Published 11 December 2018
https://doi.org/10.17895/ices.pub.4654

OSPAR request on review of the OSPAR Case Report for the addition of *Haploops* communities to the OSPAR List of Threatened and/or Declining Species and Habitats

Advice summary

ICES has reviewed the case report for the addition of *Haploops* communities to the OSPAR List of Threatened and/or Declining Species and Habitats. In addition to the advice below, comments have been added directly to the draft case supplied to ICES (see Annex).

The case was found to be broadly accurate scientifically, based on the information available. ICES notes that though the case is based on a small part of OSPAR Region II, *Haploops* (of unknown status) also occur widely in other parts of Region II. The draft case study provides examples of trends taken from HELCOM waters; these are not part of the OSPAR region, and the request is confined to OSPAR Region II. These trends are in waters where there has been no trawling since the 1930s. There are positive trends in *Haploops* communities in part of OSPAR Region IV.

The only scientifically published work cited in the original case report from within OSPAR Region II relates to the southern Kattegat where there has been a decline in the extent and depth distribution of the *Haploops* communities. This paper does not attribute this change to a human activity, but it does list some possible causes. A more recent paper does attribute the change to trawling, based on a balance of likelihood, though ICES notes that concrete evidence is still not provided. Insufficient is known about the biology and natural trends/cycles in *Haploops* communities to yet attribute certain causes of change. Without knowledge of the causes of change, it is difficult to design suitable management measures.

Request

Part A–peer review of the Haploops *communities Case Report*

Following agreement at ICG-POSH, BDC and the OSPAR Commission it has been agreed to provisionally add Haploops *communities to the OSPAR List of Threatened and/or Declining Species and Habitats, as threatened and/or declining in OSPAR Region II (North Sea). In line with the procedure for listing and delisting species and habitats, as outlined in OSPAR agreement 2016-02, ICES is requested to undertake a peer review of the Case Report. ICES to review the Case Report is scientifically correct and has been correctly assessed against the Criteria for the Identification of Species and Habitats in need of Protection and their Method of Application (The Texel-Faial Criteria) OSPAR Agreement 2003–13.*

Part B–report on additional information on the status of Haploops *communities within OSPAR reporting units L2.2.6 and L2.2.2.*

ICES is requested to assess, also using other means than the case report, if there is evidence of Haploops occurrence and status (i.e. are they threatened and/or declining) within the reporting units L2.2.6 and L2.2.2, and in particular in the area that would be excluded from OSPAR Region II by the proposed French boundary change, as outlined in the maps below. It should be noted that ICES is not being asked to provide advice on the boundary change, only on the status of Haploops Communities in the area.

Review

Part A (i)–Scientific accuracy

ICES considers that more knowledge is necessary to better understand the *Haploops* genus, the habitats created by each species, and the dynamics and status of those habitats. The elements listed below are the main issues identified:

1. The taxonomy of the genus *Haploops* is evolving rapidly, with the description of several new species. For example, in 2008 only 17 species were known, but by 2018, 27 species had been described. As a consequence, it is currently very hard to determine which species lives where, particularly in relation to older records. Not all species live in high–density populations and only a limited number of the species create structural habitat. An assessment of the distribution of the various species should be a prerequisite to better understanding the dynamics of the habitats.

Not all species are likely to show the same sensitivity to the different anthropogenic pressures that they may encounter.

2. The presence of *Haploops* individuals does not necessarily mean that a structural habitat is also present. There is therefore a need for a clear definition of a quantitative biomass/adult abundance threshold to decide whether the presence of *Haploops* in the benthic community creates a different habitat from homogenous muddy/fine sand. The definition would need to be made specifically for OSPAR Region II as this threshold may differ geographically. ICES suggests using measures of biomass or of adult abundance rather than individual abundance to avoid the effects of juvenile recruitment.
3. ICES notes that of the 27 *Haploops* species known in 2018, only three – *H. nirae*, *H. tubicola,* and *H. tenuis* – would be able to form dense populations and to structure a benthic community recognized today as a specific habitat within the EUNIS classification level 4: "Deep circalittoral mud" (A5.37), "Circalittoral fine mud" (A5.36), and "Infralittoral fine mud" (A5.34).
4. Little is known of the long-term dynamics of *Haploops* habitat communities. Without this knowledge it is difficult to assess the status of individual areas of habitat, or the status over larger areas. A change noted between two surveys could either be part of cyclical change, or be caused by some anthropogenic pressure. This makes it difficult to categorize a habitat as being threatened or declining. Long-term survey of different *Haploops* habitat communities should be promoted in order to better understand the temporal dynamics of the habitat in a global change context.
5. Regarding potential threats, *Haploops* is a cold-water amphipod genus, with exceptional dense populations only in shallow waters. It may therefore also be sensitive to oceanic warming in the near future.
6. Comments have been added directly in the Case report which is attached in the Annex to this advice, and the several references listed below would help to strengthen the Case report.

Part A (ii)–Evaluation against the Texel–Faial criteria

<u>Global importance</u>: The evidence presented is scientifically sound regarding what is currently known. Note that the presence of a few *Haploops* individuals does not imply the presence of *Haploops* habitat (see above).

<u>Regional importance</u>: The elements presented for OSPAR Region II are accurate. There is, however, a strong need to better define the habitat (i.e. determining the *Haploops* biomass or abundance threshold). In addition, some of the evidence presented is from the Sound (Øresund) which is outside the OSPAR area (although this is not mentioned). It is difficult to evaluate the full presence of the habitat within OSPAR Region II.

<u>Rarity</u>: The elements presented are accurate considering current knowledge. Note that though *Haploops* species live across large bathymetric or latitudinal gradients, they rarely form the *Haploops* habitat itself (thus spatially restricted).

<u>Sensitivity</u>: Evidence supporting sensitivity to human activities is neither strong nor persuasive. For example, there are *Haploops* habitats in areas that are at least partially subjected to eutrophication, and it is known that some trawl fishers actively avoid *Haploops* areas as the habitat can clog and damage nets. In the part of the HELCOM area (the Sound) where trawling is cited in the Case report to have caused declines, trawling has been banned since 1932; nevertheless, *Haploops* was recorded as being present around 2000, but cannot be found in 2018. Ampecliscidae are said to be sensitive to oilspills in general, but nothing has been shown on *Haploops* themselves, and some *Haploops* species are known to live on or close to cold seeps. Moreover, known large variations in *Haploops* populations are currently poorly understood. Some reported declines remain unexplained although they occurred in areas presumably away from direct human pressure (demersal fishing). Thus, several environmental as well as species-specific drivers are very likely to be involved in such variability. ICES does not consider that there is enough knowledge to clearly assess the sensitivity of the habitat.

