Benthic macro invertebrates at Moriusaq, NW Greenland

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1 INTRODUCTION

Dundas Titanium A/S is currently assessing the possibilities to explore a titanium rich black sand deposit on the south coast of Steensby Land near Moriusaq in North Greenland. The activities will include shipping to and from a new port near Moriusaq and possibly also discharge of fines to the ocean.

To assess the environmental impact of the planned mining activities, up-to-date information on the flora and fauna of the seafloor is needed. Previous knowledge in this region is limited to grab sampling near Saunders Island in 1939-1940 (Vibe 1950), a survey from the western most part of the area in 2008 (Boertmann & Mosbech 2017) and a study in the North Star Bay (DHI 2004).

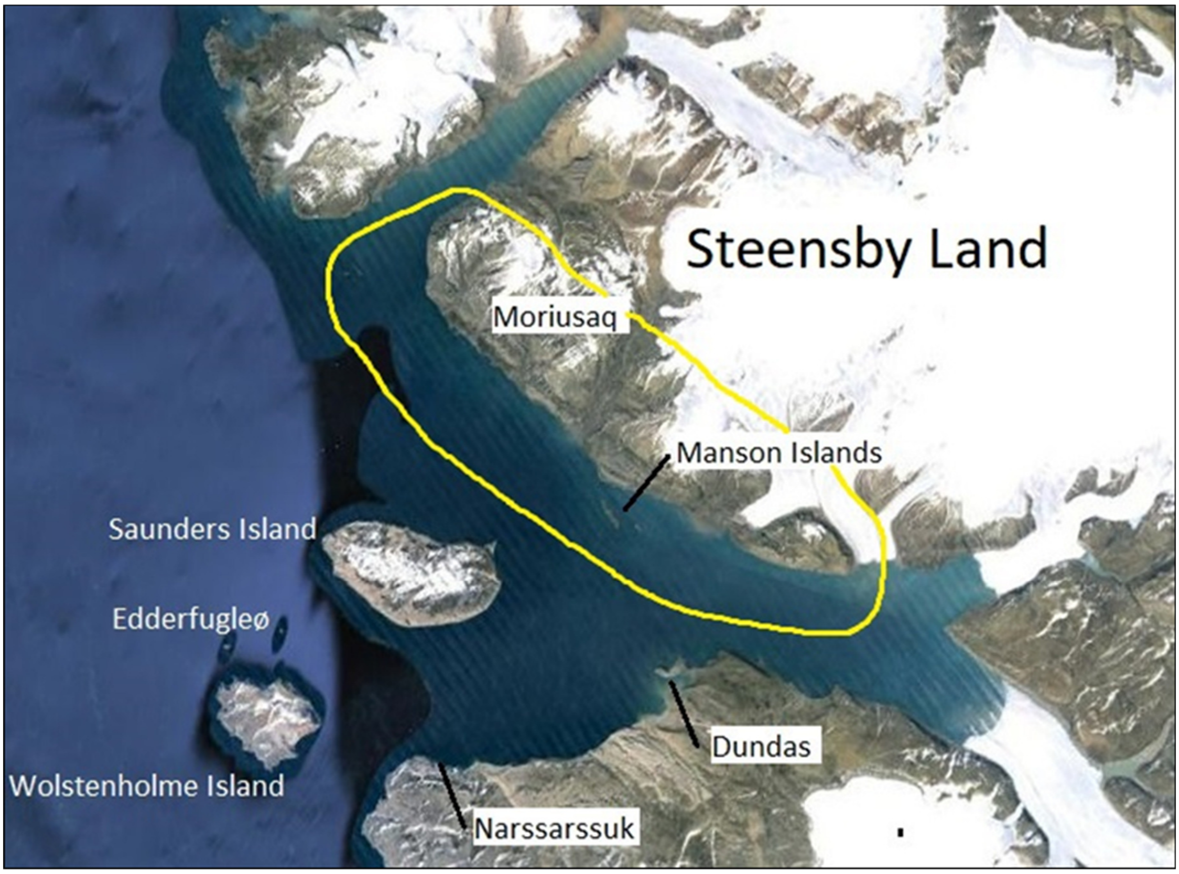


Figure 1. The assessment area covered in this report (yellow circle)

Marine studies were therefore carried out in 2016, 2017 and 2018 off the southwest coast of the Steensby Land peninsula (Figure 1) – in the following called the assessment area. This included underwater video footage and grab sampling of the seabed along transects from the shoreline to *c.* 20 m water depths.

This report presents the main results of the new surveys. Focus is on providing a broad description of the physical structures of the seafloor, including the benthic communities of macroinvertebrates. Special attention is given to bivalves, in particular the distribution and density of mussel species known to be important walrus food items.

Figure 2. *Heliometra glacialis* from the seafloor off Moriusaq at 18 m water depth

2 THE ASSESSMENT AREA

2.1 Ice coverage

The assessment area is covered by thick sea ice much of the year. On average, the ice start to break up in May-June, and the sea is free of ice from late June to late October (Svašek Hydraulics 2016, pers. obs.). However, there are large annual variations with open water already in April or May in some years, while in other years (such as 2016), much ice still present in late June (Figure 3).

Figure 3. Sea ice at Moriusaq on the 27 June 2017

2.2 Bathometry

The water depth in the assessment area gradually increases from the coastline to reach around 100 m in the sounds between Steensby Land and Saunders Island (Figure 4).

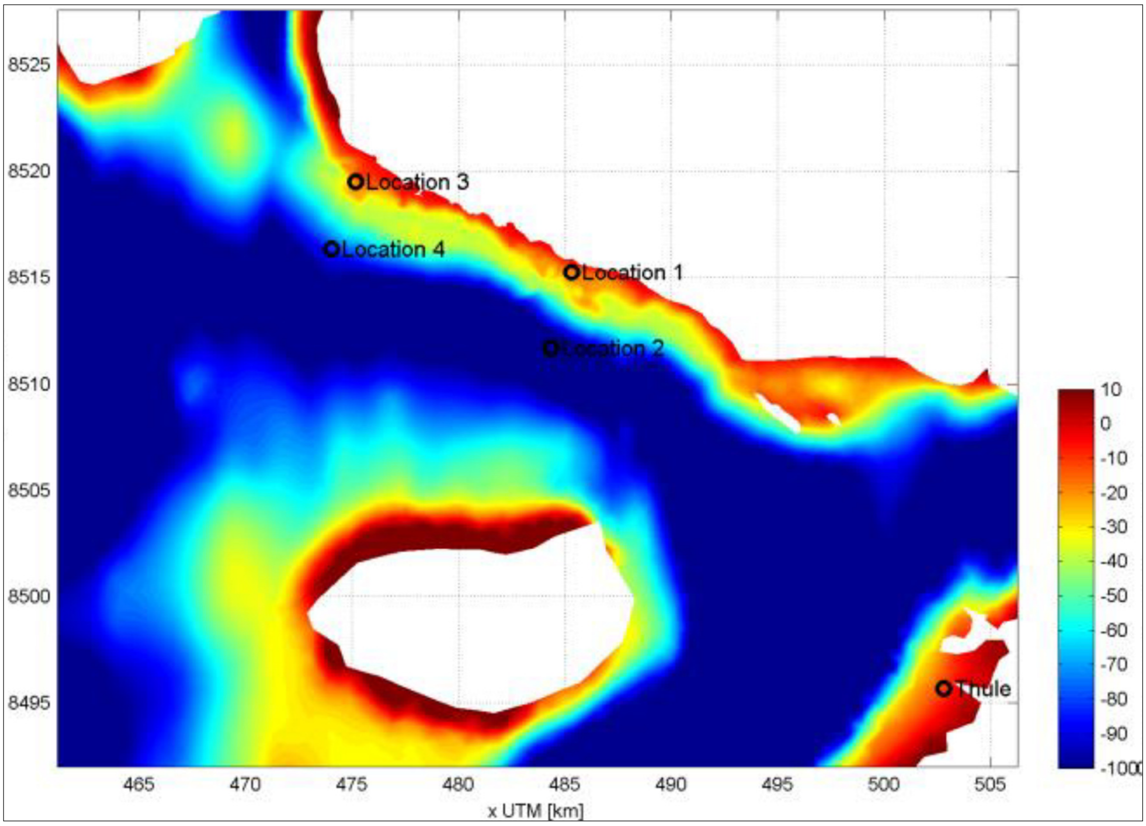


Figure 4. Bathometry of the assessment area (from Svašek Hydraulics 2016)

2.3 Currents and tides

Because tidal currents are generally dominant in shallow areas, such as the assessment area, focusing on tidal forces will result in a good representation of the hydrodynamics of the assessment area (Svašek Hydraulics 2016).

Using a two-dimensional finite element flow model software (FINEL2D), the mean high water spring has been modelled to 1.63 m and the mean low water spring to -1.35 m (Svašek Hydraulics 2016).

The modelling revealed that the flow direction is generally parallel to the coastline for both ebb and flood, with the magnitude of the current to be significantly higher during flood than under ebb conditions (Figure 5 & 6).

