the characterizing sponges, and resistance has been assessed as **'Medium'** with a resilience of '**High**'. Sensitivity has, therefore, been assessed as '**Low**'.

Salinity increase (local)	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

Marin *et al*. (1998) described the presence of *Dysidea fragilis* in a hypersaline coastal lagoon (42-47 g/l) in La Mar Menor, Spain. No evidence could be found for characterizing sponges. Studies on hydroids have found that prey capture rates may be affected by salinity and temperature (Gili & Hughes, 1995) although no evidence was found for species that characterize this biotope. This biotope occurs in full and variable salinity (Connor *et al*., 2004). An increase to hypersaline conditions is likely to affect the characterizing species, but '**No evidence'** to support an assessment could be found.

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

Castric-Fey & Chassé (1991) conducted a factorial analysis of the subtidal rocky ecology near Brest, France and rated the distribution of species from estuarine to offshore conditions. *Dysidea fragilis* and *Raspailia ramosa* were rated as unaffected by salinity at this range. *Cliona celata* and *Pachymatisma johnstonia* had a slight preference for more estuarine conditions. Mean salinity difference across the study was low (35.1 and 33.8‰ respectively) but with a greater range being experienced in the Inner Rade (±2.4‰ compared with ±0.1‰). It should be noted that the range of salinities identified in this study do not reach the lower benchmark level. Some of the characterizing species occur in harbours and estuaries, including *Halichondria* spp. and *Hymeniacidon perleve* (Ackers *et al*., 1992). Little evidence for the characterizing hydroids could be found. Stebbing (1981a) found that, for the hydroid *Campanularia flexuosa*, growth was inhibited from 70% seawater (ca 25‰) and that exposure to below 30% seawater (ca 10‰) was lethal after 3 days. *Nemertesia* spp. and *Halecium halecinum* were recorded as occurring in variable to full salinity biotopes (18-35‰). *Dendrodoa grossularia* has been recorded in biotopes occurring from full to low salinity regimes (<18-35‰).

Sensitivity assessment. This biotope CR.MCR.CFaVS.CuSpH and its sub-biotopes (CFaVS.CuSpH.As and CFaVS.CuSpH.VS) occur in 'full' or 'variable' salinity. Many of the characterizing species also appear in similar biotopes with lower salinities (Connor *et al*., 2004). However, the biotope CFaVS.CuSpH.VS occur in areas of less stable and lower salinities (but variable salinities) has a lower species diversity than the CFaVS.CuSpH.As or CFaVS.CuSpH. Therefore, a prolonged reduction in salinity at the benchmark level (i.e. from full to reduced) is likely to reduce the species richness of CFaVS.CuSpH.As and result in the less species-rich CFaVS.CuSpH.VS biotope. However, it is unclear if the transition would occur within a year (the benchmark duration). Therefore, a precautionary resistance of '**Medium**' is suggested. Hence, resilience is assessed as **'High**' and the sensitivity is assessed as **'Low'** at the benchmark level.

Water flow (tidal current) changes (local)	High Q: Low A: NR C: NR	High Q: High A: High C: High	Not sensitive 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). Whilst little evidence for the characterizing sponges could be found, the important characterizing hydroids are typically found in places of low to moderate water movement, although Hayward & Ryland (1995b) note that abundant communities occur in narrow straits and headlands which 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). The hydroid growth form also varies to adapt to prevailing conditions, allowing species to occur in a variety of habitats (Gili & Hughes, 1995). In general, flow rates are an important factor for feeding in hydroids and prey capture appears to be higher in more turbulent conditions that prevent self-shading by the colony (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 hydroids.

As sessile filter feeders, ascidians generally require a reasonable water flow rate in order to ensure sufficient food availability. It was shown that in stagnant water, phytoplankton density became reduced in a 20-30 cm layer immediately above a dense colony of *Ciona intestinalis* (Riisgård *et al.*, 1996). If dislodged, juvenile and adult ascidians have a limited capability to re-attach, given calm conditions and prolonged contact with the new substrata (Carver *et al*., 2006; Millar, 1971).