<u>Ecological significance</u>: The evidence presented is convincing and scientifically correct. At high densities, three species (at least) of *Haploops* are engineer species. Not only do they increase alpha and beta diversity, they also have a functional role as fish feeding areas and as zones of increased benthic primary production (at least in shallow areas). Such functional roles are undoubtedly beneficial to coastal ecosystems harbouring these habitats.

<u>Status of decline</u>: Although there has been apparent decline within one part of OSPAR Region II, there is no evidence that this has occurred across the region and sites in adjacent OSPAR regions have not declined. ICES considers that there is insufficient evidence to demonstrate the *Haploops* habitat is declining in OSPAR Region II as a whole.

Report on additional information on the status of *Haploops* communities within OSPAR reporting units L2.2.6 and L2.2.2

ICES has not been able to find any records within the area of the proposed French boundary change. As far as can be determined there are no suitable muddy substrates in these reporting units for *Haploops*. The nearest known populations are to the south of Brittany (Figure 1).

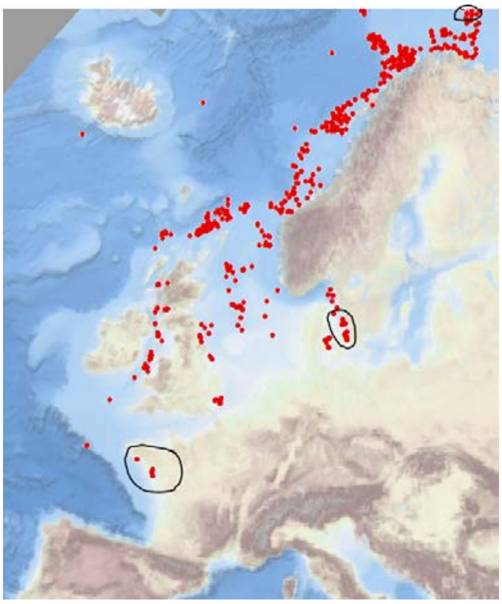


Figure 1 Map of occurrence of the *Haploops* genus from EMODnet Data Portal (checked on 8 November 2018). The areas mainly covered by the case report are circled.

Further advice

As can be seen in Figure 1, *Haploops* as a genus is known to occur widely in OSPAR Regions I, II, III, and in the northern part of Region IV. Should OSPAR wish to widen the geographic scope of the designation of the habitat, then ICES would recommend a full reassessment of the case.

Further sources and references to support the case

Allen, J. A. 1953. Observations on the epifauna of the deep-water muds of the Clyde Sea area, with special reference to *Chlamys septemradiata*. Journal of Animal Ecology, 22: 240–260.

Bellan-Santini, D., and Dauvin, J. C. 2008. Contribution to knowledge of the genus *Haploops*, a new location for *Haploops lodo* (Crustacea: Amphipoda: Ampeliscidae) from the bathyal North Atlantic Ocean with a complement to the description of the species. Journal of Natural History, 42: 1065–1077.

Bellan-Santini, D., Kaim-Malka, R., and Dauvin, J. C. 2018. Two new *Haploops* species (Crustacea: Gammaridea: Ampeliscidae) from the North Atlantic Ocean: *H. bjarnii* and *H. quebecoisis* [Contribution to the knowledge of the *Haploops* genus. 9.]. Zootaxa, 4483: 480–496.

Buchanan, J. B. 1963. The bottom fauna communities and their sediment relationships of the coast of Northumberland. Oikos, 14: 154–175.

Buhl-Mortensen, P., and Buhl-Mortensen, L. 2018. Impacts of bottom trawling and litter on the seabed in Norwegian waters. Frontiers of Marine Science, 5: 42. doi: 10.3389/fmars.2018.00042.

Dauvin, J. C. 1987. Evolution à long terme (1978–1986) des populations d'Amphipodes des sables fins de la Pierre Noire (Baie de Morlaix, Manche Occidentale) après la catastrophe de l'Amoco Cadiz. Marine Environmental Research, 21: 247–273.

Dauvin, J. C. 1996. Ampeliscidae from the Faroe Islands. (Contribution to the BIOFAR programme). Bollottino del Museo Civico di Storia Naturale di Verona, 20: 47–60.

Dauvin, J. C., Alizier, S, Sandrine, A., Weppe, A., and Guðmundsson, G. 2012. Diversity zoogeography of Icelandic deep-sea Ampeliscidae (Crustacea: Amphipoda). Deep-Sea Research, I, 68: 12–23.

Dauvin, J.-C., and Bellan-Santini, D. 1990. An overview of the amphipod genus *Haploops* (Ampeliscidae). Journal of the Marine Biological Association of the United Kingdom, 70: 887–903.

Dauvin, J. C., and Bellan-Santini, D. 1996. Ampeliscidae (Amphipoda) from the Bay of Biscay. Journal of Crustacean Biology, 16: 149–168.

Dauvin, J. C., Bellan-Santini, D., and Kaim-Malka, R. 2017. Importance of systematic in knowledge and protection of biodiversity, the case of the genus *Haploops* Liljeborg, 1856 (Ampeliscidae). Biodiversity Journal, 8: 409–410.

Glémarec, M., Lebris, H., and Le Guellec, C. 1986. Modifications des écosystèmes des vases côtières du sud-Bretagne. Hydrobiologia, 142: 159–170.

Göransson, P. 1999. Det långa och det korta perspektivet i södra Kattegatt – bottendjurens berättelse från två provpunkter. Fauna och Flora, 94(3): 125–138. In Swedish.

Josefson, A. B., Loo, L-O., Blomqvist, M., and Rolandsson, J. 2018. Substantial changes in the depth distributions of benthic invertebrates in the eastern Kattegat since the 1880s. Ecology and Evolution, 8: 9426–9438. Doi: 10.1002/ece3.4395.

Kaïm-Malka, R., Bellan-Santini, D., and Dauvin, J. C. 2016. On some *Haploops* species collected in the North Atlantic Ocean with the description of *Haploops islandica* n. sp. (Crustacea: Gammaridea: Ampeliscidae) [Contribution to the knowledge of the *Haploops* genus. 8.]. Zootaxa, 4179: 42–76.

Kaïm-Malka, R. A. 2010. *Haploops longiseta*, a new species from the Atlantic Ocean (Crustacea, Gammaridea, Ampeliscidae). [Contribution to the knowledge of the *Haploops* genus. 6.]. Zootaxa, 2356: 57–68.

Kaïm-Malka, R. A. 2012. *Haploops antennata*, a new species from the North Atlantic Ocean (Crustacea: Gammaridea: Ampeliscidae). [Contribution to the knowledge of the *Haploops* genus. 7.]. Zootaxa, 3320: 36–46.

Kanneworff, E. (1966). On some amphipod species of the genus *Haploops*, with special reference to *H. tubicola* Liljeborg and *H. tenuis* sp. nov. from the Oresund. Ophelia, 3: 183–207.