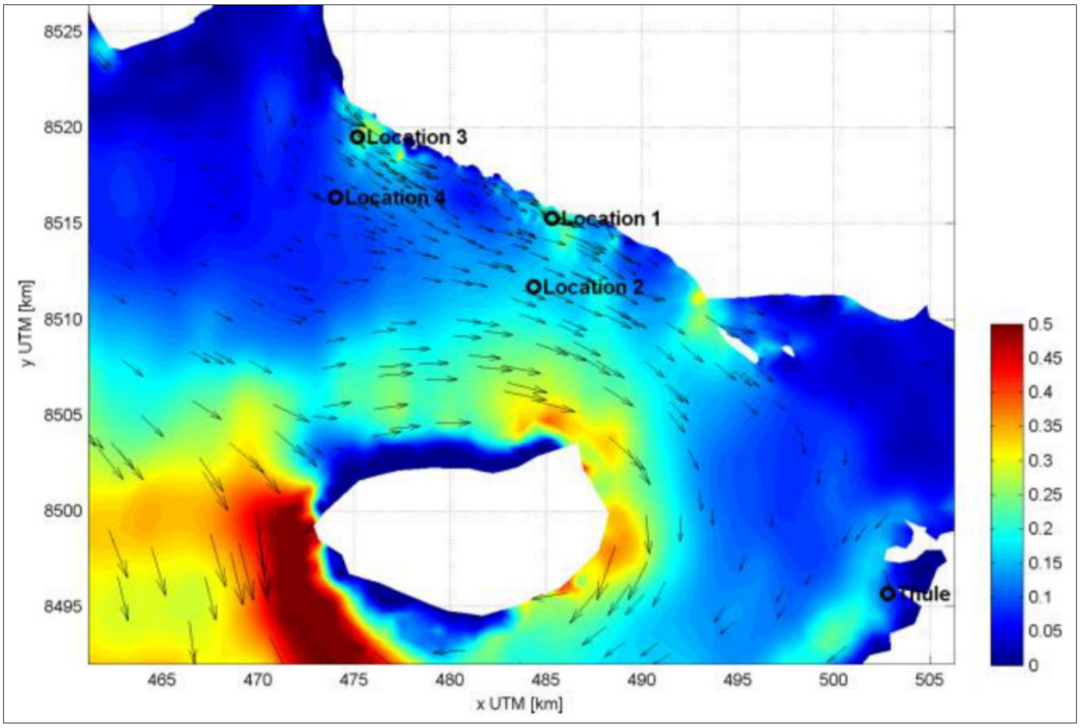


Figure 5. Tidal current velocities and flow patterns (m/s) during ebb conditions (from Svašek Hydraulics 2016)

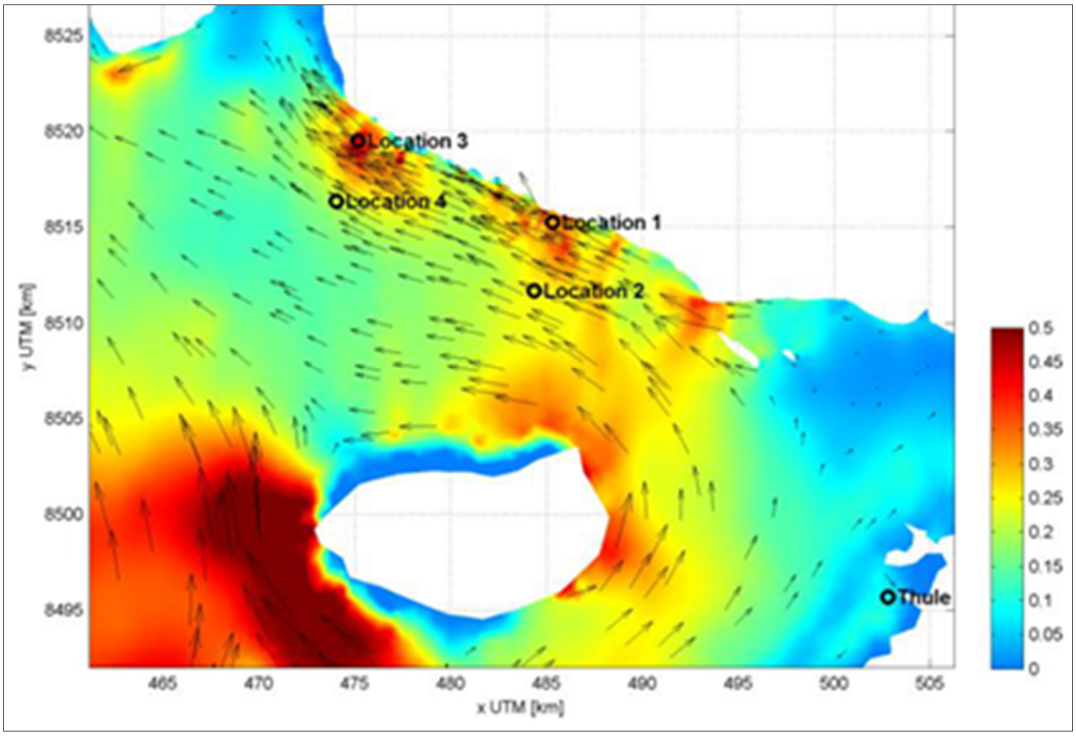


Figure 6. Tidal current velocities and flow patterns (m/s) during flood conditions (from Svašek Hydraulics 2016)

2.4 Natural silt plumes

The two glacial rives Iterlak and Pinguarsuit discharge large amounts of fine material into the sea off the Steensby Land peninsula from May-June to September-October. Since tidal forces dominate the sea currents regime in the assessment area, the silt plumes are mostly limited to a zone parallel to the coastline (Figure 7 & 8).

In summer, the turbidity of the water of the assessment area is generally rather high due to a significant sediment load. This is particularly apparent close to the glacial river deltas, when there is strong flood current but also on days with strong wind which can induce some re-suspension of fine sediments in shallow areas (pers. obs).

Figure 7. Silt plume off the outlet of Iterlak River on 27 June 2017

Figure 8. Silt plume off Pinguarsuit River on 1 October 2017

3 SAMPLING METHODS

3.1 Video footage of the sea floor 2017 and 2018

Video footage of the seafloor was carried out along six transect perpendicular to the coast line (transect M1, M 1.5, M 2, M3, M 3.5 and M 4 on Figure 10). Video footage was recorded at depths from 1-2 m to c. 20 m depth, using an underwater camera supplemented by artificial light.

Figure 9. Video footage was recorded using a Paralenz underwatercamera supplemented with LED lamps

3.2 Video footage by ROV in 2019

Video footage of the seabed was taken at 39 sampling station (18-76 m depth) along the transects used for other sampling (Figure 10), with a BlueROV2 with a Waterlinked underwater GPS positioning system. Still photos are later extracted from the video footage. On each station at least 5 minutes of videos are recorded.

3.3 Grab sampling of macro zoo-benthos

Grab sampling of macro zoo-benthos was carried out at 30 station along eight transects (Figure 10) in 2016 and 2017 using a Van Veen grab that collects 0.1m^2 of the seabed.

Along each transect, samples were collected at four stations: 6m, 10m, 15 m and 20m (except at 6 m at transect M1 and M1.5 due to hard bottom). The position of the stations was recorded using a GPS and depth reading was from an echo-sounder.

Five replicate samples were collected at each station. The samples were sieved through a 10 mm screen and preserved in alcohol.

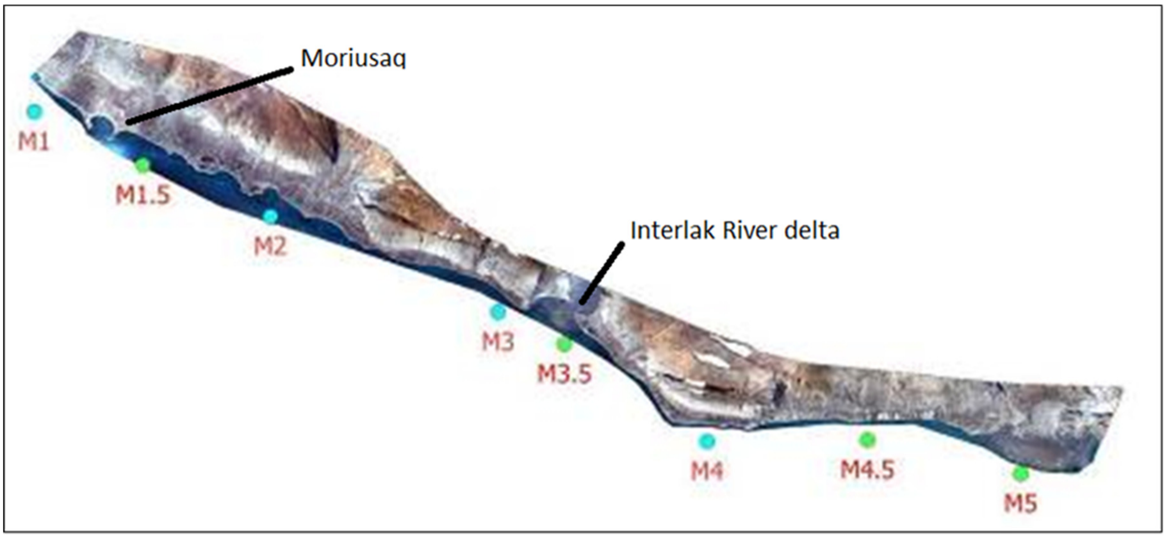


Figure 10. Position of grab sampling transects (M1 – M5). Video footage was carried out at transect M1, M1.5, M2, M3, M3.5 and M4

3.4 Analyses of data

Underwater video

Still photos were gapped from the underwater video and the ROV videos. The photos were subsequently used to characterise the physical structure of the seafloor and to describe the presence of macro algae and epi-fauna.

ROV video

The systematic videos taken by the ROV are analyses by a classification of the visible organism into a simple scale:

1. Rare species/group, only 1-3 individuals observed on the video.
2. Scattered or fairly common species/group.
3. Dominating species. More or less continuously visible during the entire video.

Grab samples

All five Van Veen replicate samples from each of the 30 stations (5-20 m depth) were analysed in the laboratory.

The animal was identified to species or to lowest possible taxonomic level. For the bivalves the number of individuals of each species per square meter was calculated. The biomass of the six most numerous bivalves was also calculated. First, the maximum shell length of the bivalves that were alive at the time of collection was measured using a digital calliper. Then the shell-free dry weight (SF DW) of the individual mussels was determined by drying the specimens at 80^{0}C for 24 h. The relationship between shell length (mm) and mass of shell-free dry matter (g SF DM) was then determined (see Appendix I). For the most numerous bivalve species, data from around 50 individuals from both sampling years were included. For less frequent species, all individuals that were collected by the grab from an area of 0.1m^2 of the seabed, were taken into account.

4 PHYCICAL STRUCTURES OF SEAFLOOR

From video footage and grab samples of the seafloor, four main physical structures were identified. This includes a narrow sandy zone from the shore to 2-3 m water depth, rocky substrate, gravel and soft bottom areas. Except for the shallow zone along the shore the distribution of the main physical structures to 50 m water depth are shown in Figure 11.

