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Suberites spp. with a mixed turf of crisiids and *Bugula* spp. on heavily silted moderately wave-exposed shallow circalittoral rock

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

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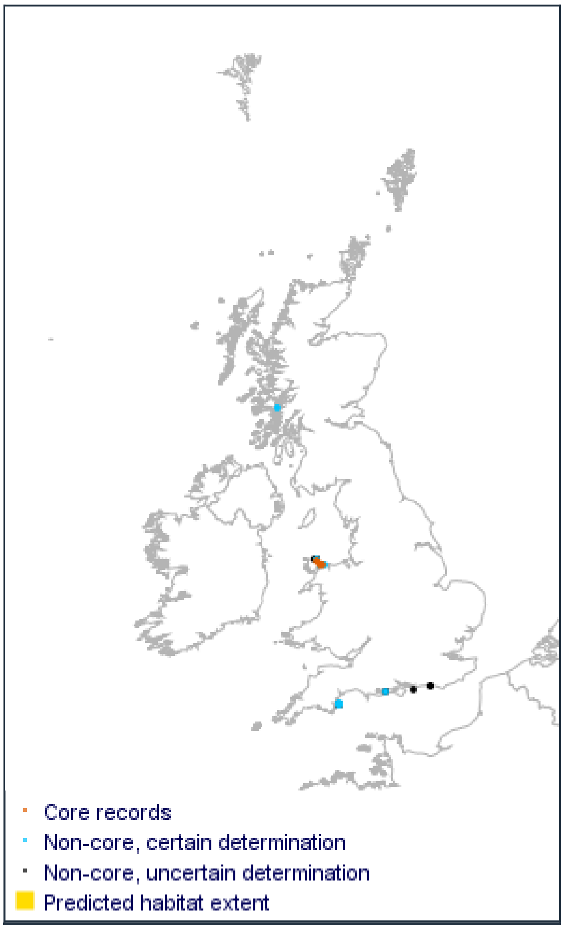

17-09-2018
Biotope distribution data provided by EMODnet Seabed Habitats (www.emodnet-seabedhabitats.eu)

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

Summary

UK and Ireland classification

EUNIS 2008	A4.136	*Suberites* spp. with a mixed turf of crisiids and *Bugula* spp. on heavily silted moderately wave-exposed shallow circalittoral rock
JNCC 2015	CR.HCR.XFa.SubCriTf	*Suberites* spp. with a mixed turf of crisiids and *Bugula* spp. on heavily silted moderately wave-exposed shallow circalittoral rock
JNCC 2004	CR.HCR.XFa.SubCriTf	*Suberites spp.* with a mixed turf of crisiids and *Bugula spp.* on heavily silted moderately wave-exposed shallow circalittoral rock
1997 Biotope		

Description

This biotope is found on heavily silted, moderately wave-exposed circalittoral bedrock and boulders (often limestone) that are subject to moderately strong tidal streams. A very high silt loading in the water column means that this 'circalittoral' biotope occurs at unusually shallow depths (1 -10 m BCD). It is characterized by a mixed faunal turf and `massive' examples of the sponges *Suberites ficus*, *Suberites carnosus* and *Hymeniacidon perleve*. Other sponges recorded in this biotope are *Cliona celata*, *Halichondria panicea*, *Esperiopsis fucorum*, *Raspailia ramosa*, *Polymastia mamillaris*, *Dysidea fragilis*, *Scypha ciliata*, *Stelligera rigida* and *Haliclona oculata*. Also characteristic of this biotope is a dense bryozoan turf with one or more crisiid species, *Flustra foliacea* and *Crisularia plumosa*. The polychaete *Polydora* spp. and the rock-boring bivalve *Hiatella arctica* are able to bore into the relatively soft limestone. There is an ascidian component to the biotope, with *Morchellium argus* and *Clavelina lepadiformis* among the most abundant. There may be scattered clumps of the hydroids *Abietinaria abietina* and *Hydrallmania falcata*. Other species present include the anemones *Metridium senile*,*Sagartia elegans* and *Urticina felina*, the starfish *Asterias rubens*, the crab *Necora puber*, the nudibranch *Janolus cristatus* and the soft coral *Alcyonium digitatum*. This biotope has currently only been recorded off the east coast of Anglesey, Wales.

Depth range

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Additional information

Please note, molecular taxonomy of the genus *Bugula* (Fehlauer-Ale *et al.*, 2015) identified several clear genera (clades), *Bugula sensu stricto* (30 species), *Bugulina* (24 species), *Crisularia* (23 species) and the monotypic *Virididentulagen*. The following review was derived from information concerning species of *Bugula* where possible. The review assumes that, while their taxonomy has changed, the biology of *Bugula sensu stricto* and *Bugulina* remains similar. Hence, references to *Bugula* spp. in the text refer to *Bugula sensu stricto*, *Bugulina*, and *Crisularia* species.

