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Dendrodoa grossularia and *Clathrina coriacea* on wave-surged vertical infralittoral rock

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

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2016-07-07

A report from:

The Marine Life Information Network, Marine Biological Association of the United Kingdom.

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This review can be cited as:

Readman, J.A.J., 2016. [*Dendrodoa grossularia*] and [*Clathrina coriacea*] on wave-surged vertical infralittoral rock. In Tyler-Walters H. and Hiscock K. (eds) *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. DOI <https://dx.doi.org/10.17031/marlinhab.190.1>



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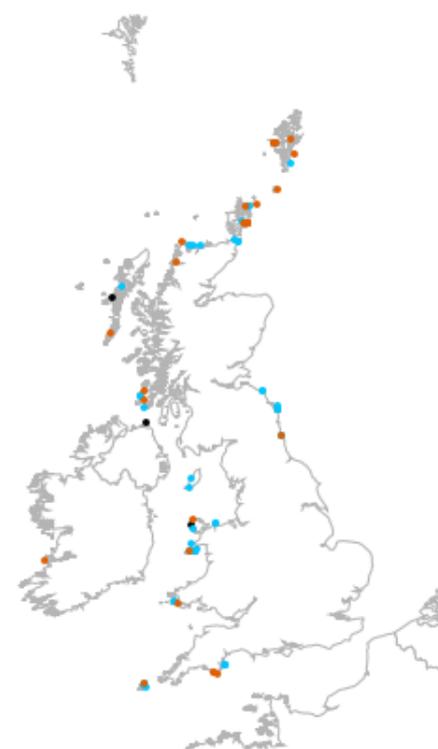
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Dendrodoa grossularia and *Clathrina coriacea* on wave-surged vertical infralittoral rock

Photographer: Keith Hiscock

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- Core records
- Non-core, certain determination
- Non-core, uncertain determination
- Predicted habitat extent

17-09-2018

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

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

Summary

☰ UK and Ireland classification

EUNIS 2008 A3.714

Dendrodoa grossularia and *Clathrina coriacea* on wave-surged vertical infralittoral rock

JNCC 2015 IR.FIR.SG.DenCcor

Dendrodoa grossularia and *Clathrina coriacea* on wave-surged vertical infralittoral rock

JNCC 2004 IR.FIR.SG.DenCcor

Dendrodoa grossularia and *Clathrina coriacea* on wave-surged vertical infralittoral rock

1997 Biotope IR.EIR.SG.SCAs.DenCla

Dendrodoa grossularia and *Clathrina coriacea* on wave-surged vertical infralittoral rock

🔍 Description

Vertical or overhanging infralittoral rock subject to considerable wave-surge, especially in the middle or back of caves but also in gullies and tunnels, and dominated by dense sheets of the

ascidian *Dendrodoa grossularia*, together with variable quantities of the sponge *Clathrina coriacea*. At some sites *D. grossularia* forms continuous sheets, with few other species present. Other sponges such as *Esperiopsis fucorum*, *Pachymatisma johnstonia*, *Leucosolenia botryoides*, *Scypha ciliata* and *Halichondria panicea* regularly occur in this biotope, though generally at low abundance. Other ascidians, especially *Polyclinum aurantium*, *Diplosoma* spp. and other didemnids may also occur, though only *P. aurantium* is ever as abundant as *D. grossularia*. Being characteristically found in the middle or towards the backs of the caves mean that there is generally insufficient light to support any foliose seaweeds, although encrusting coralline algae are not uncommon. More scoured areas may also contain the anemone *Urticina felina*, whilst *Sagartia elegans* is often present in low numbers. Mobile fauna are often limited to the starfish *Asterias rubens* and *Henricia* spp., the brittlestar *Ophiopholis aculeata* and crabs *Cancer pagurus* and *Necora puber*. The barnacle *Balanus crenatus* can occur, usually in low densities.

↓ Depth range

0-5 m, 5-10 m

Additional information

-

✓ Listed By

- none -

Further information sources

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Sensitivity review

Sensitivity characteristics of the habitat and relevant characteristic species

This review addresses a group of high energy, wave exposed that occur on rock surfaces in gullies, caves and overhangs within the infralittoral. They are dominated by crustose sponges including *Halichondria panicea*, *Pachymastia fucorum*, *Amphilectus (Esperiopsis) fucorum* and *Clathrina coriacea*. Given the limited evidence available and the range of different sponges present across the biotope groups, assessments for this group are quite generalized.

