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Cumaceans and *Chaetozone setosa* in infralittoral gravelly sand

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

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

Researched by Dr Heidi Tillin **Refereed by** Admin

Summary

UK and Ireland classification

EUNIS 2008	A5.136	Cumaceans and *Chaetozone setosa* in infralittoral gravelly sand
JNCC 2015	SS.SCS.ICS.CumCset	Cumaceans and *Chaetozone setosa* in infralittoral gravelly sand
JNCC 2004	SS.SCS.ICS.CumCset	Cumaceans and *Chaetozone setosa* in infralittoral gravelly sand
1997 Biotope		

Description

In shallow medium-fine sands with gravel, on moderately exposed open coasts, communities dominated by cumacean crustaceans such as *Iphinoe trispinosa* and *Diastylis bradyi* along with the cirratulid polychaete *Chaetozone setosa* (agg.) may occur. *Chaetozone setosa* is a species complex so it is likely that some variability in nomenclature will be found in the literature. Other important taxa may include the polychaetes *Anaitides* spp., *Lanice conchilega*, *Eteone longa* and *Scoloplos armiger*. This community may be subject to periodical sedimentary disturbance, such that a sub-climactic community may develop with opportunistic taxa such as *Chaetozone setosa* and *Scoloplos armiger* often dominating the community (Allen, 2000).

Depth range

-

Additional information

-

Listed By

- none -

Further information sources

Search on:

G G G JNCC

Sensitivity review

Sensitivity characteristics of the habitat and relevant characteristic species

The biotope description and characterizing species are taken from JNCC (2015). The biotope is characterized by cumaceans such as *Iphinoe trispinosa* and *Diastylis bradyi* along with the cirratulid polychaete *Chaetozone setosa* (agg.). The sensitivity assessments focus on these species as these are considered key to defining the biotope. Information on the basic biology, life history, and population dynamics of cumaceans is lacking (Tillin & Tyler-Walters, 2014). The sensitivity assessments developed for the cumaceans are based almost entirely on information regarding habitat preferences (based on distribution records) and species traits. Other polychaetes also occur in this biotope and the sensitivity assessments generally consider *Eteone longa* and *Scoloplos armiger*. This community may be subject to periodical sedimentary disturbance so that it remains in an early successional state characterized by opportunistic species (Allen, 2000).

Resilience and recovery rates of habitat

The biotope is characterized by species that have strong recoverability from physical disturbances. The cumaceans are mobile and undertake daily migrations out of the sediment (Van der Baan & Holthuis, 1972) and have the potential to recolonize the biotope through migration of adults.

The resilience of *Chaetozone* spp. was reviewed by MES (2010). Chaetozone has a lifespan of 1-2 years and reaches sexual maturity in <1 year. There is little information on the fecundity but the eggs are fertilized externally and may have a significant larval dispersal potential. It shows all the characteristics of an opportunistic species with a short lifespan and rapid growth rate. Where the environmental conditions are suitable, *Chaetozone setosa* is likely to recover to be one of the first genera to recover following disturbance (MES, 2010).

Scoloplos armiger has a lifespan of about four years and reaches maturity at two years. The sexes are separate and as many as 100-5000 eggs of about 0.25 mm are fertilized externally between February-April. The eggs are attached to the seabed in a gelatinous mass and emerge after three weeks and burrow near the site of release. There may be a very short lecithotrophic pelagic phase in subtidal populations but dispersal is very limited. This genus has a low dispersal potential (MES 2010). *Scoloplos armiger* is considered to be species that characterize the end of the transitional phase and the final equilibrium communities following impact or disturbance, rather than initial opportunistic species (Newell *et al.*, 1998).

The polychaete *Eteone longa* is a good swimmer, of high fecundity, fast growing and with pelagic larvae without sediment preferences on settlement (Rasmussen, 1973; Olivier *et al.*, 1992). The combination of these characteristics make it a good colonizer of disturbed sediments (Pearson & Rosenberg, 1978) including in the Tyne Estuary (Hall, 1995) and at a sewage sludge disposal site off the Tyne mouth (Khan, 1991 cited from Herrando-Perez & Frid, 2001 and references therein).