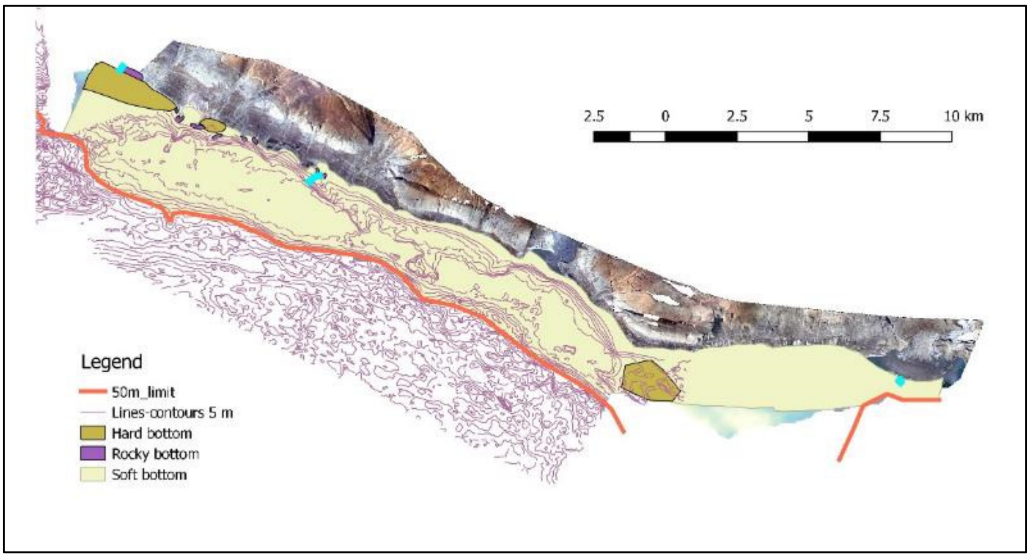


Figure 11. Main physical structures of the sea-floor off the project area (between c. 2 and 50 m water depth)

1. Sandy seafloor with ripples

Except for smaller areas with rocky coast or boulders, the shoreline of the assessment area consists of a sandy substrate with well-developed ripples from the shore to 2-3 m depth (Figure 12).

No benthic animals (or plants) were recorded from the sandy substrate. This is probably due to wave action and ice scouring that takes place much of the year.

Figure 12. Sandy substrate with ripples

2 Rocky substrates with the seafloor mainly covered by large stones

Rocky substrate almost completely covered by macro algae (Figure 13) was found to be limited to a few small stone reefs off the western part of coast (at transect M1 and M1.5) and around the two island groups Three Sister Bees and Manson Islands. This physical structure is especially well developed from around 2-3 m to 7-8 m depth.

Rocky substrate is very rich in macro algae (Figure 13), fish (such as sculpins) and probably also macro invertebrates.

3. Hard substrate with the seafloor covered by gravel mixed with sand

Areas with hard bottom consisting of small stones mixed with sand was limited to the western part of the assessment area along transect M 1, M 1.5 and M 2. Here, the majority of the sea floor is covered by small stones and gravel (Figure 14) between c.4 m and 8-9 m water depths.

The grab sampling only revealed low densities of macro invertebrates from this type of sea floor. However, this may to some extent be biased due to the challenges associated with collecting samples from this bottom type. Few macro algae occur on gravel seafloor on shallow water. Below 20m depth there are no macro algae.

Figure 13. Rocky substrate almost completely covered by macro algae

Figure 14. Hard bottom with gravel mixed with sand and scattered macro algae.

4. Soft substrate with the seafloor covered by silt and fine sand

Soft bottom dominates the eastern part of the assessment area (from transect M 3 eastwards) from around 2-3 m to at least 10 m, as well as all the deeper parts of the entire area (i.e. 10 to 70 m). Much of the fine material on the sea floor is probably discharged by glacial rivers.

Video footage and grab sampling showed that soft bottom areas are rich in macroinvertebrates, with some areas having large numbers of polychaete*s* and bivalves (Figure 15 - 17).

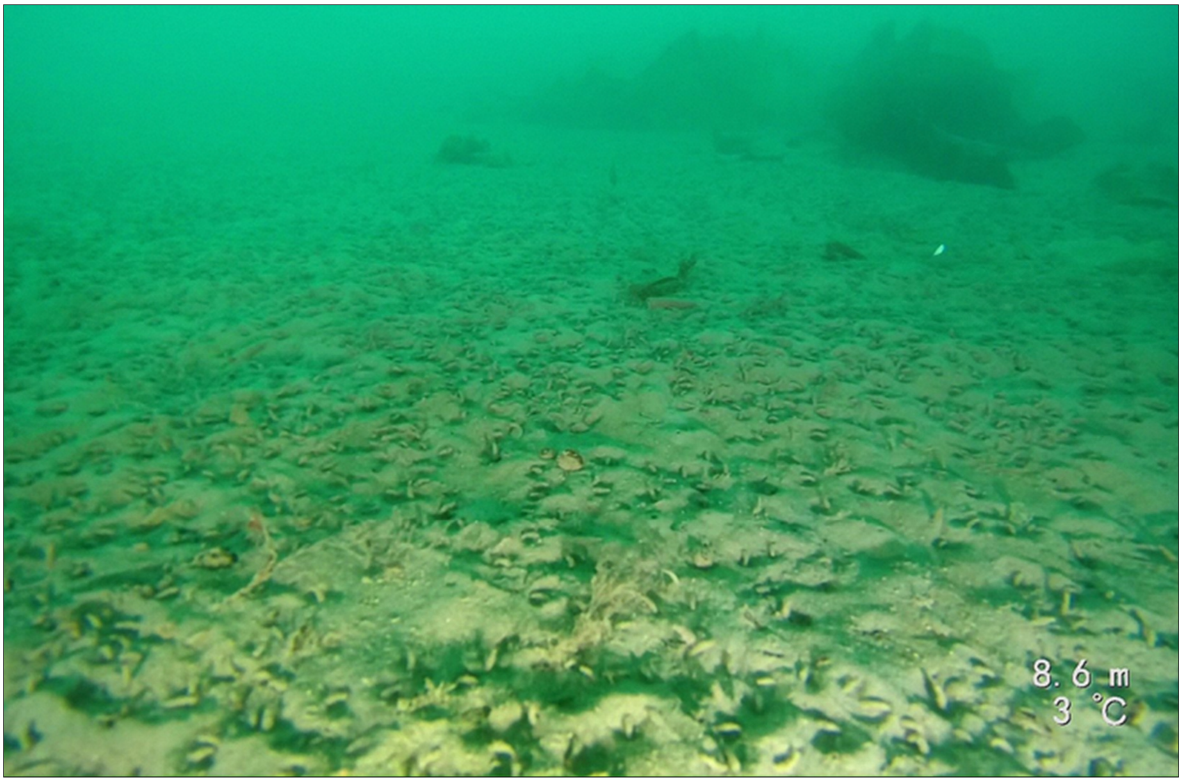


Figure 15. Soft bottom substrate with large numbers of the polychaete*s* (mainly Pectinaria)

Figure 16. Soft bottom substrate with polychaete*s* (Pectinaria) and bivalve siphons (Mya)

Figure 17. Soft bottom off Moriusaq with large numbers of polychaete*s* (mainly Pectinaria but also Sabelli-
dae)

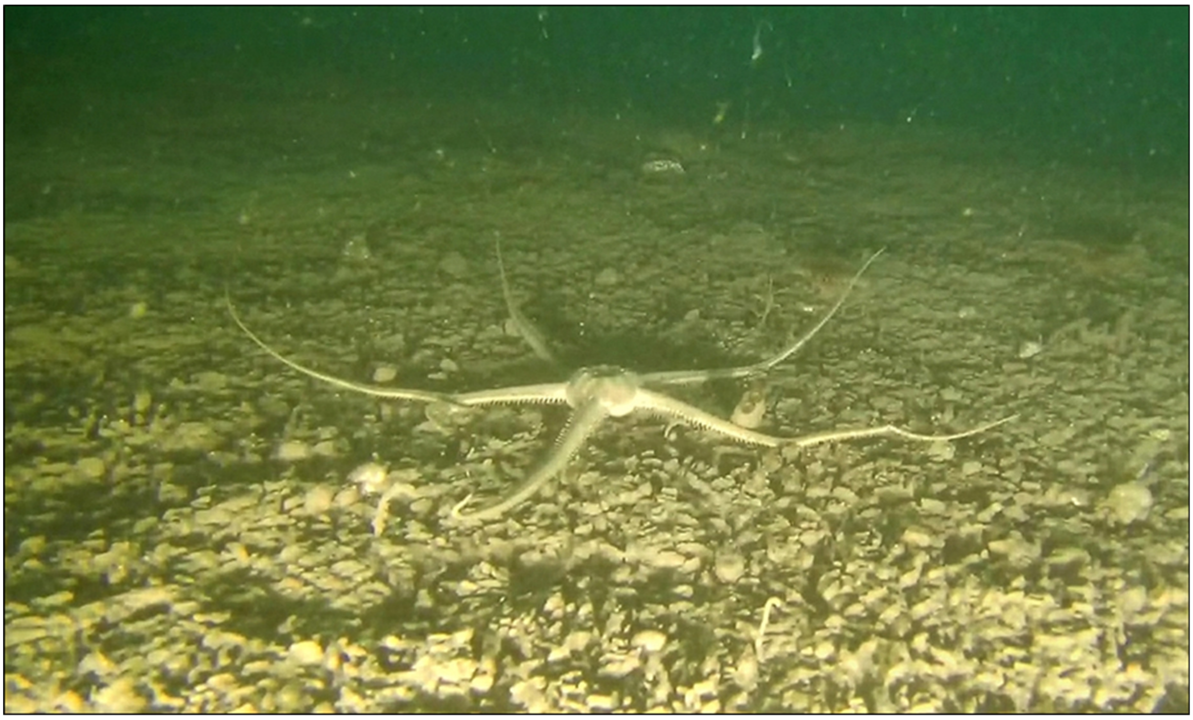


Figure 18. Ophiuroid on soft bottom at 18 m water depth

5 MACRO INVERTRABRATES

5.1 Species diversity

A total of 106 taxa of macro invertebrate benthos were identified to species or to a higher taxonomic (Appendix 2). This undoubtedly only represents a small part of the benthos species present in the area. However, the purpose of the present study was not to sample and identify all species but to compile enough data for an assessment of the potential environmental impacts of a proposed mining project. For this reason, focus was on a general description of the key benthic communities and their distribution within the assessment areas. Because part of the assessment area is known to be feeding area for walruses in some years a more detailed analysis was carried out of these areas' bivalves.