Shields, M. A., and Hughes, D. J. 2009. Large-scale variation in macrofaunal communities along the eastern Nordic Seas continental margin: comparison of four stations with contrasting food supply. Progress in Oceanography, 82: 125–136.

Sköld, M., Göransson, P., Jonsson, P., Bastardie, F., Blomqvist, M., Agrenius, S., Hiddink, J. G., Nilsson, H. C., and Bartolino, V. 2018. Effects of chronic bottom trawling on soft seafloor macrofauna in the Kattegat. Marine Ecology Progress Series, 586: 41–55. Doi: 10.3354/meps12434.

Annex Case text with track changes and direct comments

Annex. OSPAR Case report for *Haploops* communities including compiled comments from ICES reviewers

Subject of nomination	
Habitat	***Haploops* communities**

Figure 1: Photo of *Haploops* community in Kattegat, Denmark. Photo taken by ROV (Oceana, 2011)

Figure 2: A bottom sample of *Haploops* spp. tubes from Kattegat (OCEANA/Carlos Minguell. 2012)

Definition for habitat mapping

Relationship to EUNIS: The biotope does not correspond directly to any EUNIS (2004) level 4 habitats due to the structure of the classification systems. The habitat is found in the following EUNIS level 4 habitats: 'Deep circalittoral mud' (A5.37), Circalittoral fine mud (A5.36) and Infralittoral fine mud (A5.34) .

Other: The *Haploops* community is also known as "Baltic aphotic muddy sediment dominated by *Haploops* spp." under the HELCOM Underwater Biotope classification system (HELCOM 2013a).

The *Haploops* community consists of several species of amphipods with adult sizes between 5 and 20 mm , which live in small, self-built tubes under the seabed in mud substrates (see Figures 1 and 2), and therefore soft-bottom habitats dominated by one or several of these species are called *Haploops* spp. communities. The genus *Haploops* (Crustacea: Amphipoda: Ampeliscidae) currently (2018) comprises 27 species (Bellan-Santini & Dauvin 2008; Kaim-Malka et al., 2006; Dauvin et al., 2017; Peart, 2017; Bellan-Santini et al., 2018), of which 17 are found in the OSPAR maritime area (*H. abyssorum, H. antennata, H. bjarnii, H. carinata, H. dellavallei, H. dauvini, H. gascogni, H. islandica, H.*

Commented [K1]: Presumably means that at least 50% of total biomass should be *Haploops* spp?

Commented [K2]: Is there an abundance/biomass threshold used by Helcom? If so, please state it

Commented [K3]: WoRMS www.marinespecies.org used for the 27 *Haploops* species although updates are frequent.

kaimmalkai, H. laevis, H. lodo, H. longiseta, H. nirae, H. proxima, H. setosa, H. similis, H. tenuis, H. tubicola and *H. vallifera*).

Haploops is mainly a deep-water genus, but of the 27 species described nowadays, four species occurred only on the continental shelf (0-200 m), while nine had been recorded at depths < 1,000 m (Fig. X). The maximum depths are reached by *H. lodo* (3,570 m) and *H. antarctica* (3,803 m) which is the record for the *Haploops* genus. Twelve species occurred on the continental shelf (0-200 m), 19 between 200 and 1,000 m depth, nine between 1,000 and 2,000 and five less than 2,000 m. Most of the described species are known only from their type locality.

Haploops species live in muddy tubes, with the tube mouths reaching above the sediment surface to heights of 3-4 cm, depending of the species and the individual maturity. The individuals remain in the tube opening, in a dorsal position, filtering the sea water with their antennae; the *Haploops* are strictly suspension-feeder species while the related genus *Ampelisca* in the Ampeliscidae family, are mixed species being suspension-feeder and surface deposit feeder (Rigolet *et al.* 2011). There can be densities of several thousand tubes per square metre.

The presence of high abundances of *Haploops* forms a particular community of consolidated muds in contrast to the surrounding muddy seabeds (Glémarec et al. 1986). *Haploops* community were first described in the Öresund and the Kattegat (Denmark) by Petersen (1913, 1918) where the population reached 4,000 ind/m^2. In the Kattegat, the characterised species in the *Haploops* community were the ophiurid *Ophiura robusta*, the polychaete *Polyphysia crassa* and the bivalve *Pseudamussium peslutrae* (= *Chlamys septemradiatus*). Such *Haploops* community in small patches were described in the Cumbrae deep in the Clyde Sea by Allen (1953) with *Lipobranchius jeffreysi* and *P. peslutrae* as associated fauna. Buchanan (1963) described a *H. tubicola* community (60-70 m depth; density until 1,500 ind.m^{-2}). The sediment was composed of medium-fine sand and silt and clay with a median which ranges between 54 to 297 µm. This *Haploops* community occurs within the general area of the *Amphiura filiformis* community.

In Sweden, sea urchins, tube worms and brittle stars such as *Ophiura robusta* were commonly found in *Haploops* communities. Such *Haploops* communities had been described along the south Brittany coast in the North of the Bay of Biscay in the Bays of Vilaine and Concarneau in the 1960 (Glémarec et al. 1986). Firstly identified as *H. tubicola* the species is in fact *H. nirae* (Kaim-Malka 1976). The Concarneau *Haploops* community and the *H. nirae* population were described in detail by Rigolet et al. 2011, 2012, 2014a, b. Rigolet et al. (2014a) had compared the macrofauna associated with *Haploops* with the adjacent benthic communities: the *Sternaspis scutata* muddy community, the *Amphiura filiformis* sandy-mud community, and the *Owenia fusiformis* muddy-sand community. Apart *H. nirae* the characteristic species of the *Haploops* community are the polychaetes *Terebellides stroemii*, *Schistomeringos rudolphii*,

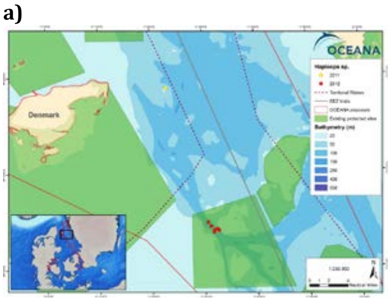
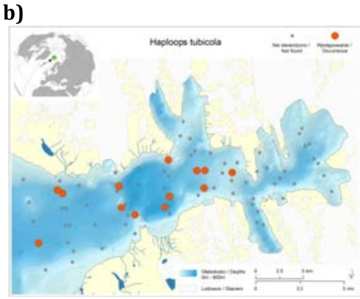
Commented [K4]: Suggest that habitat structure created by the presence of high Haploops densities needs to be described here including heterogeneity and complexity

Commented [K5]: Only single specimens of Haploops found in Sweden in the last 10 years despite intensive sampling (comment from one of ICES reviewers)