Listed By

- none -

Further information sources

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Sensitivity review

Sensitivity characteristics of the habitat and relevant characteristic species

This biotope is characterized by 'massive' examples of the sponges *Suberites ficus*, *Suberites carnosus* and *Hymeniacidon perlevis (previously perleve)*, although other sponges are present, together with a dense bryozoan turf including *Flustra foliacea*, *Bugula plumosa* and crisiids. The biotope is recorded in heavily silted, wave exposed bedrock and boulders in moderately strong water flow. Whilst classed as circalittoral, the biotope occurs in relatively shallow conditions (0-20 m) due to heavy siltation (Connor *et al*., 2004). Other species are found within a range of circalittoral, faunal turf biotopes. However, the distribution and size of the *Suberites* spp. is an important characterizing feature. Therefor the sensitivity assessment is heavily based on the sensitivity of these sponges, although all sponges and bryozoans are considered where appropriate.

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 hermaphroditic (Hayward & Ryland, 1995b). Short-lived ciliated larvae are released via the aquiferous system and metamorphosis follows settlement. Growth and reproduction are generally seasonal (Hayward & Ryland, 1995b). Rejuvenation from fragments can also be 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). These microbial communities comprise up to 40% of sponge volume which may have a profound impact on host biology (Webster & Taylor, 2012).

Many sponges recruit annually, growth can be quite rapid, with a lifespan of one to several years (Ackers, 1983), However sponge longevity and growth is highly variable depending on the species and conditions (Lancaster, 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 & Laffoley (1993) monitored 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. *Hymeniacidon perlevis* is found in thin sheets, cushions and rarely as branching-erect. It is found from the Arctic to the Mediterranean from the littoral to the circalittoral (Ackers *et al*., 1992). Embryos have been recorded off the south coast of coast of England from July to October and longevity is believed to be three or more years (Fish & Fish, 1996).

Suberites ficus is a massive, highly variable demosponge that can be encrusting, lobed or elongate up to 30 cm. It is firm, but elastic, growing epilithically on rock, stones or shell has been reported in the low littoral and is common to all coasts in north west Europe (Hayward & Ryland, 1995b). It is firm and moderately elastic and is widespread throughout the Arctic and Atlantic in the northern hemisphere (Ackers *et al*., 1992). *Suberites* spp. have been recorded as epibiotic on crustacean and gastropod shells (Williams & McDermott, 2004) and may therefore be quite opportunistic. Hermit crab sponges have been reported to vary in abundance from season to season and from year to year (Sandford, 2003). Custodio *et al.* (1998) described the formation of multicellular aggregates from dissociated single cells of *Suberites domuncula* (primmorphs) as a means of proliferation.

Bryozoans are sessile fauna forming colonies through asexual budding following settlement of sexually produced larvae (Hayward & Ryland, 1995). Larvae have a short pelagic lifetime of up to about 12 hours (Ryland, 1976). Recruitment is dependent on the supply of suitable, stable, hard substrata (Eggleston, 1972b; Ryland, 1976; Dyrynda, 1994). *Alcyonidium diaphanum* forms an erect colony that can grow up to 50 cm long but more usually 15 cm. It has a small encrusting base, which attaches to hard substratum. The size, colour and colony form varies widely around the British Isles (Ager, 2007). Even in the presence of available substratum, Ryland (1976) noted that significant recruitment in bryozoans only occurred in the proximity of breeding colonies, Hiscock (1981) described *Flustra foliacea* colonizing a wreck several hundreds of metres from any significant hard substrata, and hence a considerable distance from potentially parent colonies. *Flustra foliacea* is a coarse, foliaceous bryozoan which tends to be found on stones and shells, reaches 10 cm in height, is common to all coasts in north-west Europe (Hayward & Ryland, 1995b) and is found across all coasts in the British Isles (NBN, 2016). Stebbing (1974) noted that *Flustra foliacea* on the Gower peninsular, South Wales had an annual growth season between March and November, with a dormant winter period, when no growth occurred, leading to a line forming across the fronds which can be used to age specimens. The species can regularly reach 6 years of age, although 12 year old specimens were reported off the Gower Peninsula (Stebbing, 1971; Ryland, 1976). Fortunato *et al.* (2013) compared numerous sets of growth data with their own observations and reported that colonies grow faster during the first couple of years (about 1.05 cm/year), slowing down afterwards, which could be due to the lateral growth of the fronds. Colonies appeared to be able to regenerate areas of the frond which had been removed by grazing. Tyler-Walters & Ballerstedt (2007) conducted a sensitivity review of *Flustra foliacea*, noting that Silén (1981) found *Flustra foliacea* could repair physical damage to its fronds with 5-10 days, concluding that, as long as the holdfast remains intact, *Flustra foliacea* would survive and grow back. Once settled, new colonies of *Flustra foliacea* take at least 1 year to develop erect growth and 1-2 years to reach maturity, depending on environmental conditions (Tillin & Tyler Walters, 2014). Four years after sinking off Lundy, the M.V. Roberts was found to be colonized by erect bryozoans and hydroids, including occasional *Flustra foliacea* (Hiscock, 1981). *Flustra foliacea* colonies are perennial, and potentially highly fecund with increasing colony size as each zooid produces a single embryo (Tillin & Tyler Walters, 2014; Eggleston (1972) with ca 10,000 larvae released from a specimen of *Flustra foliacea* within 3 hrs (Dalyell, cited in Hincks, 1880). Whilst Bryozoan larvae are typically very short lived, limiting recruitment to the immediate area surrounding breeding colonies, specimens experiencing strong water movement would improve dispersal potential, and may explain reports of *Flustra foliacea* colonizing the wreck of the *MV Roberts*, several hundreds of metres from any significant hard substrata, and hence a considerable distance from potentially parent colonies (Hiscock, 1981; Tyler-Walters & Ballerstedt, 2007).

