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

Sagartiogeton undatus and *Ascidiella aspersa* on infralittoral sandy mud

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

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Please note. This MarESA report is a dated version of the online review. Please refer to the website for the most up-to-date version [https://www.marlin.ac.uk/habitats/detail/1119]. All terms and the MarESA methodology are outlined on the website (https://www.marlin.ac.uk)

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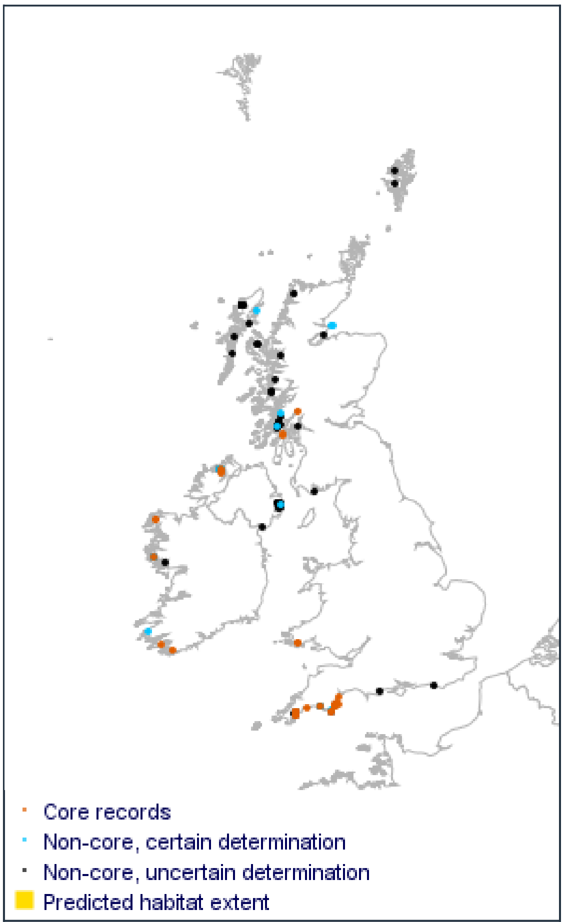

17-09-2018
Biotope distribution data provided by EMODnet Seabed Habitats (www.emodnet-seabedhabitats.eu)

Researched by John Readman **Refereed by** Admin

Summary

UK and Ireland classification

EUNIS 2008	A5.332	*Sagartiogeton undatus* and *Ascidiella aspersa* on infralittoral sandy mud
JNCC 2015	SS.SMu.ISaMu.SundAasp	*Sagartiogeton undatus* and *Ascidiella aspersa* on infralittoral sandy mud
JNCC 2004	SS.SMu.ISaMu.SundAasp	*Sagartiogeton undatus* and *Ascidiella aspersa* on infralittoral sandy mud
1997 Biotope		

Description

Sheltered sublittoral mud or sandy mud in shallow water with relatively few conspicuous species may be characterised by the anemone *Sagartiogeton undatus* in low numbers and the tunicate *Ascidiella aspersa*. Other taxa may include*Carcinus maenas*, *Pagurus bernhardus* and terebellid polychaetes. The burrowing anemones *Cerianthus lloydii* may also be found occasionally. The status of this biotope is uncertain at present as it is not known whether it is an impoverished, disturbed or epifaunal variant of other sheltered, shallow mud biotopes such as PhiVir or if the areas in which it has been recorded have been incompletely surveyed.

Depth range

-

Additional information

-

Listed By

- none -

Further information sources

Search on:

G G JNCC

Sensitivity review

Sensitivity characteristics of the habitat and relevant characteristic species

SS.SMu.ISaMu.SundAasp occurs in sheltered sublittoral mud or sandy mud in shallow water with relatively few conspicuous species. It is characterized by the anemone *Sagartiogeton undatus* in low numbers and the ascidian *Ascidiella aspersa*. Other burrowing anemones including *Cerianthus lloydii* may also be found. Very little information for the characterizing species was found and the assessments are quite general. Where there was little or no evidence for the characterizing *Sagartiogeton undatus*, the assessment was based on similar species, including *Cerianthus lloydii*. Assessments for the ascidians used evidence for the characterizing *Ascidiella aspersa* where possible, and *Ciona intesinalis* as an example of a large ascidian. Low confidence scores are ascribed to sensitivity assessments that rely on evidence from these non-chaarcterizing species. Other species are not important in defining the biotope and are therefore not considered.