	Heteromastus filiformis, *Hilbigneris gracilis*, *Mediomastus fragilis*, *Macroclymene santandarensis*, *Spiophanes kroyeri*, *Aricidea* sp. and *Lysidice hebes* and the sipunculid *Aspidosiphon (Aspidosiphon) muelleri muelleri*. The taxonomic richness is higher in *Haploops* community, which is more homogeneous compared to the neighbouring habitats sand; 33% of all taxon are exclusively found in this community (Rigolet 2014a). Moreover, species associated with this habitat are very diverse (Rigolet *et al.* 2013), and include species that are exclusively associated with this engineered habitat, like other deep and cold-water benthic species of the Ampeliscidae family, such as species of *Ampelisca* and *Byblis*, although the correlation between these groups and their biogeographical distribution is unclear. In Brittany, a new species to science (*Photis inornatus,* Myers *et al.* 2012) was exclusively found in this habitat, along with many other species. The community also represents an important feeding ground for fish, such as plaice, halibut and cod (Rigolet *et al.* 2014, Oceana 2014; HELCOM 2013a, b, c; Naturstyrelsen 2012). The *Haploops* community from the Öresund forms an important feeding ground for fish such as plaice *Pleuronectes platessa* and halibut *Reinhardtius hippoglossoides* (Görasson 2002, 2010).	
Geographical extent		
OSPAR Regions	I-Arctic waters II- Greater North Sea III- Celtic Sea IV- Bay of Biscay and Iberian Coast V-Wider Atlantic	**All regions** The occurrence and prevalence of these communities varies throughout the OSPAR regions. Communities of some *Haploops* species are widespread across multiple regions. For example, *H. tubicola* extends its distribution to all OSPAR regions, all the way from the Sound, Kattegat, Skagerrak, Celtic seas; the North Atlantic from Norway (including the Barents sea) to the Mediterranean, the Adriatic, North Pacific and the Arctic Ocean (HELCOM 2013). Nevertheless, this large *H. tubicola* distribution in the north-hemisphere should be re-evaluated after the re-examination of the specimens coming from diverse area, this species being probably a complex of species. *Haploops setosa* occurs in the Arctic Ocean (Beaufort Sea) and North Atlantic; 69-2,886 m (Dauvin and Bellan-Santini 1990); Faeroe Islands, 99-1,319 m (Dauvin 1996); around Iceland, 97-2,082 m (Bellan-Santin and Dauvin 1997, Dauvin *et al*. 2012); and to the North of Iceland, 192-1,141 m (Kaïm-Malka et al. 2016; Dauvin et al., 2017). *Haploops vallifera* occurs in OSPAR Regions I and V. Offshore Iceland; 913-1,960 m (Dauvin and Bellan-Santini 1990); Faeroe Islands 600-1,098 m (Dauvin 1996); Iceland, one station 1,392 m (Bellan-Santini and

Commented [K6]: There are taxonomy problems that need to be checked. There are today no evidence that *H tubicola* is present in the Bay of Biscay. Past identification are probably erroneous. Needs reassessment

Commented [K7]: This reference only says that *H. tubicula* occurs in the Sound, Kattegat, Skagerrak and the North Sea. More references needed for the other areas.

		Dauvin 1997); south and western part of the Iceland, 13 stations from 285 to 1,963 m (Dauvin et al. 2012). *H. tenuis* is more common in Region II (Kattegat, Skagerrak, the North Sea and the western and northern coasts of Norway) and can also be found in Region I (Barents Sea); *H. nirae* is found in Region IV (Bay of Biscay and the Iberian Coast), and *H. abyssorum* is found in Region V (Wider Atlantic) around the Azores (Rigolet *et al.* 2012; Dauvin & Bellan-Santini 1990). *H. similis* is also found in in the South of the Bay of Biscay north-eastern Atlantic Ocean, 1,024 m (Dauvin and Bellan-Santini 1996 and is also found in the Barents sea (Mareano, in prep.) The distributions of some *Haploops* species are expanding. *H. nirae*, for instance, is spreading relatively quickly within specific locations in Region IV; at Concarneau and the Bay of Vilaine, in the northern Bay of Biscay, France, there has been a fivefold increase in the distribution of *H. nirae* since 1963. The habitat is also present in coastal embayments along the entire South Brittany coast (Rigolet *et al.* 2014).
Biogeographic zones	from Dinter, 2001	Barents Sea, Lusitanian-Boreal, Boreal, South Iceland-Faroe shelf.
	a)  **c)**	**b)**  **d)**

Commented [K8]: Reference missing

Commented [K9]: Dauvin & Bellan-Santini give H similis from this part of Region IV

	Figure 3: Distribution of various *Haploops* communities in the OSPAR regions: **a)** *Haploops* communities in the Kattegat, Denmark, Region II (Oceana 2011 and 2012); **b)** *H. tubicola* in Svalbard's Hornsund fjords, Region I (BIODAFF project); **c)** *Haploops* communities in South Brittany, France, Region IV (from Toulemont (1972), Ehrhold *et al.* (2006), Ehrhold et al (2007; **d)** *H.tubicola* distribution in Icelandic waters, Region I (Dauvin *et al.* 2012).
Application of Texel-Faial Criteria	
Global importance If Yes specify evidence (brief description)	**Qualifies.** A significant proportion of key *Haploops* communities, with the highest known densities in the world, are or have been found within the OSPAR area (see Figure 3). Dense *Haploops* communities (i.e., with densities equal to or greater than one thousand individuals per square metre), are only found in a few locations globally (Bellan-Santini and Dauvin 1989). These locations are areas in the North-East Atlantic such as the Sound and Kattegat (Denmark and Sweden, Region II), several bays in South Brittany (France, Region IV), as well as the Bay of Fundy (Canada), and the East Siberian Sea (Russia) (Rigolet *et al.* 2013). Nevertheless, the quantitative data on the *Haploops* are rare for the shallow populations and they concern of few number of species. Rigolet et al. (2012) estimated a mean density of 14,400 ind. m^{-2} with a maximum density of 25,500 ind. m^{-2} for *H. nirae* population in the bay of Concarneau, North part of the Bay of Biscay (3000 ha). Similarly in the Bay of Vilaine (7000 ha in 2010), the density of *H. nirae* can reached 18,000 ind.m^{-2} (Rigolet et al. 2011, 2014a). In the Bay of Concarneau, the *Haploops* community had expanded from 650 ha in 1963- to 3700 ha in 2003 (Rigolet et al. 2012). The maximum density of the deep species *H. setosa* reaches 300 ind. m^{-2} in the North Atlantic Ocean (Shields and Hughes 2009).
Regional importance If Yes specify evidence (brief description)	**Qualifies.** The known distribution of dense shallow *Haploops* communities is restricted to a few locations in OSPAR region II (Kattegat and the Skagerrak), and Region IV (South Brittany France). In region IV, *Haploops* communities have a larger distribution range, from the coast of South Brittany (France) in the Northern part of the Bay of Biscay where communities are spreading (Rigolet et al. 2012).
Rarity	**Qualifies.** The distribution of *Haploops* communities is patchy, both globally and in the OSPAR maritime area. *Haploops* are sedentary animals and *Haploops* communities with high densities are restricted to only a few locations, in particular in OSPAR Regions II

Commented [K10]: References missing in the reference list

Commented [K11]: Reference not found

Commented [K12]: References missing in the reference list

Commented [K13]: Does not really illustrate global distribution, but see map in main review advice

Commented [K14]: Not any longer (comment from ICES reviewer), and the Sound is not in the OSPAR area

Commented [K15]: This reference does not include the East Siberian Sea location.