Bugula spp. are perennials which tend to form short lived, large colonies in summer with significant die-back in late autumn and a dormant winter phase (Eggleston 1972; Dyrynda & Ryland, 1982). Reproduction occurs in summer/early autumn with some species such as *Bugula flabellate* reportedly having two generations of fronds capable of reproduction each year (Dyrynda & Ryland, 1982). Eggleston (1972) reported that newly settled specimens from the first generation in the Isle of Man grew rapidly and contributed to the second generation. Hatcher (1998) reported colonization of slabs, suspended 1 m above the sediment, by *Bugula fulva* within 363 days while Castric-Fey (1974) noted that *Bugula turbinata*, *Bugula plumosa* and *Bugula calathus* did not recruit to settlement plates after ca two years in the subtidal even though present on the surrounding bedrock. Similarly, Keough & Chernoff (1987) noted that *Bugula neritina* was absent from areas of seagrass bed in Florida even though substantial populations were present <100m away.

Resilience assessment. Bryozoans tend to be fast growing fauna that are capable of self-regeneration. Dispersal of the larvae is limited and whist it is likely that the bryozoan turfs would regenerate rapidly, within 2 years (resilience of 'High') for most levels of damage, in the case of removal of 75% or more of the bryozoans/habitat (Resistance of 'None'), recovery could take longer and a resilience of 'Medium' (2-10 years) should be recorded in such cases.

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. The recolonization of epifauna on vertical rock walls was investigated by Sebens (1985, 1986). He reported that 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 two years. A few individuals of *Alcyonium digitatum* and *Metridium senile* colonized within four years (Sebens, 1986) and would probably take longer to reach pre-clearance levels. The sponge *Halichondria panicea* reached pre-clearance levels of cover within 2 years and whilst the sponges present in this biotope would likely to return rapidly, the biotope is characterized by 'massive' examples of the sponges, one of the defining differences between this biotope and CR.MCR.CFaVS.CuSpH.As (Connor et al., 2004). These massive forms are likely to take longer to grow and a cautious resilience assessment of 'Medium' for resistance of 'None' or 'Low' is made. For resistance assessments of 'Medium' or 'High', resilience is assessed as 'High'.

Overall, the community is assessed to have resilience of '**Medium**' for resistance of 'None' or 'Low'. For resistance assessments of 'Medium' or 'High', resilience is assessed as '**High**'.

Hydrological Pressures

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

Suberites ficus has been recorded throughout the British Isles (NBN, 2015) and is widely distributed in north west Europe (Fish & Fish, 1996). *Suberites carnosus* and *Hymeniacidon perlevis* have been reported across the western, southern and northern British Isles (NBN, 2015) and more widely as southerly as Cape Verde (Van Soest, 1993) and the Azores (Boury-Esnault & Lopes, 1985) respectively. Bachinski *et al.* (1997) studied heat response in *Suberites domunculu*, noting stress response within 5 minutes of exposure to 31°C.

Bugula spp. grow and reproduce in the summer months. However, day length and/or the phytoplankton bloom characteristic of temperate waters are probably more important than temperature (Ryland, 1967; 1970; Tyler-Walters, 2005). Cocito & Sgorbini (2014) studied spatial and temporal patterns of colonial bryozoans in the Ligurian Sea over 9 years. High temperature events were recorded, the first causing mass mortality among a number of species. *Flustra foliacea* is perennial Stebbing (1971a) and widespread throughout the British Isles (NBN, 2015). It is distributed across north-west Europe (Fish& Fish, 1996). Stebbing (1971a) noted that *Flustra foliacea* on the Gower peninsular, South Wales had an annual growth season between March and November.

Sensitivity assessment. All characterizing species are found across the British Isles and (considering that this biotope occurs off Anglesey) it is unlikely that a high temperature event at the benchmark level would result in mortality and resistance is therefore assessed as '**High**', resilience as '**High**' and the biotope is '**Not sensitive**' at the benchmark level.

Temperature decrease (local)	High Q: Low A: NR C: NR	High Q: High A: High C: High	Not sensitive Q: Low A: NR C: NR

Suberites ficus has been recorded throughout the British Isles (NBN, 2015) and is widely distributed in north west Europe (Fish & Fish, 1996). *Suberites carnosus* and *Hymeniacidon perlevis* have been reported across the western, southern and northern British Isles (NBN, 2015) and more widely from northern Norway (Hentschel, 1929) and Svalbard, as *Hymerniacidon caruncula* (Hentschel, 1929) respectively.