Sensitivity assessment. The CR.MCR.CFaVS complex biotopes occur in moderate energy habitats (moderate water flow and wave sheltered habitats) (Conor *et al*., 2004). However, CFaVS.CuSpH and CFaVS.CuSpH.As are recorded from strong to weak tidal streams and CR.MCR.CFaVS.CuSpH.VS from strong to moderately strong tidal streams in a range of wave exposures from moderately exposed to extremely sheltered. Therefore, water flow is probably the most important contributor to water movement in many but not all examples of the biotopes. A significant decrease in water flow could result in a change to the CR.LCR.BrAs group of biotopes, whereas a significant increase may result in a change to CR.HCR.FaT. However, change at the benchmark level of 0.1-0.2 m/s is unlikely to be significant and resistance is, therefore, assessed as **'High'**, resilience as **'High'** and the biotope is assessed as **'Not sensitive'** at the benchmark level.

Emergence regime 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

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

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

Roberts *et al.* (2006) studied deep sponge reef communities (18-20 m) in sheltered and exposed locations in Australia. They reported greater diversity and cover (>40% cover) of sponges in wave-sheltered areas compared with a sparser and more temporal cover in exposed sites (25% cover). Erect sponges dominated the sheltered sites while encrusting sponges dominated in exposed locations. Jackson (2004) reported that *Nemertesia ramosa* was intolerant of high wave exposure because it was only found in sheltered areas. Faucci *et al.* (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. High energy wave action can be detrimental to ascidian populations. This is mainly through physical damage to the sea squirts and through the abrasive action of suspended sediment (Jackson, 2008). *Ciona intestinalis* is often dominant in highly sheltered areas such as harbours (Carver *et al*., 2006). Decreases in wave exposure are unlikely to have any effect. If dislodged, juvenile and adult *Ciona intestinalis* have a limited capability to re-attach, given calm conditions and prolonged contact with the new substratum (Carver *et al*., 2006; Jackson, 2008; Millar, 1971) but increases in wave exposure above moderately exposed are likely to cause a proportion of the population to die, especially in the shallower examples of the biotope if the cobbles and pebbles on which the biotope occurs are mobilized by wave action. *Ascidia mentula* has rarely been recorded at depths shallower than 15 m (Svane, 1984), it is possible that damage could occur if subjected to increased wave exposure.

Sensitivity Assessment. The CR.MCR.CFaVS complex biotopes occur in moderate energy habitats (moderate water flow and wave sheltered habitats) (Conor *et al*., 2004). However, CFaVS.CuSpH and CFaVS.CuSpH.As are recorded from strong to weak tidal streams and CR.MCR.CFaVS.CuSpH.VS from strong to moderately strong tidal streams in a range of wave exposures from moderately exposed to extremely sheltered. Therefore, water flow is probably the most important contributor to water movement in many but not all examples of the biotopes. A decrease in wave exposure is probably 'not relevant', however, an increase in wave exposure is likely to result in a fundamental change to mixed faunal turf (XFa) communities. Nevertheless, change at the benchmark level of 3-5% in wave height is unlikely to be significant and resistance is, therefore, assessed 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

While 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.