Resilience assessment. The biotope is characterized by species that are either mobile as adults (cumaceans and *Eteone longa*) or that have been identified as opportunistic species that rapidly colonize disturbed sediments and that may benefit from the removal of competitors and predators (*Chaetozone setosa*). Recovery of *Scoloplos armiger* may take longer than some species but may be complete within two years and the biotope may be considered to have recovered where this species is still increasing in abundance. Resilience is, therefore, assessed as ‘High’, for any level of resistance.

Hydrological Pressures

	Resistance	Resilience	Sensitivity
Temperature increase (local)	No evidence (NEv) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR

No evidence was found for the characterizing cumacean species.

Scoloplos armiger is a species complex as is *Chaetozone setosa*. Both are widely distributed but populations may be sibling species and exhibit different tolerances. Until recently, *Chaetozone setosa* was considered cosmopolitan with records world-wide, from the intertidal zone to the deep sea. It is now known that there are several species of eyeless *Chaetozone* spp. in the north-east Atlantic but the worldwide distribution is unclear. Chambers *et al.* (2007) assessed numerous records of *Chaetozone setosa* in the north-east Atlantic, and identified habitat preferences *Chatezone setosa* was frequently found in habitats where the mean minimum winter bottom temperature is 5-10°C and the summer maximum is >10°C (Chambers *et al.*, 2007)

Bamber & Spencer (1984) observed that *Eteone longa* were present in summer in an area affected by thermal discharge in the River Medway estuary. The species is clearly tolerant of temperature fluctuations as the sediments were exposed to the passage of a temperature front of approximately 10°C between heated effluent and estuarine waters during the tidal cycles (Bamber & Spencer, 1984).

Sensitivity assessment. No information was found on the maximum temperatures tolerated by the characterizing species, *Chaetozone setosa* and the cumaceans. This pressure is not assessed due to lack of evidence.

Temperature decrease (local)	No evidence (NEv) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR

No evidence was found for the characterizing cumacean species.

Scoloplos armiger is a species complex as is *Chaetozone setosa*. Both are widely distributed but populations may be sibling species and exhibit different tolerances. Until recently, *Chaetozone setosa* was considered cosmopolitan with records world-wide, from the intertidal zone to the deep sea. It is now known that there are several species of eyeless *Chaetozone* in the north-east Atlantic and the worldwide distribution is unclear. Chambers *et al.* (2007) assessed numerous records of *Chaetozone setosa* in the north-east Atlantic. The species is frequently found in habitats where the mean minimum winter bottom temperature is 5-10°C and the summer maximum is >10°C.

Sensitivity assessment. No information was found on the maximum temperatures tolerated by the characterizing species, *Chaetozone setosa* and the cumaceans. This pressure is not assessed due to lack of evidence.

Salinity increase (local)	Low Q: Low A: NR C: NR	High Q: High A: Low C: Medium	Low Q: Low A: Low C: Low

This biotope occurs in full salinity habitats (30-35 ppt) (JNCC, 2015). An increase at the pressure benchmark refers to an increase to hypersaline conditions (>40 ppt).

No direct evidence was found to assess sensitivity of the characterizing species. The cumacean *Iphinoe canariensis*, was absent from the discharge point of brine effluents at 47-50 psu in the Canary Islands (Riera *et al*., 2012). Scoloplos armiger was found at low abundances at the discharge point (Riera *et al*., 2012). However, in the western Baltic Sea *Scoloplos armiger* abundance was greatest between 12 psu and 17 psu and reduced abundance with increasing salinity was observed (Gogina *et al*., 2010). As *Scoloplos armiger* is a species complex and is not a cosmopolitan species there may be differences in tolerances between populations.

Sensitivity assessment. Although short-term increases in salinity may be tolerated, a persistent increase in one MNCR salinity category above the usual range of the biotope may reduce species richness and abundance. Biotope resistance is assessed as 'Low' and recovery as 'High' (following restoration of habitat conditions). Biotope sensitivity is assessed as 'Low'.