Crisp (1964) studied 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 found that *Pachymastia johnstonia* and *Halichondria panicea* were wholly or partly killed by frost, several species appeared to be missing including *Amphilectus fucorum*. Others, including the characterizing *Hymeniacidon perlevis* were unusually rare and a few species, including *Polymastia boletiformis*, were not seriously affected. It should be noted that Crisp's general comments on all marine life state that damage decreased the deeper the habitat and that the extremely cold temperatures (sea temperatures between 4-6°C colder than the 5 year mean over a period of 2 months) is more extreme than the benchmark level for assessment.

Berman *et al.* (2013) monitored sponge communities off Skomer Island, UK over three years. 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 with a Rho value of 0.171 (P = 0.01%; 9999 permutations).

Some sponges do 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.*, 1982).

Characterizing bryozoans including *Flustra foliacea*, *Bugula plumosa* and *Bugula flabellata* have been recorded across the British Isles, from the Channel Isles to the northern coast of Scotland (NBN, 2015).

Flustra foliacea is perennial Stebbing (1971a) and widespread throughout the British Isles (NBN, 2015) and north-west Europe (Fish& Fish, 1996). Stebbing (1974) noted that *Flustra foliacea* on the Gower peninsular, South Wales had an annual growth season between March and November, with a dormant winter period, when no growth occurred. Growth resumed in spring, leading to a line forming across the fronds which can be used to age specimens (Stebbing, 1971a).

Sensitivity assessment. All characterizing species are found across the British Isles and (considering that this biotope occurs off Anglesey) it is unlikely that a low temperature event at the benchmark level would result in mortality and resistance is therefore assessed as '**High**', resilience as '**High**' and the biotope is '**Not sensitive**'.

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) describes the presence of *Dysidea fragilis* in a hypersaline coastal lagoon (42-47 g/l) in La Mar Menor, Spain.

Soule & Soule (1979) cite Hastings (1927) who described the presence of 5 bryozoans in hypersaline conditions in the Suez Canal. No evidence could be found for characterizing species.

Sensitivity assessment. 'No evidence' for mortality or tolerance of the characterizing bryozoans or sponges in hypersaline conditions could be found.

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

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 unaffected at this range. *Cliona celata* and *Pachymatisma johnstonia* had a slight preference for more estuarine conditions. Mean salinity difference between the two farthest zones 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 sponges occur in harbours and estuaries, including *Hymeniacidon perlevis* (Ackers *et al*., 1992). *Suberites ficus* is generally found in oceanic water, where there is no freshwater influence (Ackers *et al*., 1992) and is therefore unlikely to be tolerant of a decrease in salinity.

Ryland (1970) stated that, with a few exceptions, the Gymnolaemata were fairly stenohaline and restricted to full salinity (30-35 ppt), noting that reduced salinities result in an impoverished bryozoan fauna. *Flustra foliacea* appears to be restricted to areas with high salinity (Tyler-Walters & Ballerstedt 2007; Budd 2008).

Dyrynda (1994) noted that *Flustra foliacea* was probably restricted to the vicinity of the Poole Harbour entrance by their intolerance to reduced salinity. Although, protected from extreme changes in salinity due to their subtidal habitat, severe hyposaline conditions could adversely affect *Flustra foliacea* colonies.

Sensitivity assessment. Whilst there is contradictory evidence amongst the sponges, *Suberites ficus* and the bryozoans are unlikely to resist a reduction in salinity. Resistance is therefore '**Low**', resilience is '**Medium**' and the sensitivity is '**Medium**'.

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 of insignificant importance for sponges.

Pumping and filtering occurs in choanocyte cells that generate water currents in sponges using flagella (De Vos *et al.*, 1991).

Water flow has been shown to be important for the development of bryozoan communities and the provision of suitable hard substrata for colonization (Eggleston, 1972b; Ryland, 1976). In addition, areas subject to high mass transport of water such as the Menai Strait and tidal rapids generally support large numbers of bryozoan species (Moore, 1977). Although, active suspension feeders, their feeding currents are probably fairly localized and they are dependent on water flow to bring adequate food supplies within reach (McKinney, 1986). A substantial decrease in water flow will probably result in impaired growth due to a reduction in food availability, and an increased risk of siltation (Tyler-Walters, 2005).

Okamura (1984) reported that an increase in water flow from slow flow (0.01-0.02 m/s) to fast flow (0.1 – 0.12 m/s) reduced feeding efficiency in small colonies but not in large colonies of *Bugula stolonifera*.

Flustra foliacea colonies are flexible, robust and reach high abundances in areas subject to strong currents and tidal streams Stebbing, 1971a; Eggleston, 1972b; Knight-Jones & Nelson-Smith, 1977; Hiscock, 1983, 1985; Holme & Wilson, 1985). Dyrynda (1994) suggested that mature fronded colonies do not occur on unstable substratum due to the drag caused by their fronds, resulting in rafting of colonies on shells or the rolling of pebbles and cobbles, resulting in destruction of the colony. Dyrynda (1994) reported that the distribution of *Flustra foliacea* in the current swept entrance to Poole Harbour was restricted to circalittoral boulders, on which it dominated as nearly mono-specific stands. While, the pumping activity of the lophophores provide the greatest proportion of the colonies food requirements (Hayward & Ryland, 1998), the current generated is probably very localized and the colonies are likely to be dependent on water currents for food supply. A significant decrease in water flow is likely to result in a decrease in the abundance of bryozoans.