Commented [K16]: No recent known records from the Skagerrak

If Yes specify evidence (brief description)	and IV. Lower densities of *Haploops* can also be found in shallow and deep muddy areas of OSPAR Regions I, III and V but these are often insufficiently documented mainly for the deep species.	
Sensitivity	• Sensitive • Very Sensitive • Neither of the above/ Not sensitive with respect to definitions	**Sensitive**
Where relevant specify evidence (brief description)	**Qualifies.** *Haploops* communities are sensitive to human activity. Haploops are sensitive to direct physical impacts and disturbances of the seafloor, as well as to eutrophication, hypoxia and turbidity (Göransson et al. 2002; Nielsen et al. 2014), and as are the other species of the Ampeliscidae family to oil pollution (Dauvin, 1987) For instance bottom-fishing activities, dredging, mining, sand and gravel extraction and offshore installations remove, disturb and stir up the sea bottom, with direct impacts on benthic animals. Evidence from Region II shows that *Haploops* face difficulties in re-establishing themselves in areas that are regularly trawled (Olesen et al. 2011). See further information under 'Threats'.	
Ecological significance	**Qualifies.** *Haploops* are bioengineering species, which build small tubes in soft sediments. *Haploops* communities with high tube densities increase the complexity and heterogeneity of the sea bottom, in comparison with adjacent, more homogeneous areas. As a result, the *Haploops* tubes affect the diversity and composition of invertebrates living in areas where they are found (Rigolet *et al.* 2014), for instance, various species of tubeworms, sea urchins and brittle stars occur within this biotope. *Haploops* are an important link in the food chain, as they are food sources for demersal fishes such as *Pleuronectes platessa* and *Reinharditus hippoglossoides* (Rigolet *et al.* 2014). Also, because of their biological activity, these engineering species strongly affect the food web, especially by promoting microphytobenthic production (Rigolet *et al.* 2014; Rigolet *et al.* 2015). *Haploops* communities develop in seafloors characterised by high fluid emissions (often methane), which makes this habitat type quite unique because of the pockmarks created. For instance, in south Brittany, the largest density of pockmarks have been observed and mapped in *Haploops* communities (Baltzer *et al.* 2014; Dubois et al, 2015). Inside *Haploops* communities, those pockmarks offer refuge for many vertebrates and invertebrates (Dubois *et al.* 2015). Dense tube mats can also improve the quality of benthos by processing particulate organic matter and oxygenating sediments (Diaz *et al.* 2008). Those maps have also been suggested to stabilise sediments by minimising the transport of silt, and facilitating the colonisation and the development of suspension-feeding species (Mackenzie *et al.* 2006). Until recently, it was unclear whether *Haploops* communities still exist in Kattegat. However, in 2011, Oceana documented this rare community in the central part of Kattegat (see Figure 3a). In one location the community was detected using an underwater remotely operated vehicle (ROV) at 70 meters depth, where fish such as cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*) were also present (Paulomaki *et al.* 2011; Oceana 2014).	

Commented [K17]: The Mareano observations in Region I are not shallow. As can be seen in EmodNet (see map in advice sheet), many observations of Haploops in Region I are from deep waters (>100m)

Commented [K18]: ICES is not convinced that the evidence demonstrates this

Commented [K19]: Does this include organic pollution?

Commented [K20]: No direct evidence of effects on Haploops communities

Commented [K21]: Surely this depends if the pressure is repeated? And the frequency of repetition. This needs to be more precise

Commented [K22]: Reference missing. This is not known to occur in Swedish waters.
Please be more precise, in particular would this case be general for *Haploops* habitats? Is there any role of *Haploops* in forming pockmarks?

Commented [K23]: What is the "quality of benthos"? Quality is a vague term. Can this be better described?

Commented [K24]: This statement is off topic here and does not seem relevant for the case. ICES recommends removal

Status of decline (including biogeographic zones specified for decline and/or threat)	• Extirpated (extinct within OSPAR area) • Severely declined • Significantly declined • Probability of significant decline • None of the above/ Not declining I- Arctic waters II- Greater North Sea III- Celtic Sea IV- Bay of Biscay and Iberian Coast V- Wider Atlantic	As referred to above, differences in abundance and trends of *Haploops* communities are apparent across the OSPAR regions. Data availability is also variable across regions, and it is not possible to determine the status of decline for all OSPAR Regions. Based on the available information, and applying the precautionary principle, the decline should be categorised as follows: **Region II: Significantly declined**
Where relevant specify evidence (brief description)	**Region II.** *Haploops* communities have declined significantly in part of OSPAR Region II. There are long historical records of the occurrence of this community in the Kattegat within Region II since the first half of the 1900s. The researcher Carl Georg Johannes Petersen (1860-1928) studied benthic fauna, including *Haploops*, in the Kattegat. This study showed that the *Haploops* community was found on bottoms below 25 metres depth in a large area of south-eastern Kattegat, (Göransson 1999,). In comparison, the current distribution range has been significantly reduced, and observed changes in community composition may indicate an associated regime shift, with an increase in the *Amphiura* brittle star community (Göransson *et al.* 2010).. The exact cause of this decline in *Haploops* remains unknown.. In Skagerrak, a decline of the *Haploops* community has been reported (HELCOM 2013a,b; Göransson *et al.* 2010) and no specimens have been found recently.	
Threat	• Currently threatened • Potentially threatened • Not threatened	**Region II: Currently threatened**
Where relevant, specify evidence (brief description)	Based on information from Region II, bottom fishing (e.g. dredging, trawling) is a potential threat to *Haploops* communities, as these fishing methods have a direct impact on the seafloor, physically damaging and disturbing benthic habitats and species (Olesen *et al.* 2011; HELCOM 2013,b,c; Nielsen *et al.* 2014). Other major potential threats are hazardous substances and eutrophication, where oxygen deficiency affects the benthic life (HELCOM 2013,b,c). Because some hazardous substances accumulate in muddy bottoms, *Haploops* communities may be particularly exposed to pollution. Other threats include climate change; increased temperatures are expected to have an impact on arctic-boreal species and habitats (Blæsbjerg *et al.* 2012; Oceana 2012; HELCOM 2013a, ,c). However, the whole picture appears to be more complex, given that in some other areas, like Region IV, *Haploops* communities appear to have benefited from increased nutrients, sediment resuspension and increase of offshore bottom-trawling activities, resulting in increased turbidity in nearshore waters (Glemarec et al, 1986; LeBris & Glemarec 1995; Hily *et al.* 2008).	
Relevant additional considerations		

Commented [K25]: Nomination is not for all Regions. ICES has not reviewed other OSPAR REgions

Commented [K26]: This is true, but only in a small part of the Region, no evidence provided from elsewhere in the Region

Commented [K27]: Edited to Remove references to the Sound (Oresund) that is not in OSPAR Region II

Commented [K28]: These information sheets there are just a sentence without reference claiming this. Not valid as evidence.