5.2 Bivalves

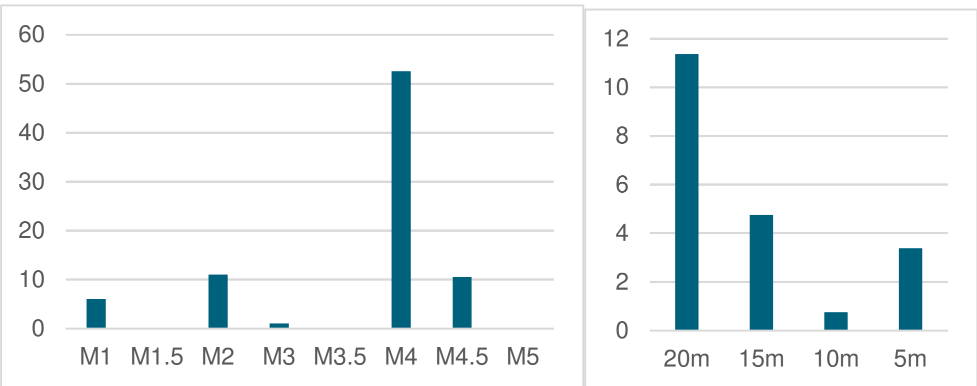
Particular efforts were made to quantify the bivalves, because some mussel species recorded from the area are known to be an important food resource for walruses.

In total 2,099 mussels were collected during the grab sampling in 2016 and 2017, representing 13 species. Six of these (*Astarte borealis*, *Ciliatocardium ciliatum, Hiatella ssp., Macoma calcarea, Mya truncate* and *Serripes groenlandicus*) were recorded in particularly high numbers. Brief descriptions of the distribution and abundance of these six species follows below.

Figure 19. *Mya truncate* is the most common mussel in the assessment area

Astarte borealis

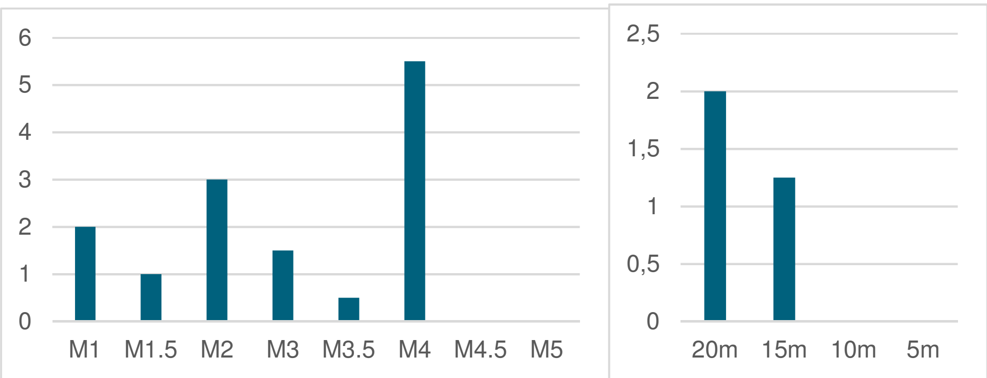
This is generally a low density species within the license area, with the exception of transect M 4 (Figure 10), where quite high numbers were sampled. Within the assessment area it generally becomes more common with increasing water depths.



Average number of mussels per m² along transects (left) and average number per m² at different depths (right).

Ciliatocardium ciliatum

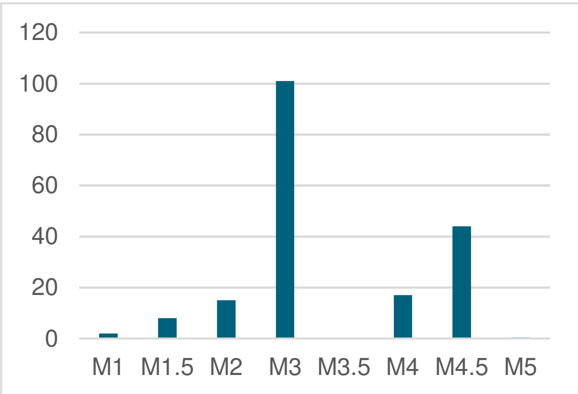
Within the assessment area this is a low density species found exclusively below 10 m water depth. It was not recorded along the easternmost transects furthest into the fjord.

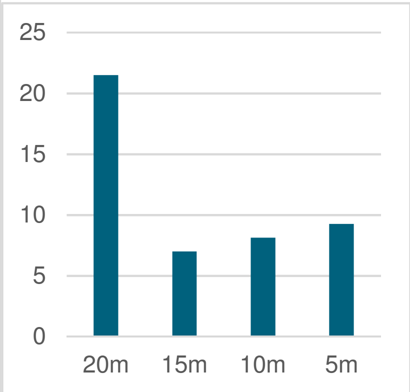


Average number of mussels per m^2 along transects (left) and average number per m^2 at different depths (right).

Hiatella sp.

This mussel was recorded in highly variable numbers and only in large numbers at transects M3 and M4.5 (Figure 10). Surprisingly, it went undetected from transect M 3.5 and M5 which are located just east of the transect with the highest number. It was found in highest number at the deepest stations.

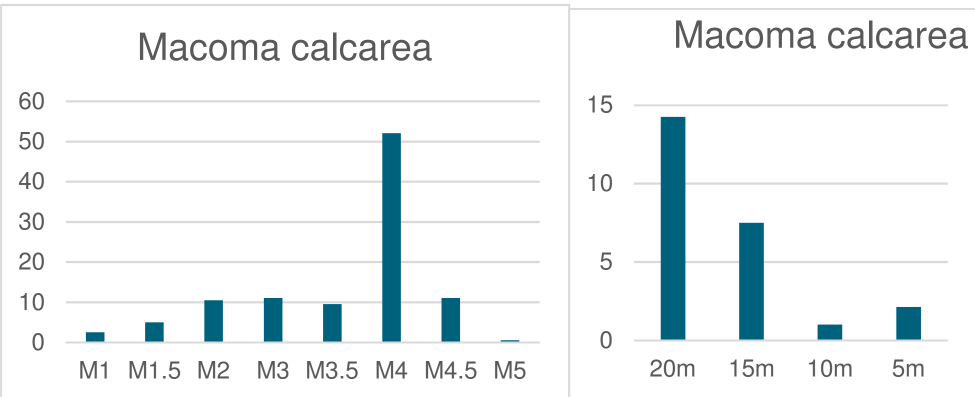




Average number of mussels per m² along transects (left) and average number per m² at different depths (right).

Macoma calcarea

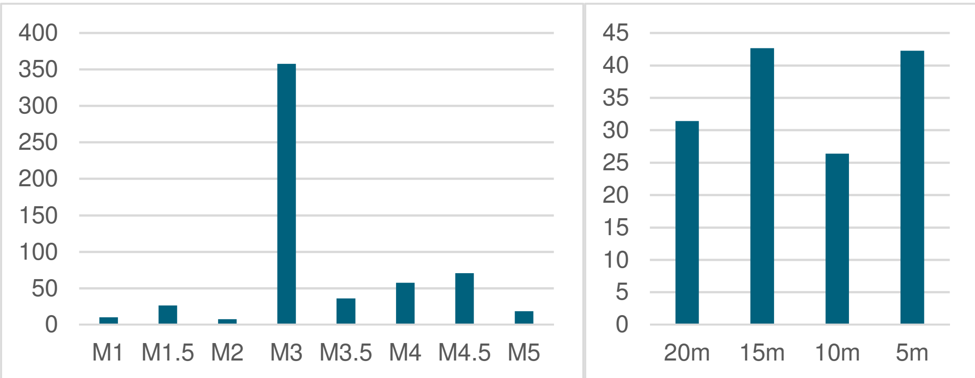
This mussel was recorded from all stations but most common in the eastern part with soft bottom. Particularly high numbers were recorded at transect M 4 (Figure 10) in depths over 10 m.



Average number of mussels per m² along transects (left) and average number per m² at different depths (right).

Mya truncata

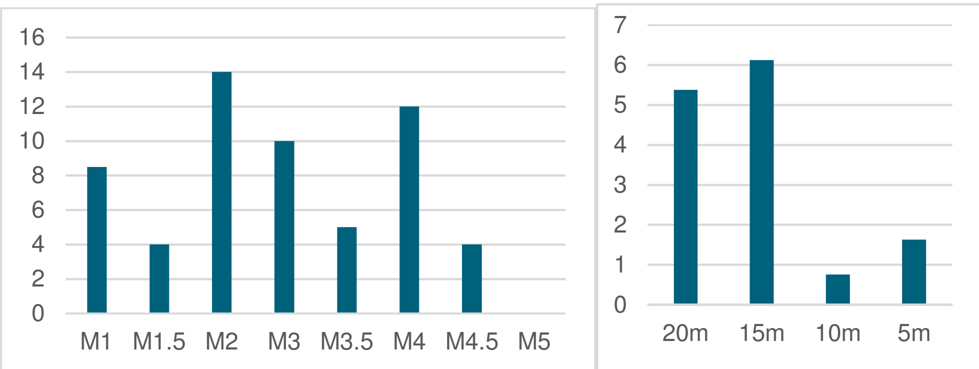
This mussel was recorded from all transects, and at most stations it was the most frequent bivalve. Particularly high numbers were sampled at M 3 (Figure 10), representing the highest density recorded from the license area. It was found in high density at all surveyed depths.



Average number of mussels per m² along transects (left) and average number per m² at different depths (right).

Serripes groenlandicus

This mussel was recorded in low numbers from all transects except the easternmost (M5 – Figure 10). Within the license area it is mainly found at water depths below 10 meter.



Average number of mussels per m^2 along transects (left) and average number per m^2 at different depths (right)

5.3 Distribution of most common bivalve species

The distribution of the six common mussel species vary considerably within the assessment area:

- *Hiatell* and *Mya* (the most numerous of all the mussels) were recorded in highest numbers along transect M3, just west of the delta of the glacial river Iterlak.
- In contrast, *Asarte, Macoma* and *Cilitocardium* were most common along transect M4.
- *Serripes* occurred in more or less the same (low) numbers along all transects.