There is a progression within this group of biotopes, with IR.FIR.SG.CrSp occurring in the areas most subject to wave surge (narrow-most gullies). In slightly less surge affected areas, ascidians (primarily *Dendrodoa grossularia*) become more abundant and therefore important in defining the character of the biotopes CrSpAsAn, DenCcor and CrSpAsDenB. A highly scoured zone of barnacles and calcareous tubeworms often form a zone below, abutting the cave/gully floor (e.g. CC.BalPom).

Additionally, anthozoans are considered important in defining the IR.FIR.SG.CrSpAsAn biotope. A variety of anthozoans are found including *Corynactis viridis*, *Sagartia elegans*, *Urticina felina*, *Alcyonium digitatum*, *Metridium senile*.

Other species present are considered non-characterizing or ubiquitous and the assessments, therefore, focus on the crustose sponges, ascidians and anemones.

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 in sponges (Fish & Fish, 1996). Some sponges are known to be highly resilient 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).

Many sponges recruit annually and growth can be rapid, with a lifespan of one to several years (Ackers, 1983). However sponge longevity and growth has been described as highly variable depending on the species and environmental conditions (Lancaster *et al.*, 2014). It is likely that erect sponges are generally longer lived and slower growing given their more complex nature than smaller encrusting or cushion sponges.

Marine sponges often harbour dense and diverse microbial communities, which can include bacteria, archaea and single-celled eukaryotes (fungi and microalgae). The microbial community can comprise up to 40% of sponge volume, and may have a profound impact on host biology (Webster & Taylor, 2012).

Fowler & Laffoley (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 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). *Hymeniacion 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). *Suberites ficus* is encrusting to massive and lobose, firm and moderately elastic. It is found across the Arctic and Atlantic (Ackers *et al.*, 1992). *Raspailia 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 (2015) 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 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). 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 change in biochemical composition (condition index and protein lipid and glycogen content) was 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. Fell & Lewandrowski (1981) observed the population dynamics of *Halichondria* spp. within an eelgrass bed in an estuary in Connecticut, US 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'. Gaino *et al.* (2010) observed reproduction within two communities of *Hymeniacion perlevis* (syn. *Hymeniacion 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 was 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).

Ackers (1992) describes *Halichondria bowerbanki* 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 and can be partly embedded in mud. Sutherland (1981) investigated the fouling community in North Carolina, 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. Sebens (1985; 1986) monitored recolonization of epifauna on cleared vertical rock walls where the sponge *Halichondria panicea* reached pre-clearance levels of cover after two years.

The reproductive period for *Clathrina coriacea* runs from July to October and reproduction through fragmentation has been reported in the summer (Johnson, 1978). The structure of the sponge *Clathrina coriacea* comprises of delicate tubes up to 1 cm in height and is common to all coasts of the British Isles. It is found in the low littoral and shallow sublittoral (Hayward & Ryland, 1995b).

Dendrodoa grossularia is a small solitary ascidian, 1.5-2 cm diameter (Millar, 1954). Settlement occurs from April-June, individuals reach their maximum size by the following summer. 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 recovery 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.

Urticina felina is likely to be very long lived, given their ability to regenerate (Francis *et al.*, 1976). *Urticina felina* will readily repair damage to the body: removal of tentacles by clipping does not alter the behaviour and the tentacle regenerates within a few days (Mercier *et al.*, 2011). *Urticina felina* internally broods young, which when released settle close to the adult. Brooding prevents predation of juveniles and in areas of high wave action and water flows counteracts removal and supports the formation of aggregations of anemones in harsh environments (Kaliszewicz *et al.*, 2012). However, brooding does limit dispersal (Kaliszewicz *et al.*, 2012) and may inhibit recovery where a population is entirely removed. Dispersal ability is considered to be poor in the similar species *Urticina eques* (Solé-Cava *et al.*, 1994). Adults can detach from the substratum and relocate but locomotive ability is very limited. Impacts that remove large proportions of the population over a wide area will effectively reduce the availability of colonists. Yet *Urticina felina* colonized the artificial reef of *HMS Scylla*, in Whitsand Bay, West Cornwall, in the second year of the vessel being on the seabed and had increased in numbers four years later (Hiscock *et al.*, 2010).