Resilience and recovery rates of habitat

Ascidiella aspersa grows to ca 10 cm in height and is usually found in clumps on muddy seabed (Naylor, 2011), although it has also been recorded on algae, stones and artificial substrata. It is common on all British coasts and is distributed from Norway to the Mediterranean (Hayward & Ryland (1995a). *Ascidiella aspersa* is found from the lower shore to 80 m depth and is tolerant of salinities down to 18‰. In Scotland, larvae settle during summer, with reproduction taking place in the summer following settlement. Longevity in the British Isles is one to one and a half years (Fish & Fish, 1996). *Ascidiella aspersa* is considered an invasive species in the Americas and Asia (Carman *et al*., 2010; Tatián *et al*., 2010; Nishikawa *et al*., 2014).*Ciona intestinalis* has been reported to spawn more or less year round in temperate conditions (Yamaguchi, 1975, Caputi *et al*., 2015, MBA, 1957) with seasonal spawning observed in colder climates from May to June on the Canadian coast (Carver *et al*., 2006) and in shallower habitats in Sweden (Svane & Havenhand, 1993). Oviparous solitary ascidians generally spawn both oocytes and sperm into the water column, where the resultant fertilized eggs develop into free swimming, non-feeding larvae. The eggs are negatively buoyant and slightly adhesive and are either released freely or in mucus strings which are especially adhesive. These strings have a tendency to settle close to or on the parent ascidian. *In vitro* studies conclude that fertilization proceeds normally whether in the water column or attached to the mucus string. The hatched free-swimming larvae settle nearby, are held by the mucus string until settlement or escape as plankton. Retention in the mucus string may explain the dense aggregations of adults found (Svane & Havenhand, 1993). *In vitro* studies indicate that both spawning and settlement are controlled by light, however *Ciona intestinalis in vivo* has been observed to spawn and settle at any time of the day (Wittingham, 1967; Svane & Havenhand, 1993 and references therein). In the Mediterranean, population collapses of *Ciona intestinalis* were observed, followed by recovery within 1-2 years (Caputi *et al*., 2015). The collapses are still poorly understood, although low salinity (Pérès, 1943) and temperature (Sabbadin, 1957) are suggested as possible drivers. Sebens (1985; 1986) described the recolonization of epifauna on vertical rock walls. Rapid colonizers such as encrusting corallines, encrusting bryozoans, amphipods and tubeworms recolonized within 1-4 months, but ascidians such as *Dendrodoa carnea*, *Molgula manhattensis* and *Aplidium* spp. achieved significant cover in less than a year and had reached pre-clearance levels of cover after 2 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 (Sebens, 1985;1986).

Little evidence was found to support a resilience assessment for burrowing anemones. MES

(2010) suggested that the genus *Cerianthus* would be likely to have a low recovery rate following physical disturbance based on long lifespan and slow growth rate. No specific evidence was cited to support this conclusion. The MES (2010) review also highlighted that there were gaps in information for this species and that age at sexual maturity and fecundity is unknown although the larvae are pelagic (MES 2010).

Eggs of *Edwardsia timida* were observed in a gelatinous matrix at the entrance to a burrow which hatched into ciliated planula larvae and completed development into young anemones within two months (Rawlinson, 1936, cited in Manuel, 1988) although no specific information on longevity, maturity, fecundity or recovery was found for the characterizing *Sagartiogeton undatus*. While burrowing anemones are capable of re-burrowing following disturbance (Manuel, 1988), it is likely that they have limited horizontal mobility and re-colonization via adults is unlikely (Tillin & Tyler-Walters, 2014). *Zostera* beds have historically provided suitable substrata for burrowing anemones, however, despite some recovery of eel grass following the mass decline in the 1930s, burrowing anemones have not reappeared in many localities (Manuel, 1988). There is very little known about community development for this biotope. Almost nothing is known about the life cycle and population dynamics of British burrowing anemones. However, anemones tend to be slow growing, long lived and may have patchy and intermittent recruitment. Sebens (1981) noted that full recovery of anemones may take five years to several decades.