Commented [K29]: This report covers two stations in The Sound (Oresund) far away from Skagerrak and outside OSPAR region II (it is in Helcom area). Not valid as evidence.

Commented [K30]: No evidence provided to support this statement in Region II; may be Potentially threatened

Commented [K31]: None of these papers has specific evidence of impact of trawling or other fishing on Haploops communities

Sufficiency of data	*Haploops* communities have been studied in past decades in the Sound and Kattegat, where these communities have severely declined. The status of *Haploops* bottoms are also well-known south of Brittany, where the communities have been increasing in recent years. The dynamics of the *Haploops* communities, their decline in some areas and increase in others is not fully understood. A number of uncertainties remain and more site specific information is needed, for instance, on the effects of bottom trawling, eutrophication, climate change etc. in order to be able to efficiently protect and potentially restore the declined communities. Whether similar increasing or decreasing trends occur in *Haploops* communities in other regions needs to be further examined, and the underlying causes for these trends studied.
Changes in relation to natural variability	The extent of *Haploops* communities can vary as a response to nutrient availability, currents, turbidity, temperature, benthic substrate etc. There may also be natural inter-specific competition for space from other species.
Expert judgement	During the process to develop the HELCOM Red List (Helcom 2013a), *Haploops* communities, and the two *Haploops* species present in the Sound and Kattegat (*H. tenuis* and *H. tubicola*) were assessed against the Red List criteria of the International Union for Conservation of Nature (IUCN). Both species were found to be in danger of becoming extinct (Endangered status for *H. tenuis*, and Vulnerable status for *H. tubicola*) and the biotope 'Baltic aphotic muddy sediment dominated by *Haploops* spp' was found to be Endangered.
Threat and link to human activities	
Cross reference to checklist of human activities in OSPAR MPAs guidelines	Cross reference to the JAMP List of human activities and pressures (OSPAR Agreement 2014-2) - Category of human activity: o Fisheries o Mariculture o Sand and gravel extraction o Exploration and exploitation of deep sea mineral resources, including deep sea mining o Dredging for navigational purposes o Land reclamation o Coastal defence o Construction or placement of artificial reefs o Placement of cables and pipelines o Dumping of wastes or other matter o Pressures: Physical loss o Changes in suspended solids (water clarity) o Siltation rate changes, including smothering o Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion o Habitat structure changes – removal of substratum (extraction) o Temperature changes / Salinity changes - local o Nutrient enrichment

Commented [K32]: Should this list be of actual (proven) activities/pressures known to affect the habitat or activities with the potential to affect? At present these are all potential threats. Some other potential threats are added for completeness. There appears also to be duplication between "categories of human activity" and "human activity"

	o Organic enrichment o Water flow (tidal current) changes – local, including sediment transport considerations o Hydrocarbon and PAH contamination o Radionuclide contamination o Deoxygenation Cross reference to checklist of human activities in OSPAR MPAs guidelines (OSPAR Agreement 2003-18) - Human activities: o Land-based activities (emissions and inputs from e.g., agriculture, forestry, industry, urban waste water) o Fishing o Aquaculture/mariculture o Extraction of sand, stone and gravel o Placement and operation of submarine cables o Dumping of solid waste and dredged spoils o Constructions (e.g. artificial islands, artificial reefs, offshore wind-farms) o Bio-prospecting o Traffic infrastructure (e.g. dredging of navigational purposes) o Coastal defence measures - Effects of human activities: o Substratum removal and change (inc. smothering) o Increased siltation (deposited sediment) o Turbidity changes (suspended sediment) o Emergence regime changes (inc. desiccation) o Temperature and salinity changes o Heavy metal contamination o Nutrient changes (eutrophication) o Physical damage to species (inc. abrasion) o Changes in population or community structure or dynamics o Introduction of non-indigenous species and genetically modified organisms
Management considerations	
Current management	Within the European Union, neither *Haploops* communities nor individual *Haploops* species are included in the Annexes of the Habitats Directive (92/43/EEC). HELCOM has listed the *Haploops* community as Endangered, and the species *Htenuis* as Endangered, while *H. tubicola* is listed as being Vulnerable. Yet open questions remain about the exact ecological role of *Haploops* communities, their severe declines in some areas, and increases in others. It is evident that this community is important for local habitat complexity (Göransson 2002), trophic networks and that it affects the biodiversity and composition of species (Reise *et al.* 2009; Rigolet 2014), some of which are found only within the *Haploops* community (Myers *et al.* 2012). Therefore, including this habitat type on the OSPAR List of Threatened and/or Declining Species and Habitats would recognise the importance of this unique fragile benthic shallow habitat type, and allow for better knowledge, protection and monitoring of *Haploops* communities across the North-East Atlantic.

Commented [K33]: The further papers by Rigolet et al could be referenced here

Commented [K34]: This highlighted part does not seem to be the right place to say this. Not really current management. It is more a discussion about possible future management