Metridium senile reproduces each year and the planulae spend months in the plankton and are likely to disperse over in excess of 10 km from parent anemones (Sebens, 1985). New jetty piles at Lundy were colonized by their third year (L. Cole, pers. comm.). Settled planulae or individuals produced by basal laceration are likely to grow rapidly. Bucklin (1987a) found that, for *Metridium senile* from California, individuals showed rapid growth to large sizes when fed at frequent intervals. Mean size grew steadily during the first eight months then levelled off. An increase from 5 cm² pedal disk area to 45 cm² occurred within 12 months. However, in clearance experiments,

Sebens (1985) found that it took 5-10 years for *Metridium senile* to return to pre-clearance cover. In another study, Wahl (1985) found that *Metridium senile* returned to rock walls only one week after oxic conditions returned following annual de-oxygenation events in the Inner Flensburg Fjord. Shick & Hoffman (1980, cited in Sebens, 1985) reported that pedal laceration in *Metridium* was greater at a site with higher water flow rate compared to slower flowing areas. This is presumably because successful recruitment by the planktonic larvae may be difficult in such as wave-surged environments. As a result, many of the species capable of asexual reproduction within this biotope may rely more on this method of reproduction in colonizing newly created space. Growth of *Metridium senile* is rapid. Bucklin (1985) working in Britain found that *Metridium senile* f. *dianthus* fragments and for *Metridium senile* f. *pallidum* newly settled individuals, grew up to 0.6 mm and 0.8 mm in pedal diameter per day respectively.

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. Sebens (1986) reported that *Halichondria panicea* reached pre-clearance levels of cover within 2 years. 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. *Dendrodoa grossularia* can reach sexual maturity within 1 year of growth and can rapidly recover following severe habitat alteration.

Hydrological Pressures

	Resistance	Resilience	Sensitivity
Temperature increase (local)	Medium Q: Low A: NR C: NR	High Q: High A: Medium C: Medium	Low Q: Low A: Low C: Low

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 *Halicnemis 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. 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 highest growth.

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), *Dendrodoa grossularia* is close to its southern range limit and a dramatic increase in temperature that is outside the normal range for the UK may cause mortality.

All anemones (*Corynactis viridis*, *Sagartia elegans*, *Urticina felina*, *Alcyonium digitatum*, *Metridium*

senile) are widely distributed across the British Isles (NBN, 2015).

Sensitivity assessment. Typical surface water temperatures around the UK coast vary, seasonally from 4-19°C (Huthnance, 2010). The biotope is considered to tolerate a 2°C increase in temperature for a year. The majority of characterizing species would be unaffected by an increase in temperature at the benchmark level. Whilst the ascidian *Dendrodoa grossularia* is widespread throughout the British Isles (NBN, 2015), it is close to its distribution limit and mortality may occur in dramatic temperature increases, as may some of the anemones. At the benchmark level, resistance is likely to be **'Medium'**, resilience is therefore **'High'** and sensitivity is assessed as **'Low'**.

Temperature decrease (local)

Medium

Q: Low A: NR C: NR

High

Q: High A: Medium C: Medium

Low

Q: Low A: Low C: Low

All characterizing sponges, anemones and the ascidian *Dendrodoa grossularia* 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 Skoma 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 *Hymenaphia 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.*, 1982).

Crisp (1964) studied the effects of an unusually cold winter (1962-63) 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 and several species appeared to be missing including *Amphilectus fucorum*. Others, including *Hymeniacion perleve* 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. Barthel (1986) reported that *Halichondria panicea* in the Kiel Bight degenerated and disintegrated after reproduction before winter, however young colonies were observed from September. *Dendrodoa grossularia* has been recorded as an abundant component of benthic fauna in Nottinghambukta, Svalbard (Różycki & Gruszczynski, 1991).

Sensitivity assessment

There is evidence of sponge mortality at extreme low temperatures in the British Isles (Crisp, 1964a). Given this evidence, it is likely that a cooling of 5°C for a month could potentially affect the characterizing sponges in shallow examples of this biotope. Resistance has been assessed as **'Medium'**, with a resilience of **'High'**. Sensitivity has, therefore, been assessed as **'Low'** at the benchmark level.