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

This biotope occurs in full salinity habitats (30-35 ppt) (JNCC, 2015). A decrease at the pressure benchmark refers to a decrease to variable salinity conditions (18-35 ppt). This biotope occurs in shallow habitats and inputs of freshwater from rain or land run-off may lower salinities.

Cumaceans are marine species with a few exceptions found in brackish water. Therefore, changes in salinity may be detrimental, although no specific information for the characterizing species was found to develop a sensitivity assessment.

Scoloplos armiger shows a lower salinity limit of 10.5 psu (Gogina *et al*., 2010), suggesting the species is tolerant of a decrease from full to reduced salinity and even the low salinity category in the MNCR scale.

Sensitivity assessment. No direct evidence was found to assess sensitivity of the characterizing cumaceans and *Chaetozone setosa*, both species are present in fully marine habitats and a reduction at the pressure benchmark is likely to result in the loss of these species and species replacement by more tolerant taxa, such as *Bathyporeia* spp. Biotope resistance is assessed as 'Low' and recovery as 'High' (following restoration of habitat conditions). Biotope sensitivity is assessed as '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

This biotope is recorded in areas where tidal flow is moderately strong (0.5-1.5 m/s) and weak (>0.5 m/s) (JNCC, 2015). Sands are less cohesive than mud sediments and a change in water flow at the pressure benchmark may alter sediment transport patterns within the biotope. Hjulström (1939) concluded that fine sand (particle diameter of 0.3-0.6 mm) was easiest to erode and required a mean velocity of 0.2 m/s. Erosion and deposition of particles greater than 0.5 mm require a velocity >0.2 m/s to alter the habitat. The topography of this habitat is shaped by currents and wave action that influence the formation of ripples in the sediment. Specific fauna may be associated with troughs and crests of these bedforms. may form following an increase in water flow, or disappear following a reduction in flow.

Christie (1985) describe that *Chaetozone setosa* prefers stable and sheltered sediments and that therefore changes in water flow that increase sediment mobility may reduce habitat suitability.

Sensitivity assessment. This biotope occurs in areas subject to moderately strong water flows and these are a key factor maintaining the clean sand habitat. Changes in water flow may alter the topography of the habitat and may cause some shifts in abundance. However, a change at the pressure benchmark (increase or decrease) is unlikely to affect biotopes that occur in mid-range flows and biotope sensitivity is therefore assessed as 'High' and resilience is assessed as 'High' so that the biotope is considered to be 'Not sensitive'.

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

This biotope occurs in the shallow sublittoral and changes in emergence are 'Not relevant'.

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

This biotope occurs in habitats that are moderately exposed to wave action (JNCC, 2015). Increases in wave exposure that exceed species disturbance tolerance may result in a change to a *Glycera lapidum* dominated biotope (JNCC, 2015). In areas of weaker wave action, more bivalves and other species that prefer more stable conditions may colonize and the biotope classification could alter to SS.SSa.IMuSa.FfabMag or SS.SSa.CMuSa.AalbNuc (JNCC, 2015).

The cumaceans and polychaete species are protected within the sediment. Populations may be indirectly affected by changes in water movement where these impact the movements of adults, particularly cumaceans that migrate out of sediments into the water column or where the supply of larvae is affected. No specific evidence was found to assess this pressure. As the biotope SS.SCS.ICS.CumCset occurs in habitats that are exposed moderately exposed and sheltered from wave action (JNCC, 2015) but exposed to tidal streams it is more likely that currents and substratum, rather than wave action are significant factors determining species composition

Sensitivity assessment. No direct evidence was found to assess this pressure. At the pressure benchmark the biotope is likely to have 'High' resistance and by default 'High' resilience to a change in significant wave height at the pressure benchmark. The biotope is therefore classed 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

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.

Gray *et al.* (1990) found that *Scoloplos armiger* were a dominant species in uncontaminated soft sediments at a case study site adjacent to the Ekofisk oil field but were not present at contaminated sites.

Eteone were described by Hiscock *et al.* (2005, from Levell *et al.*, 1989) as a very tolerant taxa, found in enhanced abundances in the transitional zone along hydrocarbon contamination gradients surrounding oil platforms.