It should be noted that a decrease in water flow would result in more deposition of suspended sediment, and consequently, a change in turbidity which could result in colonization by algal species.

Sensitivity assessment. CR.HCR.XFa.SubCriTf occurs in moderately strong water flow (0.5 – 1.5 m/sec). Whilst an increase at the benchmark level could result in increased scour and result in a change to more opportunistic hydroids and bryozoans, a decrease would reduce scour and could favour more slow growing faunal groups. However, a decrease of 0.1- 0.2 m/sec is unlikely to be significant and resistance is therefore assessed as **'High'**, resilience as **'High'** and the biotope is **'Not sensitive'** at the benchmark level.

Emergence regime changes	Low Q: Low A: NR C: NR	Medium Q: Low A: NR C: NR	Medium Q: Low A: Low C: Low

This biotope can occur in the 0-5 m range.   *Suberites ficus* occurs on the lower shore, *Hymeniacidon perlevis* up to the middle shore and *Bugula turbinata* on the lower shore (Fish & Fish, 1996; Dyrynda & Ryland, 1982) and mortality is likely to be low for these species in the event of an increase in emergence at the benchmark level.   However, *Flustra foliacea* is recorded as a sublittoral species (Fish & Fish, 1996) and mortality is likely to occur in the in hthe shallow examples of this biotope.

Resistance is therefore assessed as '**Low**', resilience is '**High**' and Sensitivity is '**Low**'.

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

Flustra foliacea occurs from very wave exposed to sheltered waters, although probably limited to deeper waters in very wave exposed conditions (Tyler-Walters & Ballerstedt ,2007) The oscillatory water flow generated by wave action may be more damaging than constant strong currents, e.g. strong wave action may generate an oscillatory flow of 2m/sec at 20m (Hiscock, 1983, 1985). *Flustra foliacea* is a common member of the flotsam, having been removed from its substratum by storms. Whilst the biotope is circalittoral, a severe increase in wave exposure (e.g. storms) could affect bryozoans colonies. Cocito *et al* (1998) described a severe winter storm of 1993 had devastating effects on the same *Flustra foliacea* population, sweeping away most of the colonies down to 11 m. 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.

Sensitivity assessment. CR.HCR.XFa.SubCriTf is characterized by the presence of 'massive' sponge forms which tend to be associated with less wave exposed locations and a significant increase in wave action could result in change in sponge morphology and may result in reclassification of the biotope. However, a change at the benchmark level is unlikely to be significant enough to affect the biotope and resistance is therefore assessed as '**High**', resilience as '**High**' and the biotope is '**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

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

Whilst some sponges, such as *Cliona* spp. have been used to monitor heavy metals by looking at the associated bacterial community (Marques *et al.*, 2006; Bauvais *et al.*, 2015), no literature on the effects of transition element or organo-metal pollutants on the characterizing sponges could be found. TBT has been reported to induce apoptotic processes in the tissue of the marine sponge *Geodia cydonium* (Batel *et al.*, 1993).

Bryozoans are common members of the fouling community, and amongst those organisms most resistant to antifouling measures, such as copper containing anti-fouling paints (Soule & Soule, 1979; Holt et al., 1995). Bryan & Gibbs (1991) reported that there was little evidence regarding TBT toxicity in bryozoa with the exception of the encrusting *Schizoporella errata*, which suffered 50% mortality when exposed for 63 days to 100ng/l TBT. Rees *et al.* (2001) reported that the abundance of epifauna (including bryozoans) had increased in the Crouch Estuary in the 5 years since TBT was banned from use on small vessels. This last report suggests that bryozoans may be at least inhibited by the presence of TBT. Hoare & Hiscock (1974) suggested that polyzoa (bryozoa) were amongst the most intolerant species to acidified halogenated effluents in Amlwch Bay, Anglesey and reported that *Flustra foliacea* did not occur less than 165m from the effluent source. The evidence therefore suggests that *Securiflustra securifrons* would be sensitive to synthetic compounds.

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.

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). 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). *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 animal, would likely lead to cancers. As sponge cells are not organized into organs the long-term effects are uncertain (Zahn *et al.*, 1981).

Little information on the effects of hydrocarbons on bryozoans was found. Ryland & e Putron (1998) did not detect adverse effects of oil contamination on the bryozoan *Alcyonidium* spp. or other sessile fauna in Milford Haven or St. Catherine's Island, south Pembrokeshire. Houghton *et al.* (1996) reported a reduction in the abundance of intertidal encrusting bryozoa (no species given) at oiled sites after the *Exxon Valdez* oil spill. Soule & Soule (1979) reported that the encrusting bryozoan *Membranipora villosa* was not found in the impacted area for 7 months after the December 1976 *Bunker C* oil spill in Los Angeles Harbour. Additionally, Soule & Soule (1979) reported that *Bugula neritina* was lost from breakwater rocks in the vicinity (in December 1979) of the *Bunker C* oil spill and had not recovered within a year. However, *Bugula neritina* had returned to a nearby area within 5 months (May 1977) even though the area was still affected by sheens of oil. Furthermore, only three of eight recorded species were present two weeks after the incident in April within the affected breakwater area. All the species had been replaced by dense growths of the erect bryozoan *Scrupocellaria diegensis* by June. Banks & Brown (2002) found that exposure to crude oil significantly impacted recruitment in the bryozoan *Membranipora savartii.*