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

The biotope is recorded in Full salinity. An increase at the benchmark level would result in hypersaline conditions. Marin (1998) described the presence of the ascidian *Dysidea fragilis* in a hypersaline coastal lagoon (42-47 g/l) in La Mar Menor, Spain. 'No evidence' for the characterizing sponges, *Dendrodoa grossularia* or other epifauna in hypersaline conditions was found.

Salinity decrease (local)

Medium

Q: Low A: NR C: NR

High

Q: High A: Medium C: Medium

Low

Q: Low A: Low C: Low

These biotopes have only been recorded in full salinity (Connor *et al.*, 2004), and any low salinity events would probably be short-lived due to the high-energy conditions.

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 a greater range was experienced in the Inner Rade ($\pm 2.4\%$ compared with $\pm 0.1\%$). 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 *Hymeniacion perleve* (Ackers *et al.*, 1992). Of the characterizing sponges present in this biotope, all except *Clathrina coriacea* have been recorded in variable salinity of lower (Connor *et al.*, 2004)

Dendrodoa grossularia has been recorded as an abundant component of benthic fauna in Nottinghambukta, Svalbard where salinity can range between 6 and 20‰ (Różycki & Gruszczyński, 1991).

Although *Urticina felina* is predominantly marine, the species does penetrate into estuaries (e.g. the Thames estuary at Mucking (NMMP, 2001) and the River Blackwater estuary (Davis, 1967). Braber & Borghouts (1977) found that *Urticina* (as *Tealia*) *felina* penetrated to about the 11 ppt Chlorinity (about 20 psu) isohaline at mid tide during average water discharge in the Westerschelde estuary, suggesting that during high river flow, it would be tolerant of reduced salinity conditions.

Although *Metridium senile* is predominantly marine, the species also penetrates into estuaries. Braber & Borghouts (1977) found that *Metridium senile* occurred in about 10ppt Chlorinity (about 19 psu) in the Delta Region of the Netherlands suggesting that it would be tolerant of reduced salinity conditions. Shumway (1978) found that, during exposure to 50% seawater, animals retracted their tentacles whilst animals exposed to fluctuating salinity, contracted their body wall and produced copious mucus.

Sensitivity assessment

This biotope is subtidal and characterized by high energy and any low salinity events would probably be short lived. However, some mortality is likely, with some of the sponges (*Clathrina coriacea*) affected. Resistance is assessed as 'Medium', resilience as 'High' and sensitivity is 'Low'.

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

These biotopes are characterized by their high energy wave surge. There is a progression within this group of biotopes, with IR.FIR.SG.CrSp occurring in the areas most subject to wave surge (found in the narrow-most gullies). In slightly less surge affected areas, ascidians (primarily *Dendrodoa grossularia*) become more abundant and therefore important in defining the character of the biotopes CrSpAsAn, DenCcor and CrSpAsDenB.

Sensitivity assessment. All the biotopes within this complex are characterized by their high energy due to wave surge, and a change in water flow is unlikely to affect the hydrodynamics of the biotope. Change at the benchmark level (0.1-0.2 m/s) is unlikely to be significant enough to alter the biotope and resistance is, therefore, assessed as 'High', resilience is 'High' and the biotope is 'Not sensitive' at the benchmark level.

Emergence regime changes**Low**

Q: Low A: NR C: NR

High

Q: High A: Medium C: Medium

Low

Q: Low A: Low C: Low

This biotope occurs in the infralittoral, however it has been recorded in the 0-5 m depth band and may therefore be subject to emergence.

Increased emergence may reduce habitat suitability for characterizing species through greater exposure to desiccation and reduced feeding opportunities for the faunal community while. Given the subtidal nature of the biotope, emergence is likely to result in a significant decline in the characterizing species. However, the topography of vertical walls, caves and gullies may afford some resistance to areas within these biotopes and resistance is therefore assessed as 'Low'. Recovery is assessed as 'High', and sensitivity as 'Low'.