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

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

Radionuclide contamination	No evidence (NEv) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR

No evidence.

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	No evidence (NEv) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR

No evidence..

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

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

Sensitivity assessment. As this biotope is structured by sediment disturbance rather than nutrient enrichment and is not characterized by macroalgae (although some may be present), the biotope is considered to have 'High' resistance to this pressure and 'High' resilience, (by default) and is assessed as 'Not sensitive'.

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

Chaetezone setosa and cumaceans were typical of enriched sites off the coast of Barcelona that were subject to effluents and sludge disposal from treatment plants (Corbera & Cardell, 1995).

Borja *et al.* (2000) assessed relative sensitivity of *Scoloplos armiger* as an ABMI Ecological Group II species (indifferent/tolerant to enrichment). Field studies have also identified *Scoloplos armiger* as a 'progressive' species, i.e. one that shows increased abundance under slight organic enrichment (Leppakoski, 1975 cited in Gray, 1979).

Eteone longa have been characterized as AMBI Group III: 'Species tolerant to excess organic matter enrichment. These species may occur under normal conditions, but their populations are stimulated by organic enrichment (slight unbalance situations). They tend to be surface deposit-feeding species' (Borja *et al*., 2010; Gittenberger & Van Loon 2011). *Eteone longa* was an early colonizer at a sewage sludge disposal site off the Tyne mouth (Khan 1991, cited from Herrando-Perez & Frid, 2001 and references therein) where levels of nutrient enrichment and organic matter are likely to be high.

Sensitivity assessment. The presence of the characterizing species in organically enriched areas indicates that biotope resistance is 'High', resilience is 'High' and the biotope is 'Not sensitive'.

Physical Pressures

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

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

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

The biotope is characterized by the sedimentary habitat (JNCC, 2015), a change to an artificial or rock substratum would alter the character of the biotope leading to reclassification and the loss of the sedimentary community including the characterizing bivalves, polychaetes and echinoderms that live buried in the sediment.

Sensitivity assessment. Based on the loss of the biotope, resistance is assessed as 'None', recovery is assessed as 'Very Low' (as the change at the pressure benchmark is permanent and sensitivity is 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

This biotope is found in medium to very fine sand with gravel and pebbles (JNCC, 2015). The change referred to at the pressure benchmark is a change in sediment classification (based on Long, 2006) rather than a change in the finer-scale original Folk categories (Folk, 1954).

An assessment of distribution records of *Chaetozone setosa* in the North Sea concluded that the species is usually associated with fine sediments (Chambers *et al.*, 2007). The polychaetes *Scoloplos armiger* and *Eteone longa* both have relatively broad sediment preferences. *Scoloplos armiger* is a burrower and changes in sediment composition that alter the grade of sediment this species must move through can affect the suitability of the habitat. An increase in coarse composition to gravels would be expected to negatively impact this burrowing species. *Eteone longa* is found in sediments with a wide range of median grain sizes: the species is only absent in very fine (<100 µm) and very coarse sediments (>500 µm). *Eteone longa* is also found in empty tubes and on oyster banks. Well-sorted types of sediments are favoured (Hartmann-Schröder, 1971; Wolff, 1973 cited in Holtmann *et al.*, 1996).The association of *Eteone longa* with a range of coarse substrata/sediments indicate that it would be able to tolerate (but possibly with population impacts) an increase in sediment coarseness (e.g. where shells and larger sediments accumulate). However, a transition to a fully coarse sediment type is likely to negatively impact this species as the habitat becomes sub-optimal. Degraer *et al.* (2006) indicate that a change to a very fine sediment would exclude this species.

Sensitivity assessment. Although *the characterizing species generally have* broad sediment preferences a change to either a finer muddy sediment or a coarser sediment, would be likely to lead to loss of the biotope (based on the JNCC description) and the characterizing species. Resistance is assessed as 'None', recovery is assessed as 'Very Low' (as the change at the pressure benchmark is permanent and sensitivity is assessed as 'High'.