More generally, anemones may be able to recruit more rapidly in certain circumstances. Colonization of offshore oil platforms in the North Sea by the anemone *Metridium dianthus* during year 3, and had extended down to a depth of 90 m by year 4. Over the following 5 years the anemone zone ascended to a depth of 40 m, out-competing both hydroids and soft corals (Whomersley & Picken, 2003).

Resilience assessment

The ascidians are likely to recover rapidly following decline, *Ascidiella aspersa* is considered an INIS (invasive non-indigenous species) in the Americas and Asia. Recovery is likely to be rapid folliwng most perturbation events.

Spawning has been reported as more or less year round in temperate conditions for *Ciona intestinalis* (Yamaguchi, 1975, Caputi *et al*., 2015; MBA, 1957). *Ciona intestinalis* reaches sexual maturity at a body height of ca 2.5-3.0 cm, with one to two generations per year and longevity of ca 1.5 years. (Fish & Fish 1996). Sebens (1985, 1986) found that ascidians such as *Dendrodoa carnea, Molgula manhattensis and Aplidium spp.* achieved significant cover in less than a year and reached pre-clearance levels of cover after 2 years.

Based on the lack of reappearance of burrowing anemones in some *Zostera* beds following total loss (Manuel, 1988) and recruitment in other anemones (Sebens, 1981), resilience has been assessed **'Low'** for events that result in decline of >75 % (resistance of 'None'). Resilience has been assessed as **'Medium'** (2 – 10 years) for other resistance levels in which decline occurs (where resistance is 'Low', 'Medium'). Confidence in this assessment is low, due to the lack of direct evidence for the characterizing species. Resistance assessments of 'High' are automatically ascribed a resilience of **'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

Ascidiella aspersa is common on all British coasts and is distributed from Norway to the Mediterranean (Hayward & Ryland, 1995b). *Sagartiogeton undatus* is found on all coasts of the British Isles and is distributed from Scandinavia to the Mediterranean (Hayward & Ryland, 1995b).

Both characterizing species are found across the British Isles and are not at their southern distribution limit. Resistance is, therefore, probably '**High**' and resilience is assessed as '**High**' and the biotope is probablly '**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: Low C: Low

Ascidiella aspersa is common on all British coasts and is distributed from Norway to the Mediterranean (Hayward & Ryland, 1995b). *Sagartiogeton undatus* is found on all coasts of the British Isles and is distributed from Scandinavia to the Mediterranean (Hayward & Ryland, 1995b). Both characterizing species are found across the British Isles and are not at their northern distribution limit. Resistance is, therefore, probably '**High**' and resilience is assessed as '**High**' and the biotope is probablly '**Not sensitive**' 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 from full to variable salinity. An increase from full salinity would result in hypersaline conditions. Naser (2011) described habitats dominated by the burrowing anemone *Cerianthus* sp. in the areas adjacent to the outlet of the Sitra Power and Water Station, Bahrain. This desalination outlet is associated with high temperatures, salinities, and a range of chemical and heavy metal pollutants. *Sagartiogeton undatus* has been recorded as occurring in variable to full salinity biotopes (Connor *et al.*, 2004).

No information on *Ascidiella aspersa* was found. *Ciona intestinalis* has been classified as euryhaline with a high salinity tolerance range (12-40‰) although it typically occurs in full salinity conditions (>30 ‰) (Tillin & Tyler-Walters, 2014). *Ciona intestinalis* has been found in salinities ranging from 11 to 33 psu in Sweden, although the same study found that parent acclimation to salinity (high or low) has an overriding and significant effect on larval metamorphic success, independent of parent origins (Renborg *et al.*, 2014).