Wave exposure changes (local)**High**

Q: Low A: NR C: NR

High

Q: High A: High C: High

Not sensitive

Q: Low A: Low C: Low

All the biotopes within this complex are defined by their exposure to wave action. As sublittoral biotopes, a change in wave height would affect the wave surge experienced by characterizing species. A decrease in wave surge could result in succession of the IR.FIR.SG.CrSp to biotopes more dominated by ascidians and/or anemones.

Conversely, an increase in wave surge could result in loss of the IR.FIR.SG.CrSpAsAn, IR.FIR.SG.CrSpAsDenB and IR.FIR.SG.DenCcor to more impoverished or scoured biotopes.

Sensitivity assessment. All the biotopes within this complex are characterized by their high energy and significant changes, particularly decreases would probably result in a fundamental change in the nature of the biotope and hence reclassification would be required. However, at the benchmark level, changes are unlikely to be significant enough to alter the biotope and resistance is, therefore, assessed as 'High', resilience is '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.

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.

Mercier *et al.* (1998) exposed *Metridium senile* to tri-butyl tin contamination in surrounding water and in contaminated food. The species produced mucus 48 hours after exposure to contaminated seawater. TBT was metabolised but the species accumulated levels of butyl tins leading the authors to suggest that *Metridium senile* seemed vulnerable to TBT contamination. However, Mercier *et al.*, (1998) did not indicate any mortality and, since *Metridium senile* is a major component of jetty pile communities immediately adjacent to large vessels coated with TBT antifouling paints.

Ascidians may be intolerant of synthetic chemicals such as tri-butyl-tin anti-foulants. Rees *et al.* (2001), working in the Crouch estuary, observed that six ascidian species were recorded at one station in 1997 compared with only two at the same station in 1987, shortly following the banning of TBT in antifouling paints. Also, there was a marked increase in the abundance of ascidians especially *Asciidiella aspersa* and *Ascidia conchilega* in the estuary after the ban on TBT was introduced.

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

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). No information was found on the intolerance of the characterizing sponges or barnacles to hydrocarbons. However, other littoral barnacles generally have a high tolerance to oil (Holt *et al.*, 1995) and were little impacted by the *Torrey Canyon* oil spill (Smith, 1968).

Ignatiades & Becacos-Kontos (1970) found that the ascidian *Ciona intestinalis* can resist the toxicity of oil polluted water and ascidia 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).

Ryland & de Putron (1998) found no detectable damage to under-boulder communities, which are similar to some overhang communities, in Watwick Bay, Pembrokeshire following the *Sea Empress* oil spill. Part of the resistance to effects might be because oil does not settle onto overhanging surfaces. However, some species, especially gastropods are likely to be narcotised and killed and some damage is likely. Return to a previous species composition would occur from new settlement from larval sources although some gastropods have no or only a short dispersal phase so that

recovery will be slow.

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

Hoare & Hiscock (1974) reported that the anemone *Urticina felina* survived near to an acidified halogenated effluent discharge in a 'transition' zone where many other species were unable to survive, suggesting a tolerance to chemical contamination. However, *Urticina felina* was absent from stations closest to the effluent, which were dominated by pollution tolerant species (such as polychaetes). Those specimens closest to the effluent discharge appeared generally unhealthy.

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
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'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
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This pressure is **Not assessed**.

De-oxygenation	High Q: Low A: NR C: NR	High Q: High A: High C: High	Not sensitive Q: Medium A: Low C: Medium
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It is likely that as this biotope occurs in areas that experience significant wave surge, re-oxygenation is likely which would limit the effects of any de-oxygenation events. However, this may mean that the species present have little exposure to low oxygen and may be sensitive to this pressure.

Halichondria panicea has been reported to survive under oxygen levels as low as 0.5-4 % saturation (ca 0.05-0.4 mg/l) for up to 10 days (Mills *et al.*, 2014). Wahl (1984, 1985) noted that the LC₅₀ value for *Metridium senile* in anoxic conditions is about three weeks and that none survive beyond six weeks. He observed that anemones detached from the substratum during the first week of deoxygenation in the Inner Flensburg Fjord and may drift away. When oxygen is lacking, *Metridium senile* diminishes body surface area. At the level of the benchmark, *Metridium senile* is not sensitive and even in extreme conditions seems able to survive for some time and then detach. No specific evidence for the other species characterizing this biotope were found.