Required further management	Effort should be made to explore protect and monitor *Haploops* communities in the Kattegat and Skagerrak (OSPAR Region II). The occurrence of these communities should also be better mapped, in order to have a full picture of its extent and conservation status. The reason for the observed decline of *H. tubicola* and *H. tenuis* is not perfectly understood. However, it is presumed that bottom fishing has played a negative role by disturbing the structure of the seabed, (Göransson *et al.* 2010). Therefore, human activities, such as bottom trawling, could be restricted when sufficient evidence identify major impacts on specific areas of *Haploops* communities. Vessels fishing in these areas could also be equipped with satellite tracking devices, to facilitate monitoring, control and enforcement. Bottom fishing is not, however, the only cause for the declines; pollution, climate change and natural biological change/variation may also play a role. Periodic anoxia has been observed in the areas where *Haploops* communities are found (Göransson *et al.* 2010). The anoxia in the Kattegat region is likely to happen due to restricted water movement and unusual water stratification, as well as excessive amounts of nutrients in the water. Pollution by various hazardous substances can also affect the deep muddy biotopes dominated by *Haploops* communities (HELCOM 2013b,c). In addition, increasing temperatures have been noted in the area (Göransson *et al.* 2010). HELCOM has also recommended that the negative effects of eutrophication and bottom trawling need to be reduced. OSPAR could help to intensify efforts to reduce nutrients flows and address eutrophication around known *Haploops* communities, as well as monitoring the status of these areas. OSPAR could also leverage awareness of the importance of *Haploops* communities among relevant management authorities and stakeholders and help identify the most effective management measures for *Haploops* communities (including their survey, management and restoration).
Useful References	Allen, J.A. (1953). Observations on the epifauna of the deep-water muds of the Clyde Sea area, with special reference to *Chlamys septemradiata*. Journal of Animal Ecology 22: 240-260. Baltzer, A., Ehrhold, A., Rigolet, C., Souron, A., Cordier, C., Clouet, H., & Dubois S.F. (2014). Geophysical exploration of an active pockmark field in the Bay of Concarneau, southern Brittany, and implications for resident suspension feeders. Geo-Marine Letters 34: 215-230 Bellan-Santini, D., & Dauvin, J.C. (1989). Vertical distribution and biogeographic repartition of the holobenthic filter-feeders crustacean. An example, the genus Ampelisca (Amphipoda), a zoological group with a high level of speciation. Bulletin de la Société Géologique de France 5: 561–568. Bellan-Santini, D. & Dauvin, J.C. (2008) Contribution to knowledge of the genus *Haploops*, a new location for *Haploops lodo* (Crustacea: Amphipoda: Ampeliscidae) from the bathyal North Atlantic Ocean with a complement to the description of the species. Journal of Natural History. 42: 1065-1077.

Commented [K35]: Most of them are not existing any longer which makes protection and monitoring worthless

Commented [K36]: Studies should not be restricted to Kattegat and Skagerrak but be implemented elsewhere in order to understand changes better. We would not know very much about Haploops if the southern Brittany studies had not occurred

Commented [K37]: Based on no evidence

Commented [K38]: Theses measures are already in place (for vessels >12m) under the CFP

	Bellan-Santini, D., Kaim-Malka, R. & Dauvin, J.C. (2018). Two new *Haploops* species (Crustacea: Gammaridea: Ampeliscidae) from the North Atlantic Ocean: H. bjarnii and H. quebecoisis [Contribution to the knowledge of the Haploops genus. 9.]. Zootaxa 4483: 480-496.Bellan-Santini, D., & Costello, M.J. (2001). Amphipoda. in: Costello, M.J. *et al.* (Eds.) . European register of marine species: a check-list of the marine species in Europe and a bibliography of guides to their identification. Collection Patrimoines Naturels 50: 295-308. Blæsbjerg, M., Abel, C., Andersen, S.M., Flensted, K.N., Mørk Jørgensen, H., Meltofte, H., Moshøj, C., Nicolajsen, S.V., Sveegaard, S., Vikstrøm, T. & Lyng Winter, H. (2012). Havets natur – et oplæg til handleplan for Danmarks marine biodiversitet. Det Grønne Kontaktudvalg. In Danish Brandt, A. (1997). Biodiversity of peracarid crustaceans (Malacostraca) from shelf down to the deep Arctic Ocean. Biodiversity and Conservation 6: 1533-1556. Bryazgin, V. (1997). Diversity, distribution and ecology of benthic amphipods (Amphipoda, Gammaridea) in the Barents Sea sublittoral. Polish Polar Research 18: 89-106. Buchanan, J.B. (1963). The bottom fauna communities and their sediment relationships of the coast of Northumberland. Oikos 14: 154-175. Buhl-Mortensen, P., & Buhl-Mortensen, L. (2018). Impacts of Bottom Trawling and Litter on the Seabed in Norwegian Waters. Front. Mar. Sci. 5: 42. doi: 10.3389/fmars.2018.00042 Dauvin, J.C. (1987). Evolution à long terme (1978-1986) des populations d'Amphipodes des sables fins de la Pierre Noire (Baie de Morlaix, Manche Occidentale) après la catastrophe de l'Amoco Cadiz. Marine Environmental Research 21: 247-273 Dauvin, J.C. (1996). Ampeliscidae from the Faroe Islands. (Contribution to the BIOFAR programme). Bollottino del Museo Civico di Storia Naturale di Verona 20: 47-60. Dauvin, J.C., Alizier, S, Sandrine, A., Weppe, A., & Guðmundsson, G. (2012). Diversity zoogeography of Icelandic deep-sea Ampeliscidae (Crustacea: Amphipoda). Deep-Sea Research I, 68: 12-23. Dauvin, J.-C., & Bellan-Santini, D. (1990). An overview of the amphipod genus *Haploops* (Ampeliscidae). Journal of the Marine Biological Association of the United Kingdom 70: 887-903. Dauvin, J.C. & Bellan-Santini, D. (1996). Ampeliscidae (Amphipoda) from the Bay of Biscay. Journal of Crustacean Biology 16: 149-168.

	Dauvin, J.C., Bellan-Santini, D. & Kaim-Malka, R. (2017). Importance of systematic in knowledge and protection of biodiversity, the case of the genus *Haploops* Liljeborg, 1856 (Ampeliscidae). Biodiversity Journal 8: 409–410. Diaz, R.J., Rhoads, D.C., Blake, J.A., Kropp, R.K., & Keay, K.E. (2008). Long-term Trends of Benthic Habitats Related to Reduction in Wastewater Discharge to Boston Harbor. Estuaries and Coasts 31, 1184-1197. Dubois, S.F., Derian, F., Caisey, X., Rigolet, C., Caprais, J.-C., & Thiebaut, E. (2015) Role of pockmarks in diversity and species assemblages of coastal macrobenthic communities. Marine Ecology Progress Series 529: 91-105 Glémarec, M., Lebris, H. & Le Guellec, C. (1986). Modifications des écosystèmes des vases côtières du sud-Bretagne. Hydrobiologia 142: 159-170 Göransson, P. (1999). Det långa och det korta perspektivet i södra Kattegatt – bottendjurens berättelse från två provpunkter. Fauna och Flora 94:3, 125-138. In Swedish. Göransson P (2002) Petersen's benthic macrofauna stations revisited in the Oresund area (southern Sweden) and species composition in the 1990s—signs of decreased biological variation. Sarsia 87:263–280 Göransson, P., Bertilsson Vuksan, S., Karlfelt, J. & Börjesson, L. (2010). *Haploops*-samhället och *Modiolus*-samhället utanför Helsingborg 2000-2009. Miljönämden i Helsingborg. In Swedish with English summary Hayward, P.J., & Ryland, J.S. (Ed.). (1990). The marine fauna of the British Isles and North-West Europe: 1. Introduction and protozoans to arthropods. Clarendon Press: Oxford, UK. 627 pp. HELCOM. (2013a) Baltic aphotic muddy sediment dominated by *Haploops* spp. Biotope information Sheet. HELCOM Red List Biotope Expert Group. HELCOM 2013b. HELCOM Species Information Sheet – *Haploops tenuis*. HELCOM Red List Benthic Invertebrate Expert Group. HELCOM 2013c. HELCOM Species Information Sheet – *Haploops tubicola*. HELCOM Red List Benthic Invertebrate Expert Group. Hily, C., Le Loc'h, F., Grall, J., & Glémarec, M. (2008). Soft bottom macrobenthic communities of North Biscay revisited: long-term evolution under fisheries-climate forcing. Estuarine, Coastal and Shelf Science 78: 413–425.