Although no information on the effects of heavy metals on the assessed hydroids was found, evidence suggests that hydroids may suffer at least sub-lethal effects and possibly morphological changes and reduced growth due to heavy metal contamination. Various heavy metals have been shown to have sublethal effects on growth in the few hydroids studied experimentally (Bryan, 1984). Stebbing (1981a) reported that Cu, Cd, and tributyl-tin fluoride affected growth regulators in *Laomedea* (as *Campanularia*) *flexuosa* resulting in increased growth. Stebbing (1976) reported that 1 µg/l Hg^{2+} was stimulatory, although the effect was transitory, exposure resulting in reduced growth towards the end of his 11 day experiments. Cadmium (Cd) was reported to cause irreversible retraction of 50% of hydranths in *Laomedea loveni* after 7 days exposure at concentrations between 3 µg/l (at 17.5°C and 10 ppt salinity) and 80 µg/l (at 7.5°C and 25 ppt salinity) (Theede *et al.*, 1979). *Laomedea loveni* was more tolerant of Cd exposure at low temperatures and low salinities. Karbe (1972, summary only) examined the effects of heavy metals on the hydroid *Eirene viridula* (Campanulidae). He noted that Cd and Hg caused cumulative effects and morphological changes. Mercury (Hg) caused irreversible damage at concentrations as low as 0.02 ppm. He reported threshold levels of heavy metals for acute effects in *Eirene viridula* of 1.5-3 ppm Zn, 1-3 ppm Pb, 0.1-0.3 ppm Cd, 0.03-0.06 ppm Cu and 0.001-0.003 ppm Hg. Karbe (1972, summary only) suggested that *Eirene viridula* was a sensitive test organism when compared to other organisms.
Although no information on the effects of heavy metals on assessed hydroid species was found, the above evidence suggests that hydroids may suffer at least sub-lethal effects and possibly morphological changes and reduced growth due to heavy metal contamination.

Trace metals (particularly mercury and copper) have been found to affect embryogenesis and larval settlement in *Ciona intestinalis* (Bellas *et al.*, 2004). Whilst there are extensive studies of larval intolerance to TBT (Mansueto *et al.*, 1993, Pellerito *et al.*, 1996, Bellas, 2005) and zinc pyrithione (Bellas, 2005), data appears non-existent for the adult stage.

Chesher (1971) found that *Ascidia niagra* was surprisingly intolerant of desalination effluent (50% mortality in 5.8% effluent solution after 96 hours), far less tolerant than the other species included in the study (echinoids, crabs and gorgonians). Whilst presence of copper was considered the most deleterious factor across the study, the increased sensitivity of the ascidians was attributed to synergistic copper and temperature effects, although the presence of other contaminants (e.g. nickel) could not be ruled out (Chesher, 1971).

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 sublittoral 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). *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).

Ignatiades & Becacos-Kontos (1970) found that *Ciona intestinalis* can resist the toxicity of oil polluted water and ascidians are frequently found in polluted habitats such as marinas and harbours, etc. (Carver *et al.*, 2006) as well as *Ascidia mentula* (Aneiros *et al.*, 2015).

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.

The species richness of hydroid communities decreases with increasing pollution but hydroid species are adapted to a wide variation in environmental factors and with cosmopolitan distributions tend to be more tolerant of polluted waters (Boero, 1984; Gili & Hughes, 1995). Stebbing (1981a) reported that Cu, Cd, and tributyl-tin fluoride affected growth regulators in *Laomedea* (as *Campanularia*) *flexuosa* resulting in increased growth. Stebbing (1981) cited reports of growth stimulation in *Obelia geniculata* caused by methylcholanthrene and dibenzanthrene. Bryan & Gibbs (1991) reported that virtually no hydroids were present on hard bottom communities in TBT contaminated sites and suggested that some hydroids were intolerant of TBT levels between 100 and 500 ng/l. No information concerning the resistance of the hydroids assessed was found. However, the above evidence suggests that several species of hydroid exhibit sublethal effects due to synthetic chemical contamination and lethal effects due to TBT contamination.

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) 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: Low A: NR C: NR	Medium Q: Medium A: Medium C: Medium	Medium 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. Most epifauna are suspension feeders adapted to water flow, although their tolerance or requirement for water flow varies with species or taxonomic group. For example, Gray *et al.* (2002) concluded that fish were more sensitive to hypoxia that crustacean and echinoderms, which in turn were more sensitive than annelids with molluscs the most tolerant. Riedel *et al.* (2012) noted that infauna were generally more tolerant than epifauna. They also noted that decapods, echinoderms, and polychaetes showed lower tolerance while ascidians and anthozoans showed higher tolerance to hypoxia and anoxia (Riedel *et al.* 2012). Mobile species, such as fish, would probably move away from the affected area.