Whilst some burrowing anemones have been associated with areas that experience high salinity due to brine effluent from desalination plants, there are is little specie specific information and '**No evidence'** was found for the characterizing species.

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

Components of the biotope community are tolerant of variable salinities. *Ascidiella aspersa* is tolerant of salinities down to 18 psu (ca 18 ‰) and is often common in estuaries, whilst *Ciona intestinalis* is tolerant of salinities as low as 11 psu (ca 11‰) (Fish & Fish, 1996). *Sagartiogeton* *undatus* has only been recorded as occurring in variable to full salinity biotopes (Connor *et al.*, 2004).

Sensitivity assessment. A decrease at the benchmark level from variable (18 -35‰) to reduced salinity (18-30‰) is unlikely to result in mortality. as some of the characterizing species have been recorded in salinities of 18‰ or lower. Resistance is therefore '**High**', resilience is '**High**' and the biotope is probably '**Not sensitive**' at the benchmark level, although confidence in the assessment 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

Increased tidal stream velocity may benefit some passive suspension feeders by increasing the supply of food but may also erode the substratum including removal of species attached to the substratum. The long-lived members of the community, the burrowing anemones, are firmly anchored into the sediment and therefore are unlikely to be lost.   SS.SMu.ISaMu.SundAasp occurs from negligible to moderately strong water flow (0 - 1.5 m/sec). sothat a change of 0.1-0.2 m/s is unlikely to be significant. The burrowing anemones are afforded some protection from the direct effects of water flow, however, prolonged increase in water flow could result in restructuring of the substrata. However, a decrease in water flow is not relevant as the biotope occurs in very weak flow.

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

This biotope can occur at 0-5 m depth. The burrowing nature of the anemones would probably confer some resistance in the event of one hour of emergence. The ascidians, however, are limited to the sublittoral. Exposure to an emergence regime is likely to cause the population to die. Therefore, resistance is assessed as '**Low**', resilience as '**Medium**' and sensitivity as '**Medium**'.

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

SS.SMu.ISaMu.SundAasp occurs in wave sheltered to extremely wave sheltered conditions. Wood (2005) described the characterizing *Sagartiogeton undatus* as typically found in sheltered locations. *Ciona intestinalis* is often dominant in highly sheltered areas such as harbours (Carver *et al.*, 2006). Decreases in wave exposure are unlikely to have any effect. High energy wave action can be detrimental to ascidian populations, mainly through physical damage to the sea squirts and through the abrasive action of suspended sediment (Jackson, 2008). If dislodged, juvenile and adult *Ciona intestinalis* have a limited capability to re-attach, given calm conditions and prolonged contact with the new substratum (Carver *et al.*, 2006; Jackson 2008; Millar 1971) but increases in wave exposure above moderately exposed are likely to remove a proportion of the population, especially in the shallower examples of the biotope.

Sensitivity assessment

The ascidians and *Sagartiogeton undatus* are likely to be damaged by significant increases in wave exposure, particularly in the shallow examples of this biotope. However, a change at the benchmark level is unlikely to result in mortality and resistance is, therefore, '**High**', resilience is '**High**' and the biotope is assessed as '**Not sensitive'**.

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

No information was found on effects of contaminants on the characterizing burrowing anemone *Sagartiogeton undatus*. Therefore, examples of anemone response to contaminants is presented.

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, intolerance has been assessed to be low specifically to TBT. No other information has been found on effects of contaminants on other species of the biotopes, so confidence is very low.

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 *Ascidiella aspersa* and *Ascidia conchilega* in the estuary after the ban on TBT was introduced.

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

Hydrocarbon & PAH contamination	Not Assessed (NA) Q: NR A: NR C: NR	Not assessed (NA) Q: NR A: NR C: NR	Not assessed (NA) Q: NR A: NR C: NR

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

No information was found on effects of contaminants on the characterizing burrowing anemone *Sagartiogeton undatus*. Therefore, examples of anemone response to contaminants is presented. One month after the *Torrey Canyon* oil spill the dahlia anemone, *Urticina felina*, was found to be one of the most resistant animals on the shore, being commonly found alive in pools between the tide-marks, which appeared to be devoid of all other animals (Smith, 1968). Ignatiades & Becacos-Kontos (1970) found that *Ciona intestinalis* can resist oil polluted water and ascidians are frequently found in polluted habitats such as marinas and harbours (Carver *et al*., 2006; Aneiros *et al*., 2015).