5.4 Bivalve species diversity

Figure 20 shows the number of bivalve species along each transect. The values are the average number of species recorded at each of the four stations. The average number of bivalve species varies from more than six species at transect M3 to 1.4 at M5. The overall (non-significant) trend is, that the highest diversity is found in the western part of the study area. Higher salinity and more heterogenic seafloor structure may explain this trend.

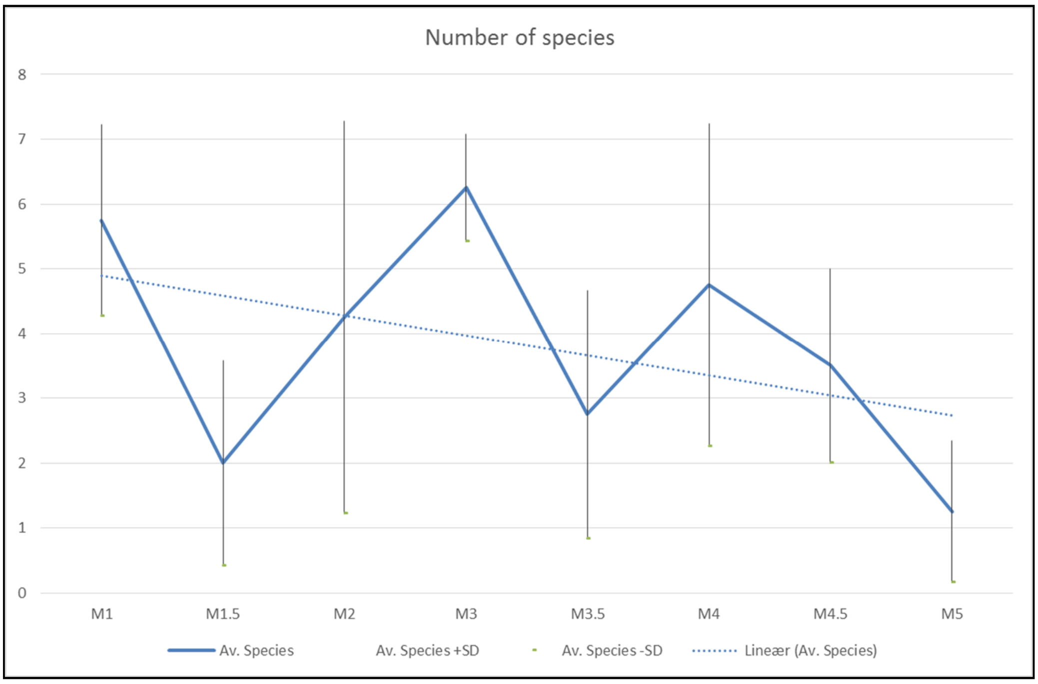


Figure 20. Average number of mussel species recorded from transects (calculated from average number recorded at each station per transect)

In Figure 21, the number of recorded bivalve specis (again calculated by averaging the numbers recorded at the four station along each transect) is shown as a function of water depth . Generally, the species diversity increases with depths, which is in agreement with the findings of Boertmann & Mosbech (2017) for fauna benthos sampled along the Greenland westcoast. The lower number near the shoreline is probably due to wave action, lower salinity due to outflow from rivers as well as disturbance by sea ice and icebergs.

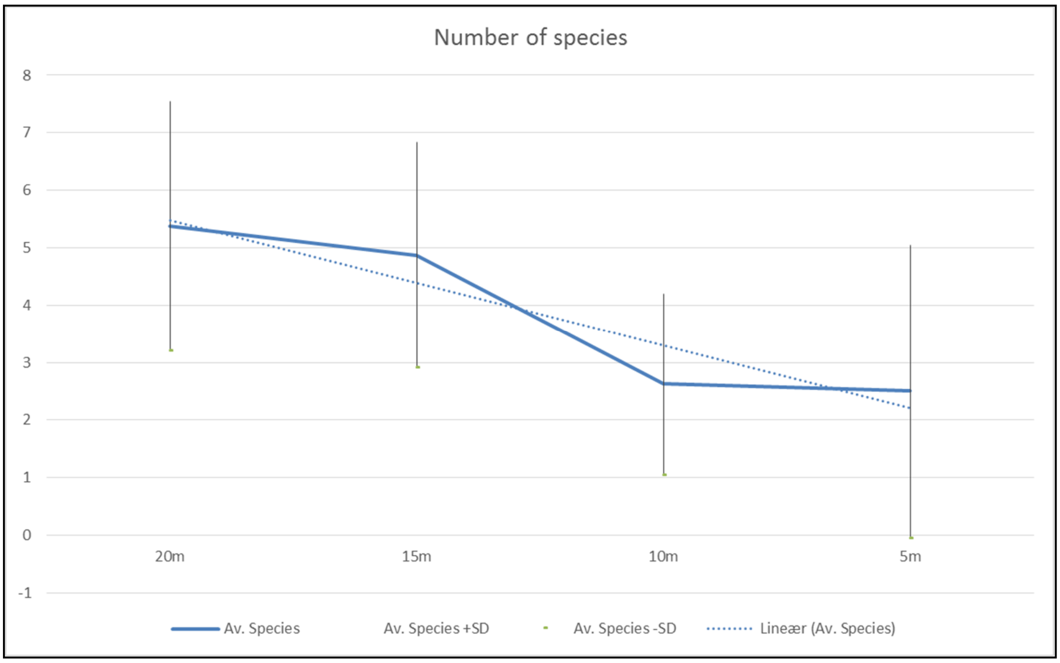


Figure 21. Average number of species as a function of water depth

5.5 Abundance of bivalves

5.5.1 Abundance along transects

Relatively low densities of mussels were recorded in areas with hard bottom such as the shallow parts of the western transects M1 – M3 (calculated by averaging the numbers recorded at the four station along each transect), while higher densities were generally found further east where soft bottom predominates (Figure 22).

Particularly high densities were recorded along transect M3 and M4 while much lower numbers were recorded at transect M3.5 although all transects have mainly soft bottom. Also, the low density along the easternmost transect (M5) is noticeable.

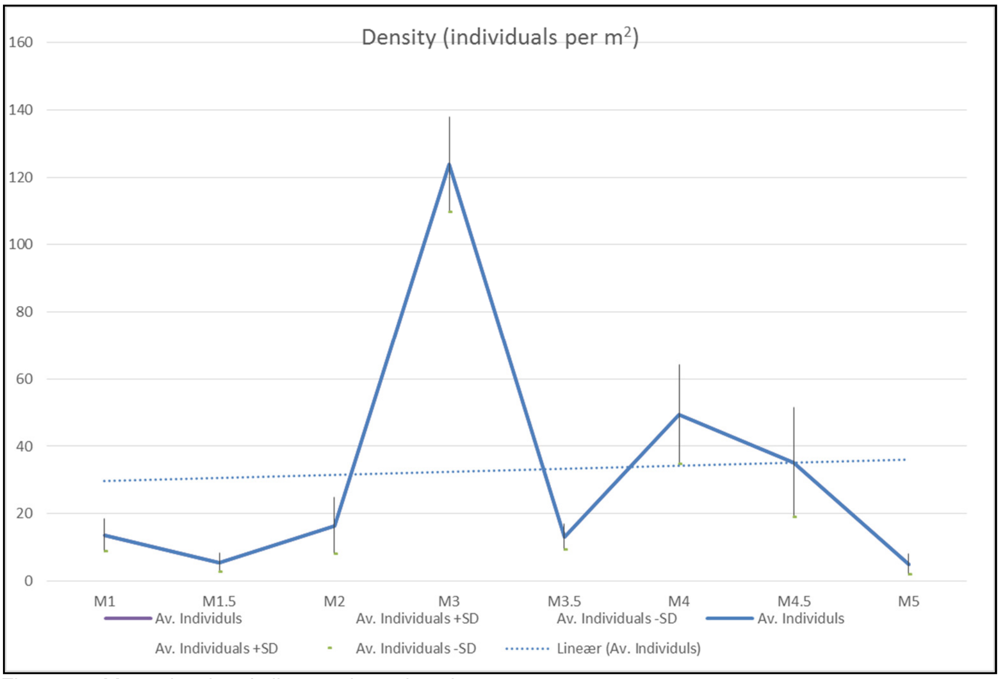


Figure 22. Mean density of all mussel species along transects

5.5.2 Abundance as a function of depth

The relative density of the six most common species as function of water depth is shown in Figure 23. Overall (all species combined) the abundance increases slightly with depth.

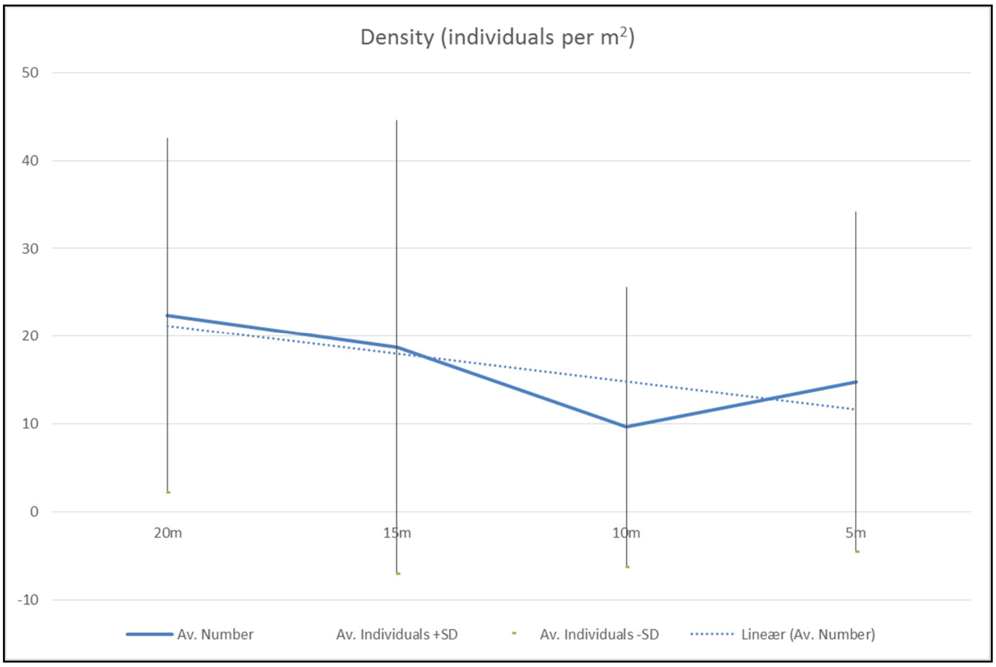


Figure 23. Density of all mussel species as function of water depth

5.6 Biomass of bivalves

The average biomass (dry weight) of all bivalves along transects is shown in Figure 24. The mussel biomass shows large variations between transects, from less than 20 g m^2 in five out of the eight transects to more than 160 g m^2 along transect M3.