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 (ca 0.5 mg/l) below ca 10 m. Despite the presence of *Tethya citrina*, *Kirchenpaueria pinnata*, *Hymeniacidon pereleve*, *Polymastia boletiformis* or *Ascidia mentula* in shallower water, no sponges or ascidians were recorded at depths below the oxycline at 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 DO), *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 of <0.3 ppm DO (ca 0.3 mg/l). Hydroids mainly inhabit environments in which the oxygen concentration exceeds 5 ml/l (ca 7 mg/l) (Gili & Hughes, 1995). Although no information was found on oxygen consumption for the characterizing hydroids, Sagasti *et al.* (2000) reported that epifaunal species, including several hydroids and *Obelia bidentata (*as *bicuspidata)* in the York River, Chesapeake Bay, tolerated summer hypoxic episodes of between 0.5 and 2 mg O_2/l (0.36 and 1.4 ml/l) for 5-7 days at a time, with few changes in abundance or species composition.

The ability of solitary ascidians to withstand decreasing oxygen levels has not been well documented. Mazouni *et al.* (2001) noted that whilst oysters (*Magallana gigas*) can survive short-term exposure to periods of anoxia (Thau Lagoon, France), the associated biofouling community dominated by *Ciona intestinalis* suffered heavy mortality. It should be noted, however, that *Ciona intestinalis* is frequently found in areas with restricted water renewal where oxygen concentrations may drop (Carver *et al.*, 2006). Whilst adverse conditions could affect health, feeding, reproductive capability and could eventually lead to mortality, recovery should be rapid.

Sensitivity assessment. The CFaVS complex of biotopes occurs in low energy environment so that low oxygen episodes may be prolonged. Therefore, resistance is assessed as '**Low**', with a resilience of '**Medium**' and sensitivity is assessed as '**Medium**'. Due to the lack of specific data for these species, confidence is recorded as '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

Gochfeld *et al.* (2012) studied the effect of nutrient enrichment (≤0.05 to 0.07 □M for nitrate and ≤0.5 □M for phosphate) as a potential stressor in *Aplysina caulifornis* and its bacterial symbionts and found that nutrient enrichment had no effects on sponge or symbiont physiology when compared to control conditions This study does contradict findings in Gochfeld *et al.* (2007) in which *Aplysina spp*. were virtually absent from a site of anthropogenic stress in Bocas del Toro, Panama, which experienced high rainfall and terrestrial runoff. The author suggested that whilst this site did include elevated nutrient concentrations, other pressures and stresses could be contributing. Rose & Risk (1985) described an increase in abundance of *Cliona delitrix* in an organically polluted section of Grand Cayman fringing reef affected by the discharge of untreated faecal sewage. Ward-Paige *et al.* (2005) described the greatest size and biomass of clionids corresponded with highest nitrogen, ammonia and □^{15}N levels. 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 control reference areas.

Ascidia mentula has been reported in Iberian bays subject to both nutrient-rich upwelling events and anthropogenic pollution (Aneiros *et al*., 2015). There is some suggestion that there are possible benefits to ascidians from the increased organic content of water; ascidian 'richness' in Algeciras Bay was found to increase in higher concentrations of suspended organic matter (Naranjo *et al.* 1996).

Nevertheless, this biotope is considered to be **'Not sensitive'** at the pressure benchmark, that assumes compliance with all relevant environmental protection standards.

Organic enrichment	High Q: Medium A: Medium C: Medium	High Q: High A: High C: High	Not sensitive Q: Medium A: Medium C: Medium

Rose & Risk (1985) described an increase in abundance of the sponge *Cliona delitrix* in an organically polluted section of Grand Cayman fringing reef affected by the discharge of untreated faecal sewage.

Fu *et al*. (2007) described *Hymeniacidon perleve* in aquaculture ecosystems in sterilized natural seawater with different concentrations of total organic carbon (TOC), at several concentrations between 52.9 and 335.13 mg/L). *Hymeniacidon perleve* removed 44–61% TOC during 24 h, with retention rates of ca. 0.19–1.06 mg/hr ·g-fresh sponge. *Hymeniacidon perleve* removed organic carbon excreted by *Fugu rubripes* with similar retention rates of ca. 0.15 mg/h g-fresh sponge, and the sponge biomass increased by 22.8%. Some of the characterizing sponges occur in harbours and estuaries, including *Halichondria* spp. and *Hymeniacidon perleve* (Ackers *et al*., 1992) and may, therefore, tolerate high levels of organic carbon

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. However, 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.