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

Biotope resistance to extraction of sediment and characterizing species is assessed as 'None. Resilience is assessed as 'High', as sediment recovery will be enhanced by wave action and mobility of sand. The characterizing species are likely to recover through transport of adults in the water column or migration from adjacent patches. Biotope sensitivity is therefore assessed as 'Medium'.

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

This biotope occurs in mobile sands that are likely to experience frequent wave disturbance and periodic sediment disturbance that prevents the development of bivalve assemblages typical of more stable areas. The species present are likely to either be resistant of some physical disturbance or to recover rapidly (JNCC, 2015).

No evidence was found to assess sensitivity to abrasion of the characterizing cumacean species. During the day when these are buried within sediments, they are likely to be protected from abrasion at the surface. The infaunal polychaetes that characterize this biotope are typical of disturbed and mobile sediments and their infaunal position provides protection from abrasion at the surface. Juveniles and adults of *Scoloplos armiger* stay permanently below the sediment surface and freely move without establishing burrows. While juveniles are only found a few millimetres below the sediment surface, adults may retreat to 10 cm depth or more (Reise, 1979; Kruse *et al*., 2004). The egg cocoons are laid on the surface and hatching time is 2-3 weeks during which these are vulnerable to surface abrasion.

Sensitivity assessment. Abrasion may damage a proportion of the populations of the characterizing species but is unlikely to result in significant removal and damage. Biotope resistance is assessed as 'Medium' and resilience as 'High' so that sensitivity is assessed as 'Low'.

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

This biotope occurs in mobile sands that are likely to experience frequent wave disturbance and periodic sediment disturbance that prevents the development of bivalve assemblages typical of more stable areas. The species present are likely to either be resistant of some physical disturbance or to recover rapidly (JNCC, 2015).

Physical disturbance reduces the abundance of *Eteone longa* (Southern Science, 1992 cited from Hiscock *et al*., 2005). The mobile polychaete *Eteone longa* is found in mobile sand areas and should, therefore, have some tolerance for shallow and surface disturbance, being able to re-burrow or avoid shallow disturbance. In the access lanes associated with oyster culture on trestles, De Grave *et al*. (1998) found higher abundances of *Eteone longa*. These areas may have been subject to vehicle access and the results provide some circumstantial support for the evidence for *Eteone* as an opportunistic species that preferentially colonizes disturbed areas (Rees, 1978 quoted in Hiscock *et al*., 2002).

Eteone longa has been categorised through literature and expert review, as AMBI Fisheries Review Group III, defined as: 'Species insensitive to fisheries in which the bottom is disturbed. Their populations do not show a significant decline or increase' (Gittenberger & Van Loon, 2011). The cumacean *Diastylis bradyi* and the polychaete *Scoloplos armiger* were assessed as AMBI Fisheries Group II defined as: 'Species sensitive to fisheries in which the bottom is disturbed, but their populations recover relatively quickly' (Gittenberger & Van Loon, 2011).

Sparks-McConkey & Watling (2001) identified *Chaetozone setosa* as a common species that declined in abundance in response to experimental trawling. Tuck *et al*. (1998) found that following trawl disturbance, abundances of *Chaetozone setosa* had recovered and became greater at treatment sites than undisturbed sites 10 months after disturbance. *Scoloplos armiger*, however, had declined at disturbed sites.

The cumacean *Diastylis lyrifera* was present at a wreck site that prevented fishing disturbance and absent from fished sites in the Irish Sea (Ball *et al*., 2000b), suggesting indirectly that these species may be sensitive to activities that lead to subsurface disturbance. Direct mortality (percentage of initial density) of cumaceans and gammarids from a single pass of a beam trawl was estimated from experimental studies on sandy and silty grounds as 22% and 28% respectively Bergman & Van Santbrink (2000a). Direct mortality of *Scoloplos armiger* was estimated as 18% (Bergman & Van Santbrink, 2000a). Experimental intertidal dredging for cockles reduced the abundance of *Scoloplos armiger* in disturbed plots compared to control sites. These differences persisted for 56 days (Hall & Harding, 1997). Ferns *et al*. (2000) reported a decline of 31% in intertidal populations of *Scoloplos armiger* in muddy sands when a mechanical tractor towed harvester was used (in a cockle fishery) (surpassing the study monitoring timeline). *Scoloplos armiger* demonstrated recovery >50 days after harvesting in muddy sands.