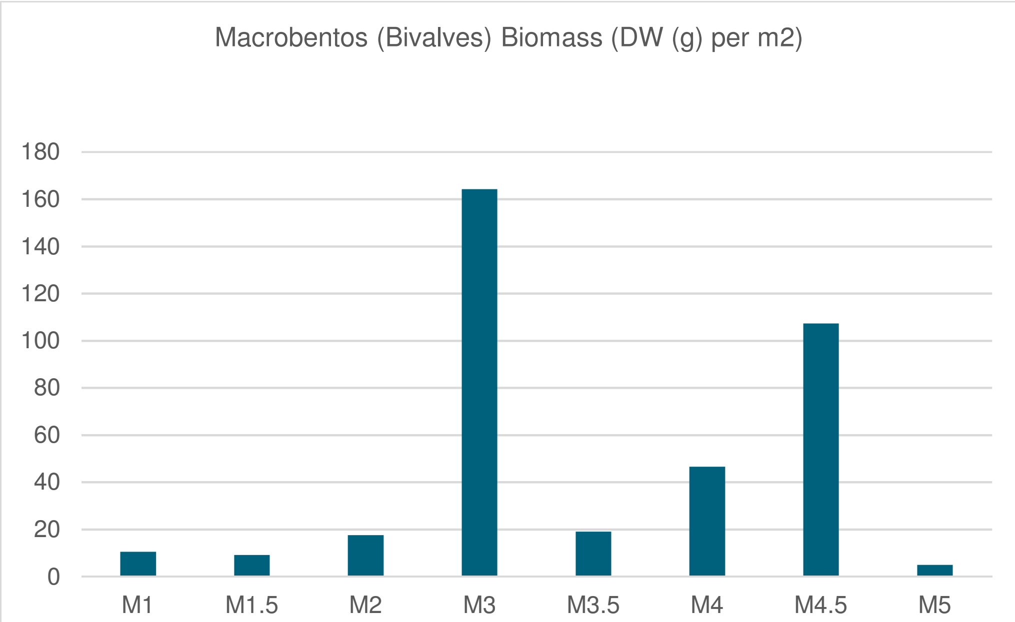


Figure 24. Average biomass of mussels (g dry weight pr. m^2) at the eight transects

Some of the variations in biomass may be explained by variations in the physical structures of the seafloor. While the stations at 6 – 10 m water depth along the westernmost transect M 1, 1.5 and 2 have a mainly hard seabed with low numbers of mussels, most stations further east have mostly soft bottom which generally holds many mussels.

Another, perhaps more important factor is two glacial rivers (Iterlak and Pinguguarisuit) which in spring and early summer discharge large amount of sediment into the sea. Although our limited data does not allow firm conclusions, it is notable that the two transects located directly in front of these rivers' outlet (transect M3.5 and M5) both have low biomass, while the two transects positioned a short distance to the west of the deltas (M 3 and M 4.5) have the highest recorded biomass.

A possible explanation could be that most of coarse-grained material (sand) washed out with the rivers, settles on the sea floor within a short distance of the river deltas, suppressing a rich benthos fauna to develop, while finer silty material (possibly containing nutrition) is transported a short distance to the west along the coastline with the prevailing flood tidal current (Figure 6) before settling on the seafloor. This is supported by observations of large plumes of silt extending mainly to west from the Iterlak delta which was observed on several occasions during aerial surveys in June (Figure 7).

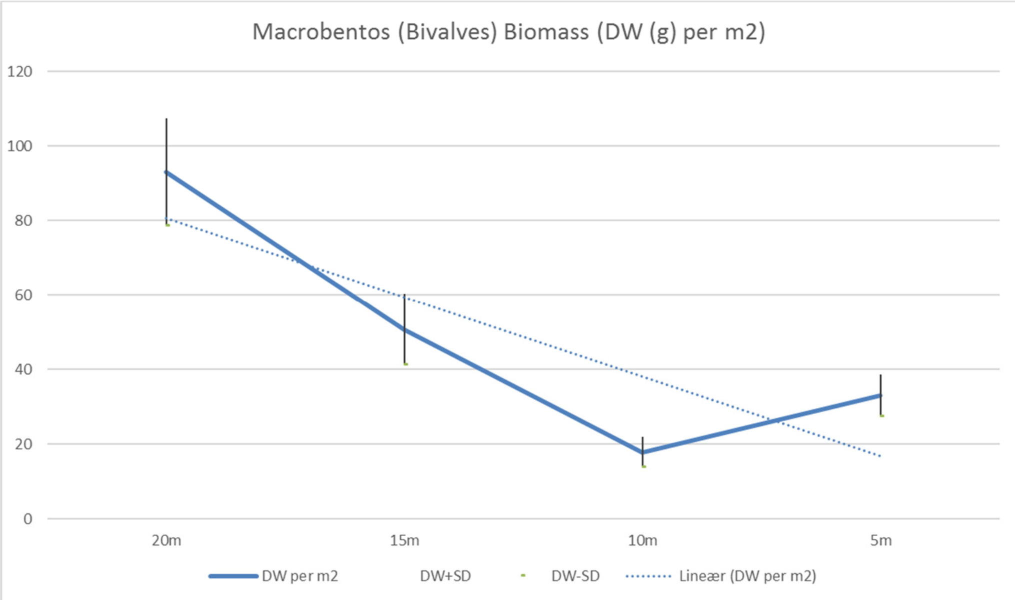


Figure 25. Average biomass of mussels (g dry weight pr. m^2) as function of water depth.

The biomass of mussels is lowest near the coast (5-10m) and highest at 20m (Figure 25). This means that both species diversity, density and biomass show the same patterns. Sejr et al. in Boertmann & Mosbech (2017) shows stabile biomass up to 125 m depth. Their number of samples on water depth below 20 meter is very limited. The turbulence and disturbance from icebergs are the most likely expaination for the low biomass in the shallow water along the coast.

5.7 Age (size) distribution of bivalves

The distribution of age classes is important parameter for evaluating the recruitment and potential sensitivity for bivalve communities.

We use the size of the bivalve as a proxy for age. Figure 26 shows a distribution with the highest frequency of mid-sized bivalves. The low number of smaller sizes may indicate an infrequent breeding event of most bivalve species.

Mya truncata can reach shell lengths of up to 7.5 cm (MarLin, 2019b). The age classes therefore include mainly younger specimens but also a few adult specimens of up tp 6.0-6.5 cm.

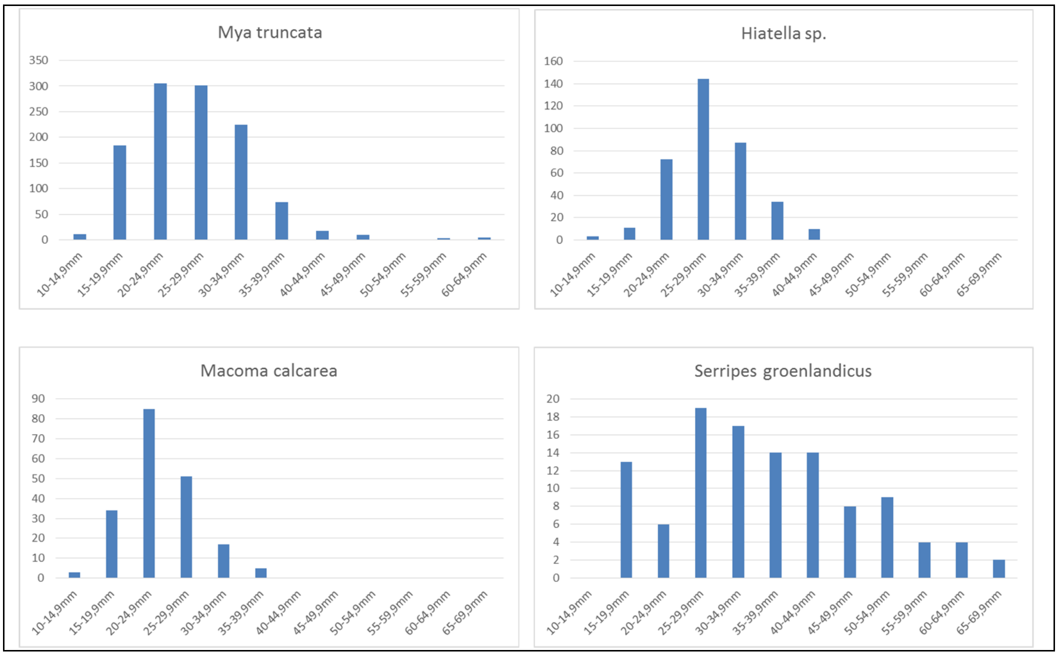


Figure 26. Size distribution of the four most frequent bivalve species.

Macoma calcarean can reach up to 70 mm and adults are usually 30-50 mm shell lengths (Arctic Ocean diversity, 2019a). Thus, adult specimens are present, and a nice come-shape age distribution is present in the area with specimens of all size classes.

Serripes groenlandicus can reach sizes of up to 100 mm with adults mostly 50-70 mm (Arctic Ocean Diversity 2019b). No specimens in the smallest size class shows a lack of recent settling but all other size classes are present. The largest mussels are in the size class 65-70 mm. a study from eastern Canada found that a approx. 95 mm was close to 40 years old (Kilada et al 2007).

Hiatella sp. has specimens in all size classes including adults of up to 40-45 mm (FIgur 25). Sejr et al (2002) found very old specimens of *Hiatella arctica.* The oldest was 126 years old and 33 mm long. Thus, the *Hiatella* specimens of up to 45 mm found in the investigated area at Dundas may well be of an equal or much higher age!

5.8 Other species

Beside the bivalves the sea floor near Moriusaq house a number of other species of invertebrates. A list of all species is provided in Appendix 2. Polychaetes are the most species rich group of macro benthos and dominates the soft bottom areas along the cost. The most abundant species, *Owenia fusiformis* and *Cistenides granulate* (figure 27) are both widespread and common in Western Greenland (see Sejr et al. in Boertmann & Mosbech 2017).