Sensitivity assessment. The hydrodynamics of this biotope would likely mean that hypoxic events would be rare and short lived. The available evidence suggests that *Halichondria panicea* and *Metridium senile* are tolerant of de-oxygenation and resistance is therefore recorded as '**High**', resilience as '**High**' and the biotope is '**Not sensitive**' at the benchmark level. Lack of evidence for other characterizing species results in a 'Low' confidence score.

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

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

Organic enrichment leads to organisms no longer being limited by the availability of organic carbon. The consequent changes in ecosystem function can lead to the progression of eutrophic symptoms (Bricker *et al.*, 2008), changes in species diversity and evenness (Johnston & Roberts, 2009) and decreases in dissolved oxygen and uncharacteristic microalgae blooms (Bricker *et al.*, 1999, 2008). Indirect adverse effects associated with organic enrichment include increased turbidity, increased suspended sediment and the increased risk of deoxygenation.

Johnston & Roberts (2009) undertook a review and meta-analysis of the effect of contaminants on species richness and evenness in the marine environment. Of the 49 papers reviewed relating to sewage as a contaminant, over 70% found that it had a negative impact on species diversity, <5% found increased diversity, and the remaining papers finding no detectable effect. It was found that any single pollutant reduced species richness by 30-50% within any of the marine habitats considered (Johnston & Roberts, 2009). Throughout their investigation there were only a few examples where species richness was increased due to the anthropogenic introduction of a contaminant. These examples were almost entirely from the introduction of nutrients, either from aquaculture or sewage outfalls.

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 species occur in harbours and estuaries, including *Halichondria panicea* (Ackers *et al.*, 1992).

There is some suggestion that there are possible benefits to the ascidians from 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).

Sensitivity assessment. These biotopes occur in high energy conditions and it is likely that the deposited organic content would be rapidly removed. There is also evidence that the filter-feeding characterizing species would tolerate an increase in organic content. Resistance is therefore assessed as 'High', resilience as 'High' and the biotope is 'Not sensitive' at the benchmark level.

	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
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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
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'**Not relevant**' to biotopes occurring on bedrock.

Habitat structure changes - removal of substratum (extraction)	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR
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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	High Q: High A: Medium C: Medium	Low Q: Medium A: Medium C: Medium
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The species characterizing this biotope occur on the rock and therefore have no protection from surface abrasion. For this assessment, the focus is on the effects of trampling and scour.

Halichondria panicea is compressible but crumbly in texture and easily broken (Ackers *et al*, 1992) and is typically found in cryptic or semi-cryptic areas (Hayward & Ryland, 1995b). Abrasion events are therefore likely to remove the sponge, however specific evidence was not found.

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, whilst damage to faunal crusts tended to be restricted, the sponge *Pachymatisma johnstoni* was highly damaged by the experimental trawl.

The abundance of *Urticina felina* increased in gravel habitats on the Georges Bank, (Canada) closed to trawling by bottom gears (Collie *et al.*, 2005) which suggested that this species was sensitive to fishing. In a recent review, assigning species to groups based on tolerances to bottom disturbance from fisheries, the anemone *Urticina felina* and the sponge *Halichondria panacea* were assigned to AMBI Fisheries Group II, described as 'species sensitive to fisheries in which the bottom is disturbed, but their populations recover relatively quickly' (Gittenberger & van Loon, 2011). *Urticina felina* also occurs in highly scoured habitats in the English Channel (Holme & Wilson, 1985).

Sensitivity assessment. These biotopes are defined by their high energy wave surge which prohibits succession. However they occur above cave and gully floors which experience significant scour and biotopes containing scour resistant barnacles and sponges tend to prevail. Any activity that physically abrades the faunal crust is likely to result in localized damage. Increase in scour or other abrasion events are likely to remove the sponge, ascidian and anemone components. Resistance is '**Low**', resilience is '**High**' and sensitivity is '**Low**'.

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)

Medium

Q: Low A: NR C: NR

High

Q: High A: Medium C: Medium

Low

Q: Low A: Low C: Low

An increase in suspended solids is unlikely to have direct effects on the characterizing species due to light penetration or clogging. However, given the high energy associated with the biotope, suspended particulates could increase the scour experienced by the characterizing species.