Sensitivity assessment. Penetration and disturbance are likely to result in decreased abundance of the characterizing *Chaetozone setosa*, *Scoloplos armiger* and cumaceans. *Eteone longa* may be more tolerant. Based on the evidence from fisheries biotope resistance is assessed as 'Low' and resilience is assessed as 'High' as the characterizing species rapidly colonize disturbed areas. Biotope sensitivity is, therefore 'Low'.

Changes in suspended solids (water clarity)	Medium Q: Low A: NR C: NR	High Q: High A: Low C: Medium	Low Q: Low A: Low C: Low

No evidence was found to assess this pressure. This biotope is found in shallow sandy habitats where wave and other sediment disturbing factors are likely to frequently re-suspend sediments. Where this biotope is found in the mouths of estuaries it is also likely to be exposed to high suspended solids from riverine inputs. The characterizing species are largely infaunal (although cumaceans migrate into the water column).

The abundance of the cumacean *Eudorellopsis deformis* is linked to benthic primary productivity (Schuckel *et al*., 2010). Schuckel *et al.* (2010) found that highest abundances occurred where increased abundance of pelagic and epipelic diatoms occurred. Increased turbidity that limited the growth of microalgae associated with sand grains could negatively affect cumacean feeding.

Sensitivity assessment. The biotope is not considered directly sensitive to a decrease or increase in suspended solids. An increase in suspended solids may lead to decreased primary productivity. Biotope resistance is assessed as 'Medium' as some effects on feeding and diatom productivity may occur from increases in suspended solids, resilience is assessed as 'High', following a return to usual conditions and sensitivity is assessed as 'Low'. This more precautionary assessment is presented in the table Indirect effects such as deposition, erosion and associated sediment change that may result from changes in suspended solids in the long-term are assessed separately.

Smothering and siltation rate changes (light)	No evidence (NEv) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR

No evidence.

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

No evidence was found to assess the sensitivity of cumaceans to this pressure and it is unclear whether the characterizing species would be able to escape the deposition of 5cm of fine sediments. *Chaetezone setosa* occurs in areas subject to high natural rates of sedimentation where other benthic macrofauna were excluded (Wlodarska-Kowalczuk *et al*., 2007) although this is likely to be due to rapid recolonization rather than survival.

Bijkerk (1988, results cited from Essink 1999) indicated that the maximal overburden through which *Scoloplos* could migrate was 50 cm in sand and mud. No further information was available on the rates of survivorship or the time taken to reach the surface. Warner (1971) simulated the effects of dredge disposal of different thicknesses on animals in aquaria or plastic cores for 2 weeks. In core experiments at temperatures ranging from 14 to 18°C and 20 to 21°C, there was a relationship between vertical migration distance and sediment depth for the congener *Scoloplos fragilis*. This species could vertically migrate through 30 cm of sand. In other core experiments in silt-clay at temperatures of 17°C to 18°C, there was a suggestion of reduced efficiency of burrowing in finer grained sediment where even the smallest amount of silt-clay proportion tested (20%) affected the burrowing ability of this species.

Sensitivity assessment. Although *Scoloplos armiger* is considered to be able to migrate vertically, this may be limited where the overburden consists of fine sediments (based on Maurer *et al*., 1978). Biotope resistance is assessed as 'Low'. Resilience is assessed as '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

Not assessed.

Electromagnetic changes	No evidence (NEv) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR

No evidence.

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

'Not relevant'.

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

Cumaceans feed on small diatoms and other organic matter present on sand grains (Ghiold, 1982). Benthic primary production is an important factor relating to food sources and so population density. The *Eudorellopsis deformis* occurs in higher densities where pelagic and epipelic diatoms occur (Schuckel *et al*., 2010). Changes in light that alter food supply may affect abundances but it should be noted that cumacean species also occur in deep waters where light penetration is limited.