Mohammad (1974) reported that *Bugula* spp. and *Membranipora* spp. were excluded from settlement panels near an oil terminal in Kuwait subject to minor but frequent oil spills. Encrusting bryozoans are also probably intolerant of the smothering effects of acute hydrocarbon contamination and pollution, resulting in suffocation of colonies and communities may be lost or damaged. Circalittoral communities are likely to be protected from the direct effects of oil spills by their depth. However, the biotope may be exposed to emulsified oil treated with dispersants, especially in areas of turbulence, or may be exposed to water soluble fractions of oils, PAHs or oil adsorbed onto particulates (Tyler-Walters, 2002).

Little information of the effects of hydrocarbons on hydroids was found although hydroid species 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).

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.

Schröder *et al*. (1998) demonstrated that exposure to selected classes of PCBs induced DNA damage in the *Suberites domuncula*. Bryozoans are common members of the fouling community, and amongst those organisms most resistant to antifouling measures, such as copper containing anti-fouling paints (Soule & Soule, 1979; Holt et al., 1995). Hoare & Hiscock (1974) suggested that polyzoa (bryozoa) were amongst the most intolerant species to acidified halogenated effluents in Amlwch Bay, Anglesey and reported that *Flustra foliacea* did not occur less than 165m from the effluent source.

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: Medium A: Medium C: Medium	Medium Q: Low A: NR C: NR	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) suggest possible adverse effects on marine species below 4 mg/l and probable adverse effects below 2 mg/l.

Little information on the effects of oxygenation on bryozoans was found. Sagasti *et al.* (2000) reported that epifauna communities, including dominant species such as the bryozoans were unaffected by periods of moderate hypoxia (ca 0.35 -1.4 ml/l) and short periods of hypoxia (<0.35 ml/l) in the York River, Chesapeake Bay, although bryozoans were more abundant in the area with generally higher oxygen. However, estuarine species are likely to be better adapted to periodic changes in oxygenation.

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. Despite the presence of *Tethya aurantia*, *Kirchenpaueria pinnata*, *Hymeniacidon perlevis* and *Suberites carnosus* in shallower depths, no sponges 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 oxygen 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).

Sensitivity assessment

The evidence suggests that the sponge communities would be severely affected in hypoxic conditions. Resistance is therefore recorded as '**Low**', with a resilience of '**Medium**' and sensitivity is classed as '**Medium**'.

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 µM for nitrate and ≤0.5 µM 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 increase in abundance of *Cliona delitrix* in organically polluted section of Grand Cayman fringing reef affected by the discharge of untreated faecal sewage. Ward-Paige *et al.*, 2005 described greatest size and biomass of Clionids corresponding with highest nitrogen, ammonia and δ^{15}N levels. Hartikainen *et al.* (2009) reported that increased nutrient concentrations resulted in freshwater bryozoans achieving higher biomass. O'Dea & Okamura (2000) found that annual growth of *Flustra foliacea* in western Europe has substantially increased since 1970. They suggest that this could be due to eutrophication in coastal regions due to organic pollution, leading to increased phytoplankton biomass (see Allen *et al.*, 1998).

Nevertheless, this biotope is considered to be **'Not sensitive'** at the pressure benchmark, that assumes compliance with good status as defined by the WFD.

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

Fu *et al.* (2007) described *Hymeniacidon perlevis* (as *Hymeniacidon perleve*) in aquaculture ecosystems in sterilized natural seawater at several different concentrations of total organic carbon (TOC) ranging from 52.9 to 335.13 mg/l. *Hymeniacidon perlevis* removed 44–61% TOC during 24 h, with retention rates of ca. 0.19–1.06 mg/h per g-fresh sponge *Hymeniacidon perlevis* removed organic carbon excreted by *Fugu rubripes* with similar retention rates over a 15 day study and the sponge biomass increased by 22.8%. Some of the characterizing sponges occur in harbours and estuaries, including *Halichondria* spp. and *Hymeniacidon perlevis* (Ackers *et al.*, 1992). Rose & Risk, 1985 described 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. 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.

O'Dea & Okamura (2000) found that annual growth of *Flustra foliacea* in western Europe has substantially increased since 1970. They suggest that this could be due to eutrophication in coastal regions due to organic pollution, leading to increased phytoplankton biomass (see Allen *et al*., 1998). Mayer-Pinto & Junqueira (2003) studied the effects of organic pollution on fouling communities in Brazil and found that some tolerance of polluted/unpolluted artificial reefs varied among bryozoan species. It should be note that *Bugula* spp. preferred the polluted sites.