Synthetic compound contamination	Not Assessed (NA) Q: NR A: NR C: NR	Not assessed (NA) Q: NR A: NR C: NR	Not assessed (NA) Q: NR A: NR C: NR

This pressure is **Not assessed**. No information was found on effects of contaminants on the characterizing burrowing anemone *Sagartiogeton undatus.*

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.

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

Radionuclide contamination	No evidence (NEv) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR

'No evidence' was found to support an assessment.

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

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

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

The burrowing anemones most likely spend significant periods of time in burrows where water movement is likely to be more restricted. Stachowitsch & Avcin (1988) reported that in two eutrophication events, anemones where relatively resistant to oxygen depletion. In the Limfjorden, oxygen concentrations fell to below 1 mg/l in the summer of 1975, with the anemones described as the most resistant group to the event (Jeirgensen, 1980). Stachowitsch (1984) observed mass mortality in the Gulf of Trieste over two weeks apparently due to oxygen deficiency (although no oxygen concentrations were given). The majority of species perished within a week, with only several types of anemones and certain infaunal forms surviving into the second week, although *Cerianthus* sp. died after one week (Stachowitsch & Avcin, 1988).

Sensitivity assessment.

Both the ascidians and anemones have been reported as being relatively resistant to oxygen depletion (Carver *et al*., 2006; Stachowitsch & Avcin, 1988). However, mortality at the benchmark level cannot be ruled out and resistance is, therefore, '**Medium**', resilience as '**Medium**' and sensitivity as '**Medium**' at the benchmark level.

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

There is some suggestion that there are possible benefits to 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). No information was available on the effect of nutrient enrichment on the burrowing anemones.

However 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: Low A: NR C: NR	High Q: High A: High C: High	Not sensitive Q: Low A: Low C: Low

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). Kocak & Kucuksezgin (2000) noted that *Ciona intestinalis* was one of the rapid breeding opportunistic species that tended to be dominant in Turkish harbours enriched by organic pollutants and was frequently found in polluted environments (Carver *et al*., 2006).

Gittenberger & Van Loon (2011) assessed *Sagartiogeton undatus* as Group II (indifferent to enrichment, always present in low densities with non-significant variations with time). But the basis for their assessment and relation to the pressure benchmark is not clear (Tillin & Tyler-Walters, 2014).

Sensitivity assessment

Both ascidians and *Sagartiogeton undatus* may be tolerant of organic enrichment and resistance is, therefore, assessed as '**High**', but with 'Low' confidence. Resilience is assessed as '**High**' and the biotope is assessed as '**Not sensitive**'.

Physical Pressures

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

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

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

If sediment were replaced with rock or artificial substrata, this would represent a fundamental change to the biotope with reclassification necessary. Change from a mixed sediment substrata to rock would also result in loss of the infaunal component.

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)	None Q: High A: High C: High	Very Low Q: High A: High C: High	High Q: High A: High C: High

SS.SMu.ISaMu.SundAasp is characterized as occurring on sandy mud (Connor *et al*., 2004). The characterizing species of may tolerate a change in one Folk class (based on the Long, 2006 simplification), as similar species have been noted to inhabit muddy sand and fine shell breccia (see Shäfer, 1972). However, this shift in substrata would necessitate a re-classification of the biotope. Resistance is, therefore, assessed as **None** based on a change from sandy mud or mud to muddy sand or gravelly mud. As this is a permanent change, resilience is '**Very low'** and sensitivity is therefore '**High**'.