There is some suggestion that there are possible benefits to the ascidians from the increased organic content of water; Ascidian ‘richness’ in Algeciras Bay was found to increase in higher concentrations of suspended organic matter (Naranjo *et al.* 1996). Kocak & Kucuksezgin (2000) noted that *Ciona intestinalis* was one of the rapid breeding opportunistic species that tended to be dominant in Turkish harbours enriched by organic pollutants and was frequently found in polluted environments (Carver *et al.*, 2006). *Ascidia mentula* has been reported in Iberian bays subject to both nutrient-rich upwelling events and anthropogenic organic pollution (Aneiros *et al.*, 2015).

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'.**

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)	Low Q: High A: Medium C: Medium	Medium Q: High A: Medium C: Medium	Medium Q: High A: Medium C: Medium

The species characterizing this biotope are epifauna or epiflora occurring on rock and would be sensitive to the removal of the habitat. Extraction of rock substratum is considered unlikely and this pressure is considered to be ‘**Not relevant’** to hard substratum habitats. However, Picton & Goodwin (2007) noted that an area of boulders with a rich fauna of sponges and hydroids on the east coast of Rathlin Island, Northern Ireland was significantly altered since the 1980s. Scallop dredging had begun in 1989 and boulders were observed to have been turned and the gravel harrowed. In addition, many of the boulders had disappeared and rare hydroid communities were greatly reduced (Picton & Goodwin, 2007). Prior records indicated the presence of large sponges, mainly *Axinella infundibuliformis* (Picton & Goodwin, 2007). Freese *et al.* (1999) also noted that trawling could remove important substratum such as boulders. Therefore, **where this biotope occurs on boulders** that could be subject to removal or extraction, resistance is likely to be **'Low'.** Hence, as resilience is probably **'Medium'** (assuming suitable substratum remains) and sensitivity is assessed as **'Medium'.**

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

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 other sponges including *Haliclona oculata* 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. The 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 was provided.

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. The sponge *Pachymatisma johnstoni* was highly damaged by the experimental trawl. However, other members of the faunal turf community were not as vulnerable to damage from trawling as sedimentary fauna and whilst damage to circalittoral rock fauna did occur, it was of an incremental nature, with the loss of faunal turf communities increasing with repeated trawls. The ascidians are epifaunal and physical disturbance is likely to cause damage and mortality. Emergent epifauna are generally very intolerant of disturbance from fishing gear (Jennings & Kaiser, 1998). However, studies have shown *Ascidia spp*. to become more abundant following disturbance events (Bradshaw *et al*., 2000). Resampling 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 an (unquantified) increase in abundance of tough-stemmed hydroids including *Nemertesia* spp. 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 1st June to 31st 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. 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 (Coleman *et al.*, 2013). The majority of the literature agrees that damage would fall within the 'Low' bracket of 25-75% reduction. Ascidians are also likely to be significantly affected, although, given their high resilience, they are likely to recover quickly. The assessment is therefore based on the sponge component of the biotope. Hence, resistance is assessed as '**Low**', resilience as '**Medium**' and sensitivity is assessed as '**Medium**'.

Penetration or disturbance of the substratum subsurface	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 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 Q: High A: Medium C: Medium	High Q: High A: High C: High	Not sensitive Q: High A: Medium C: Medium

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 2000; Bell & Smith, 2004; Bell *et al.*, 2015; Schönberg, 2015). 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 aurantium*, *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. Some of the characterizing sponges occur in harbours and estuaries, including *Halichondria* spp. and *Hymeniacidon perleve* (Ackers *et al.*, 1992). Storr (1976) observed the sponge *Sphecispongia vesparium* 'backwashing' to eject sediment and noted that other sponges (such as *Condrilla nucula*) use secretions to remove settled material. *Raspailia ramosa* and *Stelligera stuposa* have a reduced maximum size in areas of high sedimentation (Bell *et al.*, 2002). Tjensvoll (2013) found that *Geodia barretti* physiologically shuts down (86% reduction in respiration) when exposed to sediment concentrations of 100 mg/l. Rapid recovery to initial respiration levels directly after the exposure indicated that *Geodia barretti* can cope with a single short exposure to elevated sediment concentrations.