Sensitivity assessment. No evidence was found to suggest that artifical light affected benthic microalgal abundance, and shading is probably localised. Therefore, biotope resistance is assessed as '**High**' (with 'Low' confidence') and resilience is assessed as '**High**' (by default) and the biotope is considered to be '**Not sensitive**'.

Barrier to species movement	High Q: Low A: NR C: NR	High Q: High A: High C: High	Not sensitive Q: Low A: Low C: Low

The characterizing polychaete species produce pelagic larvae as do many pf the polychaete species. Barriers that reduce the degree of tidal excursion may alter larval supply to suitable habitats from source populations. Conversely, the presence of barriers may enhance local population supply by preventing the loss of larvae from enclosed habitats. As the bivalve species characterizing the biotope are widely distributed and produce large numbers of larvae capable of long distance transport and survival, resistance to this pressure is assessed as 'High' and resilience as 'High' by default. This biotope is therefore considered to be 'Not sensitive'.

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'. *Chaetozone setosa* are eyeless (Chambers *et al*., 2007) and visual disturbance is unlikely to affect the other species that are predominantly infaunal.

Biological Pressures

	Resistance	Resilience	Sensitivity
Genetic modification & translocation of indigenous 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

Key characterizing species within this biotope are not cultivated or translocated. This pressure is therefore considered 'Not relevant' to this biotope group.

Introduction or spread of invasive non-indigenous species	None Q: High A: High C: High	Very Low Q: Low A: NR C: NR	High Q: Low A: Low C: Low

Few invasive non-indigenous species may be able to colonize this biotope due to the high-levels of sediment disturbance. However, two species may be of concern. The slipper limpet *Crepidula fornicata* may settle on stones in substrates and hard surfaces such as bivalve shells and can sometimes form dense carpets which can smother bivalves and alter the seabed, making the habitat unsuitable for larval settlement. Dense aggregations trap suspended silt, faeces and pseudofaeces altering the benthic habitat. Where slipper limpet stacks are abundant, few other bivalves can live amongst them (Fretter & Graham, 1981; Blanchard, 1997). Muddy and mixed sediments in wave sheltered areas are probably optimal but *Crepidula fornicata* has been recorded from a wide variety of habitats including clean sands and areas subject to moderately strong tidal streams (Blanchard, 1997; De Montaudouin & Sauriau, 1999). Bohn *et al*. (2015) report that in the Milford Haven Waterway (MHW), south-west Wales, UK, highest densities were found in areas of high gravel content (grain sizes 16-256 mm), suggesting that the availability of this substrata type is beneficial for its establishment.

Sensitivity assessment. The sediments characterizing this biotope are likely to too mobile or otherwise disturbed for most of the recorded invasive non-indigenous species currently recorded in the UK. The slipper limpet may colonize this habitat resulting in habitat change and potentially classification to the biotope which is found in similar habitats SS.SMx.IMx.CreAsAn. Based on *Crepidula fornicata* biotope resistance is assessed as 'None' and resilience as 'Very Low' (as removal of established non-native is unlikely), so that biotope sensitivity is assessed as 'High'.

Introduction of microbial pathogens	No evidence (NEv) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR

No evidence.

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

No species within the biotope are targeted by commercial or recreational fishers or harvesters. This pressure is therefore considered 'Not relevant'.

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

Direct, physical impacts are assessed through the abrasion and penetration of the seabed pressures, while this pressure considers the ecological or biological effects of by-catch. Species in these biotopes, including the characterizing species, may be damaged or directly removed by static or mobile gears that are targeting other species (see abrasion and penetration pressures). Loss of these species would alter the character of the biotope resulting in re-classification, and would alter the physical structure of the habitat resulting in the loss of the ecosystem functions such as secondary production performed by these species.

Sensitivity assessment. Species within the biotope are relatively sedentary or slow moving although the infaunal position may protect some burrowing species from removal. Biotope resistance is therefore assessed as 'Low' and resilience as 'High' as cumaceans and *Chaetozone setosa* are likely to recolonize rapidly. Biotope sensitivity is assessed as 'Low'.

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