Habitat structure changes - removal of substratum (extraction)	None Q: Medium A: Low C: Medium	Low Q: Medium A: Medium C: Medium	High Q: Medium A: Low C: Medium

Sedimentary communities are likely to be highly intolerant of substratum removal, which will lead to partial or complete defaunation, expose underlying sediment which may be anoxic and/or of a different character and lead to changes in the topography of the area (Dernie *et al*., 2003). Any remaining species, given their new position at the sediment / water interface, may be exposed to unsuitable conditions.

Shäfer (1972) conducted a review of locomotion of the *Ceriantharia*. The burrowing anemones require open tubes as they breathe with their entire body surface (Shäfer, 1972). *Sagartiogeton undatus* can be found 10-15 cm into the sediment (Manuel, 1988). Extraction of 30cm would probably result in total loss of the burrowing anemones as they would be unlikely to escape rapidly.

Recovery of the sedimentary habitat would occur via infilling, although some recovery of the biological assemblage may take place before the original topography is restored, if the exposed, underlying sediments are similar to those that were removed. Newell *et al*. (1998) indicate that local hydrodynamics (currents and wave action) and sediment characteristics (mobility and supply) strongly influence the recovery of soft sediment habitats.

Sensitivity assessment. Extraction of 30 cm of sediment will remove the characterizing biological component of the biotope. Assuming that the revealed substratum is not altered (in terms of the Folk scale), resistance is assessed as '**None**' and biotope resilience is assessed as '**Low**'. Sensitivity is therefore assessed as '**High**'.

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

No specific evidence for the characterizing burrowing anemone *Sagartiogeton undatus* was found, however it was noted that *Cerianthus lloydii* is rarely caught by fishing boats since it retreats into the burrow as the trawl net approaches (Grzimek, 1972). While Langton & Robinson (1990) reported a 25-27 % decline in abundance of cerianthids following a marked increase in scallop dredging in the Gulf of Maine, this decrease could be down to penetrative disturbance (see below).

Ascidiella aspersa and *Ciona intestinalis* are large, emergent, sessile ascidians, and physical disturbance is likely to cause damage with mortality likely. Emergent epifauna are generally very intolerant of disturbance from fishing gear (Jennings & Kaiser, 1998). However, studies have shown some ascidians become more abundant following disturbance events (Bradshaw *et al.*, 2000), presumably due to high resilience and a reduction in spatial competition.

Sensitivity assessment

Given the ability to retract into the sediment, the burrowing anemones would be quite resistant to surface abrasion events. However, given the sessile, emerged nature of *Ascidiella aspersa*, damage and mortality following a physical disturbance effect are likely to be significant. Resistance has been assessed as '**Low**', resilience as '**Medium**' and sensitivity as '**Medium**'.

Penetration or disturbance of the substratum subsurface	Low	Medium	Medium
	Q: Medium A: Medium C: Medium	Q: Medium A: Medium C: Medium	Q: Medium A: Medium C: Medium

No specific evidence for the characterizing *Sagartiogeton undatus* was found, however it was noted that the similar *Cerianthus lloydii* is rarely caught by fishing boats since it retreats into the burrow as the trawl net approaches (Grzimek, 1972). Langton & Robinson (1990) reported a 25-27 % decline in abundance of cerianthids following a marked increase in scallop dredging in the Gulf of Maine. *Sagartiogeton undatus* grows to a length of ca 12 cm (Manuel, 1988) and burrows 10-15 cm into the sediment (Manuel, 1988). The ascidians are epifaunal and disturbance effects are likely to be analogous to the surface abrasion pressure (see above). However, *Sagartiogeton undatus* may be more affected.

Sensitivity assessment. Based on monitoring of cerianthid populations exposed to scallop dredging by Langton & Robinson (1990), resistance is likely to be '**Low**', resilience '**Medium**' and sensitivity '**Medium**'.

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

A significant increase in suspended sediment may have a deleterious effect on the suspension feeding community. It may clog feeding apparatus, which would result in a reduced ingestion over the benchmark period and, subsequently, a decrease in growth rate (Jackson, 2004). A decrease in suspended sediment is likely to benefit the community associated with this biotope. The suspension feeders may be able to feed more efficiently due to a reduction in time and energy spent cleaning feeding apparatus.