It should be noted that many of the characterizing sponges have been recorded in the turbid biotopes CFaVS.CuSpH.VS and CFaVS.CuSpH.As (Connor *et al.*, 2004). For example, CR.MCR.CFaVS.CuSpH.VS occurs in estuarine waters and, therefore, the species in the biotope are likely to be well adapted to turbid conditions. Wass *et al.* (1999) described suspended sediment maxima for 'medium' sized rivers as rarely exceeding 500 mg/l, with a few rivers (including the Don and the Swale) experiencing concentrations in excess of 1000 mg/l. Langston *et al.* (2003) described annual mean suspended sediment concentrations in the Tamar as varying from 61 mg/l to 1039 mg/l in the upper estuary, 6 to 18 mg/l in the outer estuary and 2 to 9 mg/l beyond. It should be noted that the values quoted are mean annual concentrations and the same report states that conditions could be 'very turbid' in the outer estuary. The estuarine turbidity maximum (the point at which highest turbidity is experienced) can be highly variable and has been reported to move by ca 12 km down-estuary during the transition from neap to spring tides in the Humber estuary (Uncles *et al.*, 2005). Estuarine environments are likely to experience variable turbidity and the species present are probably tolerant of significant short-term changes in suspended solid concentrations.

Long-term increase in turbidity may affect primary production in the water column and, therefore, reduce the availability of diatom food, both for suspension feeders and deposit feeders. In addition, primary production by the microphytobenthos on the sediment surface may be reduced, further decreasing food availability for deposit feeders. However, primary production is probably not a major source of nutrient input into the system and, furthermore, phytoplankton will also immigrate from distant areas and so the effect may be decreased.

Sensitivity assessment. CR.MCR.CFaVS.CuSpH.VS and CuSpH.As are considered to be turbid (unquantified) (Connor *et al.*, 2004). Mortality at the benchmark level is, therefore, considered unlikely and resistance is '**High**', resilience is '**High**' and the biotope is assessed as '**Not sensitive**'. The lack of evidence for characterizing species, as well as a lack of consensus in the literature results in a 'Low' quality confidence score.

Smothering and siltation rate changes (light)	Medium Q: High A: High C: Medium	High Q: High A: Medium C: Medium	Low Q: High A: Medium C: Medium

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 2000; Bell & Smith, 2004; Bell *et al.*, 2015; Schönberg, 2015;). However, Wulff (2006) described mortality in three sponge groups after four weeks of complete burial under sediment; 16% of *Amphimedon* biomass died compared with 40% and 47% in *Iotrochota* and *Aplysina* respectively. Ackers *et al.* (1992) reported that *Halichondria bowerbanki* can be partly embedded in mud. It should also be noted that some of the characterizing sponges are likely to be buried in 5 cm of sediment deposition.

In general, it appears that hydroids are sensitive to silting (Boero, 1984; Gili & Hughes, 1995) and decline in 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 deep water 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). *Halecium halecinum* can grow up to 25 cm and *Kirchenpaueria pinnata* can grow to ca 10 cm (Hayward & Ryland, 1994). Some of the community is, therefore, likely to survive smothering by 5 cm.

The solitary ascidians considered in this report are permanently attached to the substratum and are active suspension feeder. *Dendrodoa grossularia* is a small ascidian, capable of reaching a size of approx 8.5 mm (Millar, 1954) and is, therefore, likely to be inundated by deposition of 30 cm of sediment. The complete disappearance of the sea squirt *Ascidiella aspersa* biocoenosis and ‘associated sponges’ in the Black Sea near the Kerch Strait was attributed to siltation (Terent'ev, 2008 cited in Tillin & Tyler-Walters, 2014).