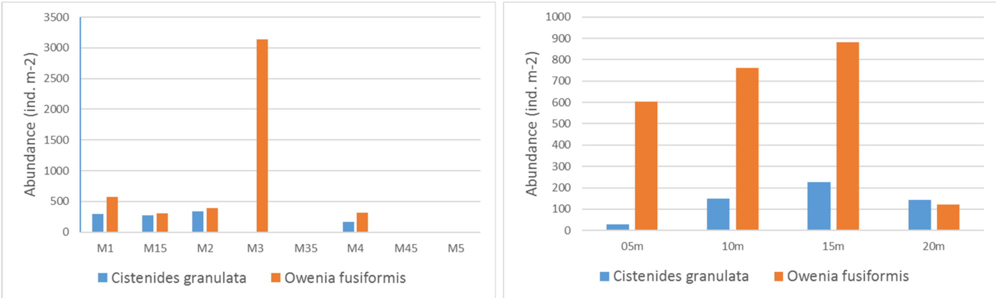


Figure 27. Abundance (individuals per m^2) of the two most frequent polychaetes based on grab samples.

Results from the 2019 ROV survey indicate a positive relation between abundance of species and the depth at least to 70 meters. This pattern corresponds to the pattern described by Sejr et al. in Boertmann & Mosbech 2017. Hovewer the variation is considerable between different taxonomic groups (figure 28).

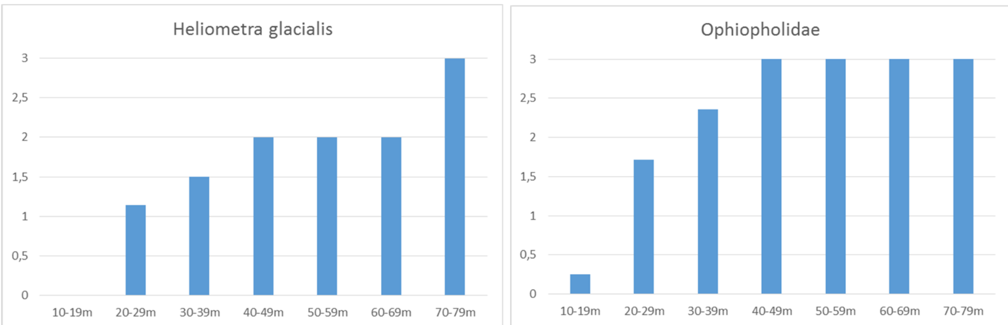


Figure 28. Examples on average of the relative abundance (1-3) for the species a *Heliometra glacialis* and the family Ophiopholidae (Brittle stars) based on 38 ROV-station on different depth.

The main reason for the lower diversity on relative shallow water may be major disturbances from the ice and heavy sedimentation originated from the large rivers.
In general, the bottom is rather uniform in large part of the project area. Most organism are widespread and distributed along the entire coastline (Figure 29).

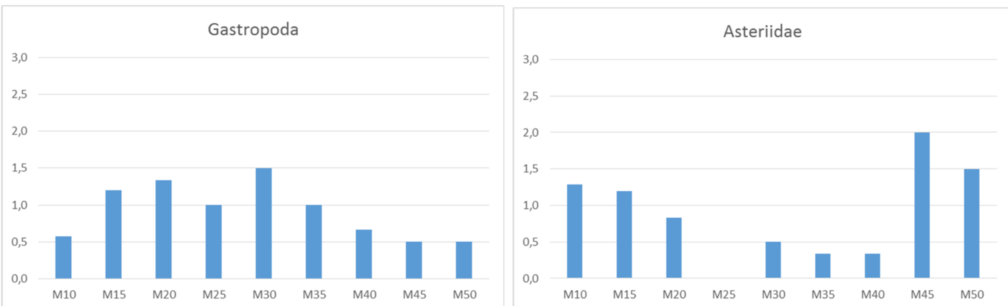


Figure 29. Examples on average of the relative abundance (1-3) for the Gastropoda (snails) and Asteriidae (Sea stars) based on 38 ROV-station on different transects.

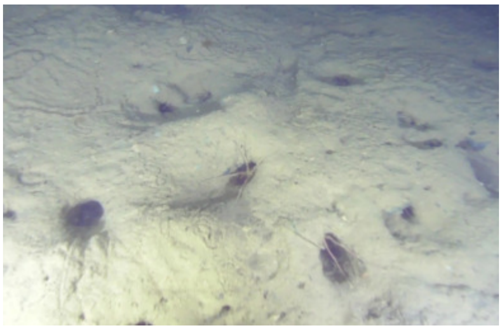
Details on the average relative frequencies are presented in Appendix 3.

Stomphia coccinea

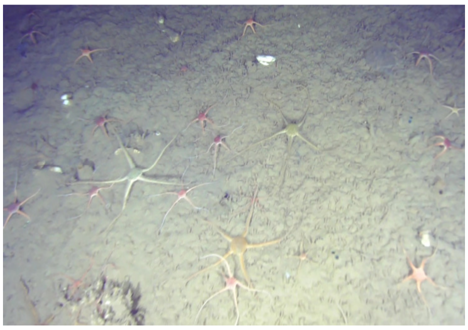
Hormathia nodosa

Solaster sp. & *Heliometra glacialis*

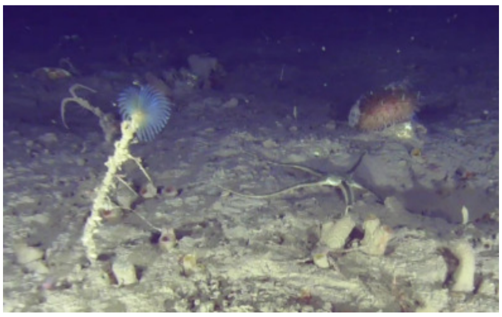
Strongylocentrotus cf. *droebachiensis*



Neohela monstrosa



Ophiopholidae spp.



Polychate sp.

Polychate sp.

Figure 29. Examples of species

6 EFFECTS OF SEDIMENT DISCHARGE ON THE BENTHIC COMMUNITIES

6.1 Potential effects

The discharge of silt material to the sea will lead to enhanced concentrations of suspended solids (SS) consisting of fine particulate matter in the seawater near the outlet. The discharge will also cause accumulation of the heavier material fraction around each of the four outlet pipes. This will potentially affect the benthic fauna communities due to:

- Increased sedimentation which may smother benthic fauna;
- Increased sediment concentration/suspended solids (SS) in the water column, which may reduce filtration and clog the filtration apparatus of benthic fauna.

6.2 Discharge strategy

Surveys of the seafloor in the area expected to be affected by high turbidity and sedimentation has shown that it consists mainly of a mix of hard substrate with the seafloor covered by small stones and with low densities of macro invertebrates and soft substrate with a richer macroinvertebrate fauna, with some areas having large numbers of bristle worms and mussels. A few small areas with large stones and many macro algae are found mainly in the north western part.

In order to minimise the impact of increased turbidity and sedimentation from the project on the marine flora and fauna several discharge strategies were considered. Studies of the sea currents off the Project area showed that the hydraulic conditions are dominated by an oscillating tidal current which moved parallel to the coastline (Svašek Hydraulics 2016). This implies that the dispersal of a SS plume and the material sedimentation will take place predominantly in zones to the northwest and southeast of the discharge point along the coastline. It must further be expected that the discharge of material will result in particularly high concentrations of SS and sedimentation near the discharge point at slack tides between the flood and ebb currents.

Since the benthic diversity and biomass in the Assessment area has been found to be lowest in the shallow water near the coast line and increase with depth (Section 6.2.4) discharge close to the shore would minimise the impact on the benthic flora and fauna. Taking also operational considerations into account (such as ice conditions in winter) a discharge depth of 10 m was chosen (as oppose to for example 35 m water depth – see EIA main report Section 5.3.3). In order to further minimise the dispersal of material into deeper water (and elsewhere) it was chosen to discharge the sediment close to the seafloor.

When deciding the location for each of the four discharge points the physical structure of the seabed and the distribution of benthic communities were taken into account. A main concern was to impact mussel banks with high biomass of species known to be important to walruses. For this reason, a minimum distance of 5 km was chosen from a discharge point to an area identified to have high density and biomass of mussels – see Figure 30 and 31. Another concern was large rocky areas with many macro algae which would suffer from reduced light penetration in situations with large amounts of suspended solids in the water column. Stone reefs are also important habitat for many species of fish. The marine surveys showed that rocky substrate was limited to a few small stone reefs off the western part of coast and around the two island groups Three Sister Bees and Manson Islands. However, with tidal current moving parallel to the coastline and the discharge points to be established close to the coastline significant disturbance of the main stone reefs at Three Sister Bees and Manson Islands was considered unlikely.

6.2.1 Effects of sedimentation on benthos

The discharge consists of silt material (<63 µm) solubilized in the local seawater. The sediment plume from the discharged has been modelled and the modelling illustrates the direction and main impacted areas of the discharge. Thus, the propagation of the sediment spill and plume around each discharge point has been mapped according to the modelling (TT-Hydraulics 2019).

The net deposition (mm) per year has been estimated from the sediment modelling, which was done for a 6-day period (TT-Hydraulics 2019), and then linearly accumulated up to one year (mm for 6 days times 61 (365 days y^{-1}/ 6 days modelling)). This is assumed to be a conservative estimate of the net deposition from the discharge.

There is limited information on impact distances for benthic fauna caused by tailings discharge (Ramirez-Llodra et al, 2015) (Morello et al , 2016). Regarding faunal tolerance to sedimentation stress, there is large variation both between communities and between species (Trannum et al, 2010). Olsgard and Hasle (1993) reported that sedimentation of mine tailings of 4-5 cm y^{-1} clearly impacted the macrofauna, while sedimentation of 1 mm y^{-1} did not result in any observable effects as explained above. In contrast, Smith and Rule (2001) found that sedimentation up to 15 cm did not affect macrofaunal community structure. Smit et al. (2008) collected literature data from experiments with single species and derived a species sensitivity distribution (SSD) curve for sedimentation (burial) stress. They found that a 6.3 mm deposited layer represented a threshold level for effects, i.e. the level corresponding to 5% affected species. At a layer thickness of 24 mm more than 80% of the species should therefore be affected. Infaunal species may escape more than 10 cm of burial (Jackson and James, 1979; Maurer et al., 1982; Bellchambers and Richardson, 1995), whereas epibenthic species are often unable to escape more than 1 cm of burial (Kranz, 1972).