For examples, *Ciona intestinalis* frequently occurs in habitats close to harbours and marinas with high levels of silt and suspended matter (Carver *et al.*, 2006; Kocak & Kucuksezgin, 2000). Naranjo *et al*. (1996) described *Ciona intestinalis* as having a large body and siphons that have wide apertures that helps prevent blocking. Increased suspended sediment may potentially have some detrimental effects in clogging up feeding filtration mechanisms. However, there are possible benefits from increased suspended sediment as ascidian 'richness' in Algeciras Bay was found to increase in higher concentrations of suspended organic matter (Naranjo *et al.* 1996). In high (up to 300 mg/l of inorganic and 2.5 x10^7 cells/l) suspended particulate concentrations, the active rejection mechanism (squirting) is increased in *Ciona intestinalis* with no discrimination between organic and inorganic particulates observed in any of the ascidians observed (Robbins, 1984a).

Despite these observations, the turbidity tolerance level for this species is not well established. Robbins (1985b) found that continual exposure to elevated levels of inorganic particulates (>25 mg/l) arrested the growth rate of *Ciona intestinalis* and exposure to 600 mg/l resulted in 50% mortality after 12-15 days and 100% mortality after 3 weeks. It was suggested that because this species can only "squirt" to clear the branchial sac, it may be vulnerable to clogging under heavy sediment loads. Specific data on the characterizing *Ascidiella aspersa* was not found.

No evidence on the effect of a change in suspended solids was found for the burrowing anemones *Sagartiogeton undatus* or *Cerianthus lloydii*.

Sensitivity assessment. Resistance to this pressure is assessed as **'High'**, but with 'Low' confidence. Resilience is assessed as **'High'** by default and the biotope is probably **'Not Sensitive'** at the benchmark level.

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

The solitary ascidians considered in this report are permanently attached to the substratum and are active suspension feeders. *Ciona intestinalis* and *Ascidiella aspersa* grow up to 15 cm and 10 cm in length respectively (Hayward & Ryland, 1995b; Fish & Fish, 1996). Smothering with 5 cm of sediment is likely to only affect a small proportion of the population.

Whilst no information for the characterizing *Sagartiogeton undatus* was found, cerianthids require open tubes as they breathe with their entire body surface (Schäfer, 1972). In the event of gradual sedimentation, the burrowing anemone compensates by upward construction of its tube. In the event of rapid sedimentation resulting in burial, cerianthids abandon their burrow, pushing vertically to the surface of the sediment (Schäfer, 1972). *Sagartiogeton undatus* is up to 12 cm long (Wood, 2005). It is probable that the majority of the anemones would tolerate the deposition by burrow extension and those unable would likely escape burial by abandoning their burrow.

Resistance is, therefore, assessed as '**High**', with '**High**' resilience, and the biotope is probably '**Not sensitive'** at the benchamrk level.

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

The solitary ascidians considered in this report are permanently attached to the substratum and are active suspension feeders. *Ciona intestinalis* and *Ascidiella aspersa* grow up to 15 cm and 10 cm in length respectively (Hayward & Ryland, 1995b; Fish & Fish, 1996). When considering that his biotope occurs on sandy mud, smothering with 30 cm of sediment would likely result in significant mortality of the population, unless the sediment is rapidly removed.

Whilst no information for the characterizing anemones was found, cerianthids require open tubes as they breathe with their entire body surface (Schäfer, 1972). In the event of gradual sedimentation, the burrowing anemone compensates by upward construction of its tube. In the event of rapid sedimentation resulting in burial, cerianthids abandon their burrow, pushing vertically to the surface of the sediment (Schäfer, 1972).

Sagartiogeton undatus is up to 12 cm long (Wood, 2005). Whilst it is unlikely that the characterizing species would be able to extend their burrows in the event of burial by 30 cm in a single event, the majority of anemones would probably escape by abandoning their burrows.

It should be noted that permanent addition of sediment could result in a change in substrata, and therefore reclassification of the biotope would be necessary, as SS.SMu.ISaMu.SundAasp occurs in negligible and weak water flow and the sediment might not be removed.