Josefson, A. B., Loo, L.-O., Blomqvist, M., & Rolandsson, J. (2018) Substantial changes in the depth distributions of benthic invertebrates in the eastern Kattegat since the 1880s. Ecology and Evolution 8:9426-9438. Doi: 10.1002/ece3.4395.

Kaïm-Malka, R., Bellan-Santini, D. & Dauvin J.C. (2016). On some *Haploops* species collected in the North Atlantic Ocean with the description of *Haploops islandica* n. sp. (Crustacea: Gammaridea: Ampeliscidae) [Contribution to the knowledge of the *Haploops* genus. 8.]. Zootaxa 4179: 42-76.

Kaïm-Malka, R.A. (2010). *Haploops longiseta*, a new species from the Atlantic Ocean (Crustacea, Gammaridea, Ampeliscidae). [Contribution to the knowledge of the Haploops genus. 6.]. Zootaxa 2356: 57-68.

Kaïm-Malka, R.A. (2012). *Haploops antennata*, a new species from the North Atlantic Ocean (Crustacea: Gammaridea: Ampeliscidae). [Contribution to the knowledge of the *Haploops* genus. 7.]. Zootaxa 3320: 36-46.

Kanneworff, E. (1966). On some amphipod species of the genus *Haploops*, with special reference to *H. tubicola* Liljeborg and *H. tenuis* sp. nov. from the Oresund. Ophelia: 183-207.

LeBris, H., & Glémarec, M. (1995). Macrozoobenthic communities of an oxygen undersaturated coastal ecosystem: the bay of Vilaine (Southern Brittany). Oceanologica Acta 18: 573–581.

Mackenzie, C.L., Pikanowski, R., & McMillan, D.G. (2006). *Ampelisca* amphipod tube mats may enhance abundance of northern quahogs *Mercenaria mercenaria* in muddy sediments. Journal of Shellfish Research 25: 841-847.

Myers, A.A., Rigolet, C., Thiebaut, E., & Dubois, S.F. (2012) A new species of amphipod, *Photis inornatus* sp. nov. (Corophiidea, Photidae) from a '*Haploops* community' in Brittany. Zootaxa:55-61

Naturstyrelsen (2012). DanmarksHavstrategi – Basisanalysen. The Danish Nature Agency, Ministry of Environment. In Danish

Nielsen, J.R., Bastardie, F., Buhl-Mortensen, L., Eigaard, O., Gümüs, A., Hintzen, N.T., Kavadas, S., Laffargue, P., Mengual, B., Notti, E., Papadoupoulou, N., Polet, H., Reid, D., Rijnsdorp, A.D., Rochet, M.-J., Robert, A., Sala, A., Smith, C., Virgili, M., & Zengin, M. .(2014). Report on assessing trawling impact in regional seas. EU-FP7 Benthis - Deliverable 7.6. http://archimer.ifremer.fr/doc/00310/42142/

Oceana. (2014) Oceana's proposals for Marine Protected Areas. http://baltic.oceana.org/en/bl/media-reports/reports/oceana039s-proposals-for-marine-protected-areas

Olesen, M., Back, J.S., & Göransson, P. (2011). Øresunds unikke dyreliv er truet. Aktuel Naturvidenskab, Vol. 2: 32-36. In Danish

Paulomäki, H., Abel, C. & Aguilar, R. (2011). Conservation proposals for ecologically important areas in the Baltic Sea. Oceana. http://baltic.oceana.org/sites/baltic.oceana.org/files/OCEANA_Baltic_report_2011_ENG.pdf

Reise, K., Bouma, T.J., Olenin, S., & Ysebaert, T. (2009) Coastal habitat engineers and the biodiversity in marine sediments. Helgoland Marine Research 63: 1–2.

Rigolet, C., Le Souchu, P., Caisey, X., & Dubois, S.F. (2011) Group sweeping: Feeding activity and filtration rate in the tubiculous amphipod *Haploops nirae* (Kaim-Malka, 1976). Journal of Experimental Marine Biology and Ecology 406: 29-37.

Rigolet, C., Dubois, S.F., Droual, G., Caisey, X., & Thiebaut, E. (2012) Life history and secondary production of the amphipod *Haploops nirae* (Kaim-Malka, 1976) in the Bay of Concarneau (South Brittany). Estuarine Coastal And Shelf Science 113: 259-271.

Rigolet, C., Dubois, S.F., & Thiebaut, E. (2013). Benthic control freaks: Effects of the tubiculous amphipod *Haploops nirae* on the specific diversity and functional structure of benthic communities. Journal of Sea Research 85: 413-327.

Rigolet, C., Thiebaut, E., Dubois, S.F. (2014) Food web structures of subtidal benthic muddy habitats: evidence of microphytobenthos contribution supported by an engineer species. Marine Ecology Progress Series 500:25-49.

Rigolet, C., Thiebaut, E., Brind'Amour, A., & Dubois, S.F. (2015) Investigating isotopic functional indices to reveal changes in the structure and functioning of benthic communities. Functional Ecology 29: 1350-1360.

Santini, D.B., & Dauvin, J.-C. (2008) Contribution to knowledge of the genus *Haploops*, a new location for *Haploopslodo* (Crustacea: Amphipoda: Ampeliscidae) from the bathyal North Atlantic Ocean with a complement to the description of the species. Journal of Natural History. 42: 1065-1077.

Shields, M.A., & Hughes, D.J. (2009) Large-scale variation in macrofaunal communities along the eastern Nordic Seas continental margin: comparison of four stations with contrasting food supply. Progress in Oceanography 82: 125-136

	Sköld, M., Göransson, P., Jonsson, P., Bastardie, F., Blomqvist, M., Agrenius, S., Hiddink, J.G., Nilsson, H.C., & Bartolino, V. (2018) Effects of chronic bottom trawling on soft seafloor macrofauna in the Kattegat. Marine Ecology Progress Series 586: 41-55. Doi: 10.3354/meps12434. Weslawski, J.M. (1990). Distribution and ecology of South Spitsbergen coastal marine Amphipoda (Crustacea). Polskie Archiwum Hydrobiologii 37: 503-519.
Contact person	Hanna Paulomäki Oceana (Baltic Office) Nyhavn 16, 4 sal 1052, Copenhagen Denmark hpaulomaki@oceana.org