Sensitivity assessment. Smothering by 5 cm of sediment is likely to impact hydroids, ascidian and sponge species. However, it is likely that enough of the population would survive to recover quite rapidly should the thin layer of sediment be removed. Resistance has been assessed as ‘**Medium**’, resilience as ‘**High**’ and sensitivity has been assessed as ‘**Low**’ at the benchmark level.

Smothering and siltation rate changes (heavy)	Low Q: High A: High C: Medium	Low Q: High A: Medium C: Medium	High Q: High A: Medium C: Medium

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, 2000; Bell & Smith, 2004; Bell *et al.*, 2015; Schönberg, 2015). 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. In 30 cm of deposition, the majority of sponges are likely to be buried, unless the topography of the biotope includes many vertical surfaces.

In general, it appears that hydroids are sensitive to silting (Boero, 1984; Gili & Hughes, 1995) and decline in 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 deep water hydroid species develop upright, thin colonies that accumulate little sediment, while species in turbulent water movement were adequately cleaned of silt by water movement.

Nemertesia ramosa is an upright hydroid with a height of up to 15 cm. The colony structure is fairly tough and flexible (Hayward & Ryland, 1994). Monosiphonic *Obelia dichotoma* stems grow to 5 cm, polysiphonic structures can reach up to 35 cm in height, *Halecium halecinum* can grow up to 25 cm and *Kirchenpaueria pinnata* can grow to ca 10 cm (Hayward & Ryland, 1994). Smothering by 30 cm of material is likely to cover almost all the hydroids. 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. Therefore, if the deposition is removed fairly rapidly, the impact may be limited.

The solitary ascidians considered in this report are permanently attached to the substratum and are active suspension feeder. *Dendrodoa grossularia* is a small ascidian, capable of reaching a size of approx 8.5 mm (Millar, 1954) and is, therefore, likely to be inundated by deposition of 30 cm of sediment. The complete disappearance of the sea squirt *Ascidiella aspersa* biocoenosis and associated sponges in the Black Sea near the Kerch Strait was attributed to siltation (Terent'ev 2008 cited in Tillin & Tyler-Walters, 2014).

Sensitivity assessment. Smothering by 30 cm of sediment is likely to cause mortality amongst the majority of characterizing and important species of these biotopes and impact recovery unless the sediment is removed. However, vertical surfaces may protect a proportion of the population, so that the effects will depend on the topography of the substratum. In addition, the sediment deposit is likely to be removed rapidly in some example of the biotope in strong water flow. Therefore, resistance at the benchmark is assessed as ‘**Low**’, resilience as ‘**Medium**’ and sensitivity is assessed as ‘**Medium**’.

Litter	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

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 to assess this pressure.

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. Therefore, the pressure is probably 'Not relevant' in this biotope and its sub-biotopes.

Introduction of light or shading	High Q: Medium A: Medium C: Medium	High Q: High A: High C: High	Not sensitive Q: Medium A: Medium 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, presumably due to a decrease in competition from 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. Gili & Hughes (1995) reviewed the effect of light on a number of hydroids and found that there is a general tendency for most hydroids to be less abundant in well-lit situations. Whilst hydroid larvae can be positively or negatively phototactic, the planulae of *Nemertesia antennina* show no response to light. (Hughes, 1977). *In vitro* studies of solitary ascidians indicate that both spawning and settlement are controlled by light, however, *Ciona intestinalis in vivo* has been observed to spawn and settle at any time of the day (Svane & Havenhand, 1993).

CR.MCR.CfaVS.CuSpH and its sub-biotopes are circalittoral biotopes (Connor *et al.*, 2004) and the community is, therefore, not dependent on direct sunlight. Increased shading (e.g. by the construction of a pontoon, pier etc) could benefit the characterizing species of this biotope. Therefore, resistance to this pressure is assessed as '**High**', resilience as '**High**' and the biotope is assessed as **'Not sensitive'.**

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) 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 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

This biotope is classified as circalittoral and, therefore, no algal species have been considered. *Didemnum vexillum* is an invasive colonial sea squirt native to Asia which was first recorded in the UK in Darthaven Marina, Dartmouth in 2005. *Didemnum vexillum* can form extensive mats over the substrata it colonizes; binding boulders, cobbles and altering the host habitat (Griffith *et al*., 2009). *Didemnum vexillum* can also grow over and smother the resident biological community. Recent surveys within Holyhead Marina, North Wales have found *Didemnum vexillum* growing on and smothering native tunicate communities, including *Ciona intestinalis* (Griffith *et al*., 2009). Due to the rapid-re-colonization of *Didemnum vexillum* eradication attempts, have (to date) failed.