Sensitivity assessment. While a propotion of the burrowing anemones would likely escape a burial event, addition of 30 cm of fine sediment would smother the ascidians. As SS.SMu.ISaMu.SundAasp can occur in areas that experience negligible water flow, the deposited sediment could be a permanent addition and necessitate a reclassification, given that the biotope is characterized as occurring on 'sandy mud'. Assuming that the sediment was removed, resistance is, therefore, assessed as '**Low**', resilience is '**Medium'** and sensitivity is '**Medium**'.

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

Not assessed.

Electromagnetic changes	No evidence (NEv) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR

'No evidence' was found.

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

McDonald (2014) studied the effect of generator noise on fouling of four vessels by *Ciona intestinalis* and found that fouling was highest at locations closest to the generators and lowest furthest away from the generators. Subsequent *in vitro* experiments demonstrated that larvae settled much faster in the presence of noise (2 h- 20 h compared with 6 h-26 h for control), underwent metamorphosis more rapidly (between 10 and 20 h compared with ca 22h) and had a markedly increased survival rate to maturity (90-100% compared with 66%). Other studies also reported that noise emissions from vessels promoted fouling by organisms including ascidians (Stanley *et al*., 2016). No evidence for burrowing anemones was found.

Sensitivity assessment. Resistance to this pressure is assessed as '**High**' and resilience as '**High**'. This biotope is therefore considered to be **'Not sensitive'**. Confidence is assessed as 'Low' given the lack of literature for anemones.

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

The biotope is recorded in the infra and circalittoral and no algae were included in the recorded species list (Connor *et al*., 2004). Whilst an increase in light could stimulate algal colonization, growth ceases for a number of red algae (including *Chrondrus crispus*) below ca 1.0 □mol $m^{-2}l^{-1}$ (ca 50 Lux), and 2 □mol $m^{-2}l^{-1}$ (ca 100 Lux) for green algae (Leukart & Lüning, 1994) . 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) 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' as barriers and changes in tidal excursion are not relevant to biotopes restricted to open waters.

Death or injury by collision	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR

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

Visual disturbance	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR

'Not relevant'

Biological Pressures

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

'No evidence' was found to assess this pressure.

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

There was **'No evidence'** of this biotope being adversely affected by non-native species. Due to the constant risk of new invasive species, the literature for this pressure should be revisited.

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

There appears to be little research into ascidian diseases, particularly in the Atlantic. The parasite *Lankesteria ascidiae* targets the digestive tubes and can cause 'long faeces syndrome' in *Ciona intestinalis* (although it has also been recorded in other species). Mortality occurs in severely affected individuals within about a week following first symptoms. (Mita *et al.*, 2012). No evidence was found on the effect of microbial pathogens on the characterizing burrowing anemones.

Sensitivity assessment

Whilst there is evidence of disease in *Ciona intestinalis*, with mortality possible in severe cases, **'No evidence'** for the characterizing species was found.

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

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

Removal of non-target species	Low Q: Medium A: Medium C: Medium	Medium Q: Medium A: Medium C: Medium	Medium Q: Medium A: Medium C: Medium

Direct, physical impacts from harvesting are assessed through the abrasion and penetration of the seabed pressures. The characterizing species within this biotope could be incidentally removed from this biotope as by-catch when other species are being targeted. The loss of these species and other associated species would decrease species richness and negatively impact on the ecosystem function. Langton & Robinson (1990) reported a 25-27 % decline in abundance of cerianthids following a marked increase in scallop dredging in the Gulf of Maine. Emergent epifauna are generally very intolerant of disturbance from fishing gear (Jennings & Kaiser, 1998). However, studies have shown some ascidians become more abundant following disturbance events (Bradshaw *et al.*, 2000), presumably due to high resilience and a reduction in spatial competition.

Sensitivity assessment

Removal of a large percentage of the characterizing species would alter the character of the biotope. The resistance to removal is '**Low**' based on the effects of scallop dredging on burrowing anemones. Resilience is assessed as '**Medium**' and overall sensitivity as **'Medium'**.

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