Sensitivity assessment

Whilst an increase in organic matter would likely be removed relatively rapidly by water movement in this biotope, such an increase is likely be beneficial to the characterizing species. Resistance is therefore '**High**' resilience is '**High**' and the biotope is '**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.

Sensitivity assessment. 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 rock.

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 Q: Medium A: Low C: Medium	Medium Q: Low A: NR C: NR	Medium Q: Low A: Low C: Low

Freese *et al.* (1999) studied the effects of trawling on a seafloor habitats and associated invertebrates in the Gulf of Alaska. They found that a transect following a single trawling event showed significantly reduced abundance of 'vase' sponges (67% expressed damage) and 'morel' sponges, although total damage could not be quantified as their brittle nature meant that these sponges were completely torn apart and scattered. The 'finger' sponges, the smallest and least damaged (14%) of the sponges assessed, were damaged by being knocked over.

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 over 50% of sponges, including *Neopetrosia*, *Spheciospongia*, *Spongia* and *Hippiospongia*, were torn loose from the bottom following a shrimp trawl in Florida, US. 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.

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. Impacts of trawling activity in Alaska study were 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 was considered likely to take many years for deep sponge communities to recover if adversely affected by physical damage Freese (2001).

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 results indicated that epifaunal species, including the sponge *Pachymatisma johnstoni*, were highly damaged by the experimental trawl. Coleman *et al.* (2013) described a 4 year study on the differences between a commercially potted area in Lundy within a no take zone. No significant difference in Axinellid populations was observed. The authors concluded that lighter abrasion pressures, such as potting, were far less damaging than heavier gears, such as trawls.

Sensitivity assessment. Given the sessile, emerged nature of the sponges and bryozoans, damage and mortality following a physical disturbance effect are likely to be significant. The physiology of the Bryozoans affords some protection in the event of abrasion events and recovery is likely to be rapid if stolons remain undamaged. Based on the damage to sponges, Resistance has been assessed as '**Low**', Resilience as '**Medium**' and sensitivity has been 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)	None Q: Low A: NR C: NR	Medium Q: Low A: NR C: NR	Medium Q: Low A: Low C: Low

An increase in suspended sediment may have a deleterious effect on the suspension feeding community. It is likely to clog their feeding apparatus to some degree, resulting in a reduced ingestion over the benchmark period and, subsequently, a decrease in growth rate (Jackson, 2004). Bryozoans are suspension feeders that may be adversely affected by increases in suspended sediment, due to clogging of their feeding apparatus. However, Tyler-Walters & Ballerstedt (2007) reported *Flustra foliacea* as tolerant to increased suspended sediment based on its occurrence in areas of high suspended sediment e.g. abundant in turbid, fast flowing waters of the Menai Straits (Moore 1977). Communities dominated by *Flustra foliacea* were described on tide swept seabeds, exposed to high levels of suspended sediment and sediment scour in the English Channel (Holme & Wilson, 1985). *Flustra foliacea* is also characteristic of sediment-scoured, silty rock communities CR.HCR.XFa.FluCoAs and CR.MCR.EcCr.UrtScr (Connor *et al*., 2004).

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 (Schönberg, 2015; Bell & Barnes, 2000; 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 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 sponges occur in harbours and estuaries, including *Hymeniacidon perlevis* (Ackers *et al*., 1992). Storr (1976) observed the sponge *Sphecispongia vesparium* back washing to eject sediment and noted that other sponges (such as *Condrilla nucula*) use secretions to remove settled material.

The very high silt loading in the water column means that this circalittoral biotope occurs at unusually shallow depths (0 - 20 m below Chart Datum). However, a decrease in suspended sediment at the depth range at which this biotope occurs could result in an algal component colonizing this biotope. This would result in a change in biotope classification, however, following return to heavily silted conditions, it is probable that the algal species would disappear and return to CR.HCR.XFa.SubCriTf would subsequently occur.

Sensitivity assessment

CR.HCR.XFa.SubCriTf is a heavily silted biotope which occurs at shallow depths. A decrease in suspended sediment could result in colonization by algal species, the biotope would therefore have to be reclassified and resistance would be '**None**'. Following return to heavily silted conditions, it is likely that the algae would disappear and the biotope would recover. Resistance is ‘**Medium**’ and sensitivity is assessed as ‘**Medium**’.

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

Flustra foliacea dominated communities were reported in a tide-swept region of the central English Channel subject to sediment transport (mainly sand) and periodic, temporary, burial (ca <5 cm) (Holme & Wilson, 1985).

Despite sediment being considered to have a negative impact on suspension feeders (Gerrodette & Flechsig, 1979), many encrusting sponges appear to be able survive in highly sedimented conditions, and in fact many species prefer such habitats (Schönberg, 2015; Bell & Barnes, 2000; 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 sea squirt *Ascidiella aspera* 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). *Hymeniacidon perlevis* is encrusting (up to 2.5 mm height) or cushion forming up to 15 cm across and 2-5 cm thick (Hayward & Ryland, 1995b). It can tolerate smothering of the main body, with the papillae protruding through the silt layer (Hayward & Ryland, 1995b). It should be noted that this biotope is characterized by ‘massive’ sponge forms and the majority should remain unburied at the benchmark level.