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 sediment conditions (Schönberg, 2015; Bell & Barnes 2000; Bell & Smith 2004). Some of the characterizing species occur in harbours and estuaries, including *Halichondria panicea* (Ackers *et al.*, 1992).

Urticina felina is found in highly turbid areas associated with biotopes such as CR.MCR.SfR.Pol (Connor *et al.*, 2004; Holme & Wilson, 1985) and is therefore considered to be unaffected by an increase in suspended solids at the benchmark.

An increase in suspended sediment could result in scour due to wave action and tidal flow. Overall, resistance is assessed as '**Medium**', mainly due to the scour effect. Resilience is '**High**' and sensitivity is '**Low**'.

Smothering and siltation rate changes (light)

Medium

Q: Low A: NR C: NR

High

Q: High A: Medium C: Medium

Low

Q: Low A: Low C: Low

This biotope typically occurs on vertical walls, with more scour resistant biotopes occurring on cave and gully floors. The majority of the examples of this biotope are therefore unlikely to be affected by smothering following an increase in sediment deposition. This being said, where the biotope does occur on the shallow or flat lower surfaces, mortality could occur, depending on the level and rate of removal of the sediment.

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). Whilst complete smothering may result in loss of the sponges, the biotope often occurs on cave walls and ceilings and thus burial is unlikely. *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 5 cm of sediment. If inundation is long lasting then the understory community may be adversely affected.

Communities dominated by the anemone *Urticina felina* were described on tide swept seabed, exposed to high levels of suspended sediment, sediment scour and to periodic smothering by thin layers of sand, up to ca 5 cm in the central English Channel (Holme & Wilson, 1985). *Urticina felina* is abundant in the sediment-scoured, silty rock communities CR.HCR.XFa.FluCoAs and CR.MCR.EcCr.UrtScr (Connor *et al.*, 2004).

Sensitivity assessment. Overall, the biotope is unlikely to be affected by smothering, as deposited sediment would be removed rapidly. Therefore, resistance is assessed as 'Medium', mainly due to the scour effect as the sediment is removed. Therefore, resilience is 'High' and sensitivity is 'Low'.

Smothering and siltation rate changes (heavy)

Medium

Q: Low A: NR C: NR

High

Q: High A: Medium C: Medium

Low

Q: Low A: Low C: Low

This biotope typically occurs on vertical walls, with more scour resistant biotopes occurring on cave and gully floors. The majority of the examples of this biotope are therefore unlikely to be affected by smothering following an increase in sediment deposition. This being said, where the biotope does occur on the shallow or flat lower surfaces, mortality could occur, depending on the level and rate of removal of the sediment.

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). Whilst complete smothering may result in loss of the sponges, the biotope often occurs on cave walls and ceilings and thus burial is unlikely.

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Communities dominated by the anemone *Urticina felina* were described on tide swept seabed, exposed to high levels of suspended sediment, sediment scour and to periodic smothering by thin layers of sand, up to ca 5 cm in the central English Channel (Holme & Wilson, 1985). *Urticina felina* is abundant in the sediment-scoured, silty rock communities CR.HCR.XFa.FluCoAs and CR.MCR.EcCr.UrtScr (Connor *et al.*, 2004).

Sensitivity assessment. Overall, the biotope is unlikely to be affected by smothering, however, an increase in sediment could result in scour following re-suspension due to wave and tidal flow. Removal of the sediment is likely to be rapid. Overall, resistance is assessed as '**Medium**', mainly due to the scour effect as the sediment is removed, although the risk that some parts of the biotope that exist on flat or gently sloping areas may experience burial. Resilience is '**High**' and sensitivity is '**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
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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
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'No evidence' was found.

Underwater noise changes	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR
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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 and resistance is therefore assessed as '**High**', Resilience as '**High**' and Sensitivity as '**Not Sensitive**'.

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
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These biotopes have very limited algal abundance, although Connor *et al.* (2004) notes that kelps are unable to colonize the biotope primarily due to the level of wave surge and vertical topography. The impact of introduction of light may therefore be of limited importance to increasing the algal component of the biotope.