Presently *Didemnum vexillum* is isolated to several sheltered locations in the UK (NBN, 2015), however, *Didemnum vexillum* has successfully colonized the offshore location of the Georges Bank, USA (Lengyel *et al*., 2009) which is more exposed than the locations which *Didemnum vexillum* have colonized in the UK. It is, therefore, possible that *Didemnum vexillum* could colonize more exposed locations within the UK and could, therefore, pose a threat to these biotopes.

Sensitivity assessment. There is **'No evidence'** at present that this biotope has been affected by INIS, however, *Didemnum vexillum* could pose a potential threat. Due to the constant risk of new invasive species, the literature for this pressure should be revisited.

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

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) and 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. 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 that may suggest a specific pathogen caused the effect (Burton, pers comm; Preston & Burton, 2015). Hydroids exhibit astonishing regeneration and rapid recovery from injury (Sparks, 1972) and the only inflammatory response is active phagocytosis (Tokin & Yaricheva, 1959;1961, as cited in Sparks, 1972). No record of diseases in the characterizing hydroids could be found. There appears to be little research into ascidian diseases, particularly in the Atlantic. The parasite *Lankesteria ascidiae* targets the digestive tubes and can cause 'long faeces syndrome' in *Ciona intestinalis* (although it has also been recorded in other species).Mortality occurs in severely affected individuals within about a week following first symptoms. (Mita *et al.*, 2012).

Sensitivity assessment. Sponge diseases have caused limited mortality in some species in the British Isles, although mass mortality and even extinction have been reported further afield. However, **'No evidence'** of mortality due to disease could be found for the important characterizing species of this biotope.

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

Spongia officinalis (a Mediterranean species) has been targeted as a commercial species for use as bath sponges, although this species does not occur in the British Isles and no record of commercial exploitation of sponges in the British Isles could be found. Hiscock (2003) stated that the greatest loss of *Axinella dissimilis* at Lundy might have been due to collecting during scientific studies in the 1970s. No indication of recovery was evident. *Axinella damicornis* was harvested in Lough Hyne during the 1980s (for molecular investigations) and the populations were reduced to very low densities, which subsequently recovered very slowly, although they are now considered to be back to their original densities (Bell, 2007). No evidence of targeted removal of the characterizing species could be found. Despite historic harvesting of the hydroid *Sertularia cupressina* in the Wadden Sea (Wagler *et al.*, 2009), no evidence for the harvesting of the characterizing hydroids could be found and targeted extraction is highly unlikely. Despite novel proposals to farm *Ciona intestinalis* as a potential feedstock for aquaculture in Sweden (Laupsa, 2015), it is very unlikely that solitary ascidians would be targeted for extraction.

Sensitivity assessment. None of the characterizing species is harvested and targeted removal is, therefore, this pressure is '**Not relevant**' to this biotope.

Removal of non-target species	Low Q: Low A: NR C: NR	Medium Q: High A: Medium C: Medium	Medium 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, removal of the characteristic epifauna due to bycatch is likely to 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 in 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 Coleman *et al*., 2013). The majority of the literature agrees that damage would fall within the ‘Low’ bracket of 25-75% reduction. Ascidians are also likely to be significantly affected, although given their high resilience, they are likely to recover quickly (Bradshaw *et al*., 2000).

Sensitivity assessment. Based on the broad agreement of trawl impacts on sponge communities and the likely disturbance to the sessile epifaunal ascidians and hydroids, resistance is assessed as ‘**Low**’, resilience as **‘Medium’** and sensitivity assessed as **‘Medium’**.

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