Sensitivity assessment: Deposition of 5 cm of sediment may bury some of the characterizing species. However, the biotope experiences moderate water flow so that and depostied sediment is prbably removed with a few tidal cycles. Resistance is assessed as ‘**High**’, resilience as ‘**High**’ and the biotope is '**Not sensitive**' at the benchmark level.

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

Flustra foliacea dominated communities were reported in a tide-swept region of the central English Channel subject to sediment transport (mainly sand) and periodic, temporary, burial (ca <5 cm) (Holme & Wilson, 1985).

Despite sediment being considered to have a negative impact on suspension feeders (Gerrodette & Flechsig, 1979), many encrusting sponges appear to be able survive in highly sedimented conditions, and in fact many species prefer such habitats (Schönberg, 2015; Bell & Barnes, 2000; 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 sea squirt *Ascidiella aspera* 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). *Hymeniacidon perlevis is* encrusting (up to 2.5 mm height) or cushion forming up to 150 mm across and 20-50 mm thick (Hayward & Ryland, 1995b). It can tolerate smothering of the main body, with the papillae protruding through the silt layer (Hayward & Ryland, 1995b).

Sensitivity assessment: Deposition of 30 cm of sediment would bury the characterizing species.

However, the biotope experiences moderate water flow. Resistance is assessed as '**Medium**', resilience as '**High**' and sensitivity as '**Low**'.

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'

Underwater noise changes	High Q: Low A: NR C: NR	High Q: High A: High C: High	Not sensitive Q: Low A: Low C: Low

Stanley *et al.* (2014) studied the effects of vessel noise on fouling communities and found that the bryozoans *Bugula neritina*, *Watersipora arcuate* and *Watersipora subtorquata* responded positively. More than twice as many bryozoans settled and established on surfaces with vessel noise (128 dB in the 30–10,000 Hz range) compared to those in silent conditions. Growth was also significantly higher in bryozoans exposed to noise, with 20% higher growth rate in encrusting and 35% higher growth rate in branching species.

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.

Sensitivity assessment

The characterizing sponges are unlikely to respond to noise or vibrations, while the bryozoan turf may benefit. Resistance is, therefore, assessed as '**High**', resilience as '**High**' and the biotope is '**Not sensitive'** at the benchmark level.

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

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, probably due to reduced competition from algae. *Flustra foliacea* larvae are positively phototactic on release, swimming for only short periods (Hayward & Ryland, 1998) however, at the depths *Flustra foliacea* can occur, light may not be important. Given the highly turbid nature of the biotope, it is unlikely that an increase in light or shade at the benchmark level would affect the biotope. Resistance is, therefore, assessed as '**High**', resilience as '**High**' and the biotope is 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

Not relevant: 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

Bugula spp. are classed as fouling bryozoans, and may be found in the intake pipes of ships or power stations, and on ships hulls. The geographic distribution of *Bugula* species has been extended by transportation by shipping (Ryland, 1967), however **'No evidence'** of genetic modification was found. No evidence for the characterizing sponges 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. A number of invasive bryozoans are of concern including *Schizoporella japonica* (Ryland *et al*., 2014) and *Tricellaria inopinata* (Dyrynda *et al*., 2000; Cook *et al*., 2013b), although no evidence for the effects on the biotope were found. CR.HCR.XFa.SubCriTf occurs close to a population of *Crepidula fornicata* at their northerly distribution limit. There is **‘No evidence’** on which to assess this pressure. Due to the constant risk of new invasive species, the literature for this pressure should be revisited.

Introduction of microbial pathogens	Medium Q: Medium A: Low C: Medium	High Q: Low A: NR C: NR	Low Q: Low A: Low C: Low

Gochfeld *et al.* (2012) found that diseased sponges hosted significantly different bacterial assemblages compared to healthy sponges, with diseased sponges also exhibiting 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. 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* were effectively dead and had a bacterial community similar to marine sediments. The fouled *Cliona* had a very distinct bacterial community that may suggest a specific pathogen caused the effect (Burton, pers comm; Preston & Burton, 2015). No evidence for disease in the characterizing bryozoans could be found.

Sensitivity assessment. Whilst mass mortality and even extinction have been reported further afield, sponge diseases have caused limited mortality in some species in the British Isles. Resistance is, therefore, assessed as **'Medium'**, resilience as **'High'** and sensitivity as **'Low'** . Given the on-going work described above, this pressure should be revisited in light of any new evidence.

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 However, this species does not occur in the British Isles and no record of commercial exploitation of sponges in the British Isles could be found. Should removal of target species occur, the sessile, epifaunal nature of the characterizing species would have little resistance to this pressure.

This pressure is **'Not relevant'** as no characterizing species are targeted.

Removal of non-target species	Low Q: Low A: NR C: NR	Medium Q: Low A: NR C: NR	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, accidental removal of the characteristic epifauna is likely to remove a proportion of the biotope and change the biological character of the biotope.

Based on the potential loss of sponges, resistance has been assessed as ‘**Low**’, resilience as ‘**Medium**’ and sensitivity has been assessed as ‘**Medium**’.

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