Jones *et al.* (2012) compiled a report on the monitoring of sponges around Skomer Island and found that many sponges, particularly encrusting species, preferred vertical or shaded bedrock to open, light surfaces. However, it is possible that this relates to decreased competition with algae. Whilst no evidence could be found for the effect of light on the other faunal species present within these biotopes, it is unlikely that they would be impacted. While increase in light could potentially promote algal growth, light may not be the limiting factor when considering the lack of algae. In any case, growth ceases for a number of red algae below ca $1.0 \mu\text{mol m}^{-2}\text{s}^{-1}$ (ca 50 Lux), whereas this value is $2 \mu\text{mol m}^{-2}\text{s}^{-1}$ (ca 100 Lux) for green algae (Leukart & Lüning, 1994).

Sensitivity assessment. A change at the benchmark level (0.1 Lux) is therefore unlikely to be significant. Resistance to this pressure is assessed as '**High**' and resilience as '**High**'. This biotope is

therefore considered to be '**Not sensitive**' at the benchmark level.

Barrier to species movement	Not relevant (NR)	Not relevant (NR)	Not relevant (NR)
	Q: NR A: NR C: NR	Q: NR A: NR C: 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)	Not relevant (NR)	Not relevant (NR)
	Q: NR A: NR C: NR	Q: NR A: NR C: 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)	Not relevant (NR)	Not relevant (NR)
	Q: NR A: NR C: NR	Q: NR A: NR C: NR	Q: NR A: NR C: NR

'**Not relevant**'

Biological Pressures

	Resistance	Resilience	Sensitivity
Genetic modification & translocation of indigenous species	No evidence (NEv)	Not relevant (NR)	No evidence (NEv)
	Q: NR A: NR C: NR	Q: NR A: NR C: NR	Q: NR A: NR C: NR

No evidence' was found.

Introduction or spread of invasive non-indigenous species	No evidence (NEv)	Not relevant (NR)	No evidence (NEv)
	Q: NR A: NR C: NR	Q: NR A: NR C: NR	Q: NR A: NR C: NR

Wave surge in this biotope will probably limit establishment of all but the most surge resistant invasive non-indigenous species (INIS) and no direct evidence was found for effects of INIS on this biotope. The low levels of light within this biotope, particularly the rear walls of caves, are considered to also inhibit invasive algal species.

The Australasian barnacle *Elminius modestus* was introduced to British waters on ships during the second World War. The species does well in estuaries and bays, where it can displace *Semibalanus balanoides*. However, on exposed shores the native species out-compete this invasive species (Raffaelli & Hawkins, 1999).

Two non-native spirobids – *Dexiospira oshoroensis* and *Pileolaria rosepigmentata* - were found on the non-native algae *Sargassum muticum* in Portsmouth (Knight-Jones *et al.*, 1975). Invasive tubeworms are reported from UK harbours (Thorp *et al.*, 1986) and are likely to be well established in areas with large volumes of ship traffic.

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 smother native tunicate communities (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.

There was '**No evidence**' regarding known invasive species that may pose a threat to IR.FIR.SG.CrSpAsAn, IR.FIR.SG.CrSpAsDenB, IR.FIR.SG.DenCcor or IR.FIR.SG.CrSp. Due to the constant risk of new invasive species, the literature for this pressure should be revisited. Due to the constant risk of new invasive species, the literature for this pressure should be revisited.

Introduction of microbial pathogens	No evidence (NEv)	Not relevant (NR)	No evidence (NEv)
	Q: NR A: NR C: NR	Q: NR A: NR C: NR	Q: NR A: NR C: NR

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. 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 ascidia* 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. Whilst evidence for disease in ascidians and sponges exists, '**No evidence**' for mortality in the characterizing species was found.

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

No evidence of targeting of the characterizing species could found and the pressure is '**Not**

relevant' to this biotope group.

Removal of non-target species

Low

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

High

Q: **High** A: **Medium** C: **Medium**

Low

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

The characteristic species probably compete for space within the biotope, so that loss of one species would probably have little if any effect on the other members of the community. However, the incidental removal of the characteristic epifauna 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 on this biotope.

Sensitivity assessment. Based on broad agreement of trawl impacts on sponge communities and the likely disturbance to the sessile epifaunal species, resistance is recorded as '**Low**', resilience is recorded as '**High**' and Sensitivity is '**Low**'

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