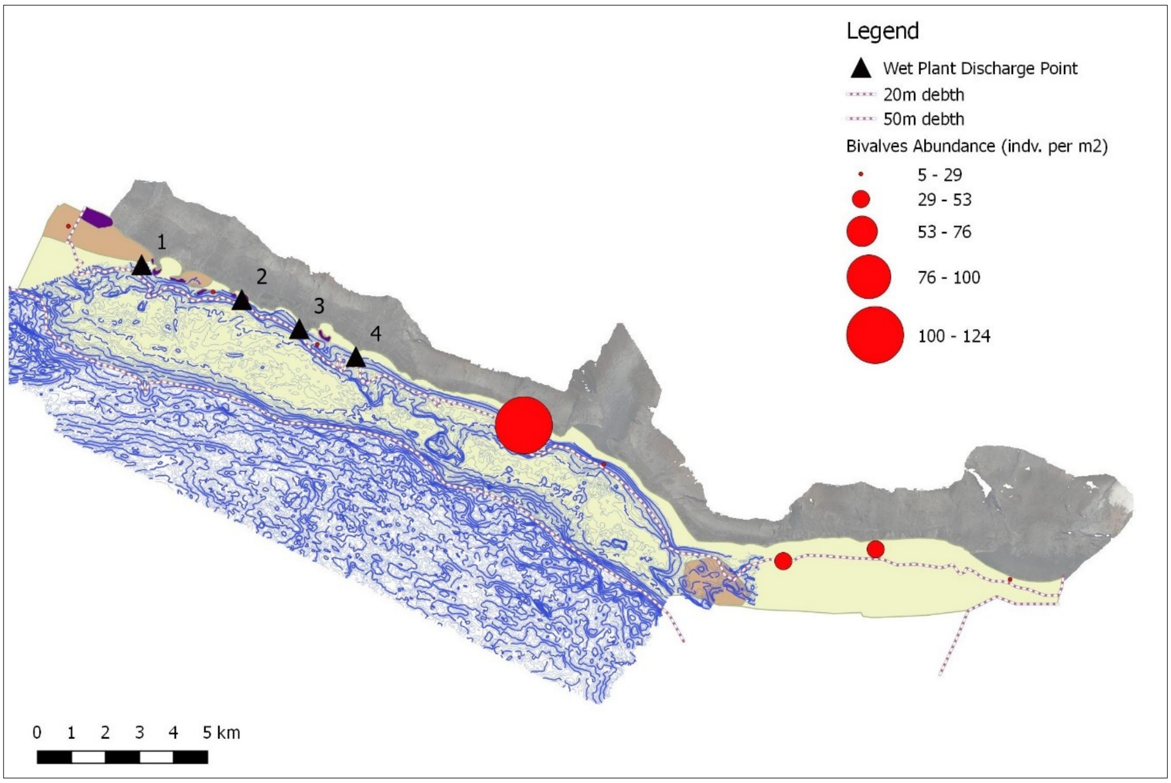


Figure 30. The four discharge points and the abundance of bivalves

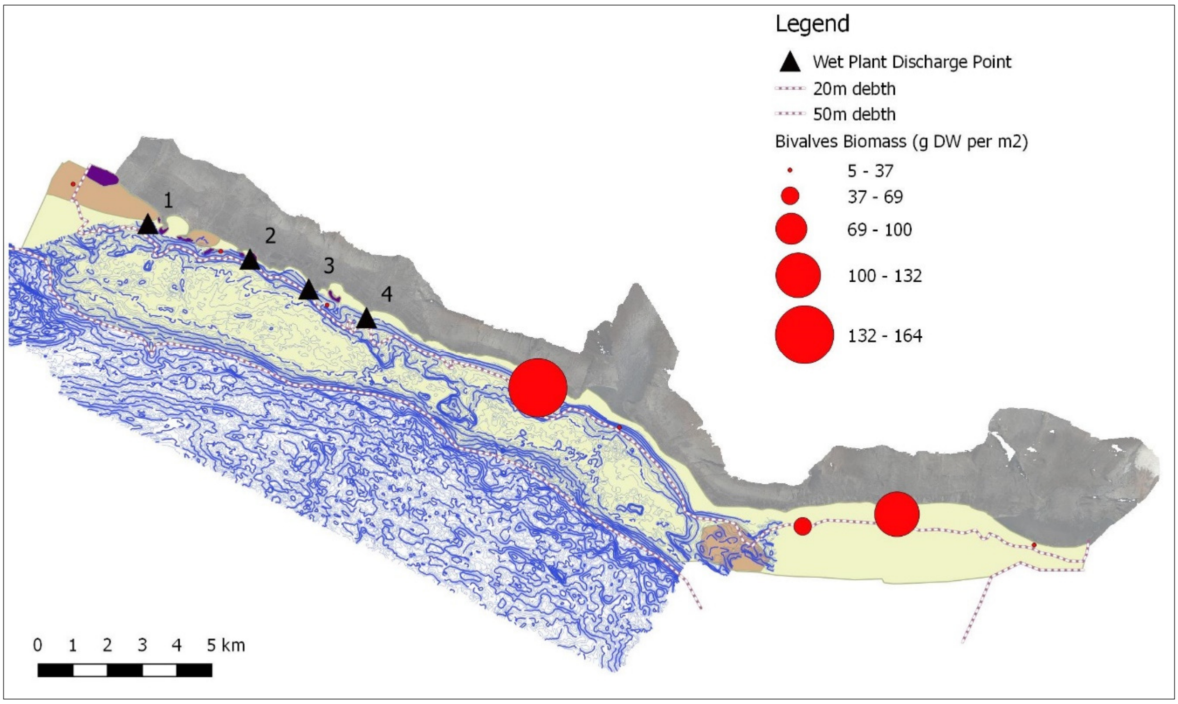


Figure 31. The four discharge points and the bivalve biomass

Polychaetes tolerate sedimentation stress better than crustaceans and mollusks (Chou et al., 2004). Furthermore, less effects of sedimentation are found when organisms are buried by sediment resembling the sediment they live in (Turk and Risk, 1981; Maurer et al., 1981a,b, 1982; Chandrasekara and Frid, 1998).

In order to make a conservative estimate of the area affected by the discharge from the Dundas mine the Norwegian study from the titanium mine in Jøssingfjorden, has been taken into account. Here a tailings deposit rate of the order of 4-5 cm year^{-1} within 1 km distance from the discharge point was found to have adverse impact on benthic fauna as measured by a significant decrease in diversity in the most disturbed sites (Olsgard F, Hasle JR, 1993). At deposition rates of 1 mm year^{-1} at a distance of more than 2-3 km, however, impacts were not detectable (Olsgard F, Hasle JR, 1993). For comparison the discharge at the titanium mine in Jøssingfjord was 2 million tons year^{-1}, whereas the yearly discharge from the Dundas mine is five times lower at approximately 385.000 tons year^{-1}. However, the tailings at Jøssingfjord was discharged into a more protected fjord (113-122 m depth), whereas the discharges in Wolstenholme Fjord is into a tidal, shallow plateau of 0-40 m depth. This will probably cause the sedimentation here to take place in a larger area.

The tailings from the Jøssingfjord mine consisted of mineral particles (feldspar (69%), pyroxene 14%), ilmenite (8%), biotite (8%) and small amounts of sulfides (Ramirez-Llodra et al, 2015)) mainly in the size range 10-200 µm, but with approximately 10 % <10µm (Olsgard F, Hasle JR, 1993). Further, they contained some iron, cobalt, chromium, copper and nickel (Ramirez-Llodra et al, 2015). The tailings were almost inert and non-toxic to marine life. The tailings were discharged as water-borne slurry, which also contained some flocculation chemicals, mainly tall oil (Olsgard F, Hasle JR, 1993). The tailings from the Dundas project will consists of the silt fraction (<63µm) and is also released as a water-borne slurry using the natural seawater as solubilizer, and with no chemicals added. Generally, the content of heavy metal in the slurry from Dundas mine is expected to be low and non-toxic to the marine life in the area (see EIA main report chapter 9.4.1). The oversized material and sand fraction are placed on land. The titanium resource at Dundas project is located along the shoreline and the material is also washed into the marine environment by waves and by natural streams during spring and summer with the largest contribution probably from the local rivers. The chemical composition of the ressource does therefore not vary significantly from that of the natural environment and is not discussed further.

6.2.2 The current fauna's sensitivity to the discharge of slurry

The degree of disturbance of benthos depends on the turbidity and sediment rate, but also on the species composition of the already established bottom communities. The Greenlandic river are known to discharge very large amount of sediments. Overeem (2017) estimated that the total sediment discharge to Baffin Bay is 0,363 Gt per year.

In this context the discharge from the Dundas mining project is 0,0005 Gt or one permille of the natural discharge

In some parts of Wolstenholme Fjord considerable natural sedimentation takes place during summer when the glacial rivers discharge sediment to the sea. Based on flow measurements and measurements of suspended solids in Iterlak River water in June 2019, Orbicon calculated that during summer Iterlak River discharges between 20 and 120 tons of fine sediments (<63µm) per hour. Exact estimation of the yearly discharge from the local rivers, Iterlak, Pinguarssuit and the rivers in the Granville fjord are not available and measures of discharge are challenging because large variation in both water flow and amount of suspended sediments both yearly and daily (see Ladegaard-Pedersen et al. 2017 for examples). However, a few water samples taken from Itelak in July 2019 show variable amount of suspended sediments (241-845 mg/L) as well as considerable variation in water flow even within a single day. A rough estimate using 120 days of running water with an average waterflow of 40,000 l/s gives an estimated discharge from this river alone between 100,000 ton and 346,000 ton. For this reason, the benthic fauna near the outlet of these rivers may already have favored a fauna and flora tolerant to considerable turbidity and sedimentation.

As an adaptation to large scale natural discharge of sediment, many of the infauna species are able to move vertically in the sediment (MarLin, 2019), and the epifauna species are generally also able to relocate themselves on the seabed (fx. sea urchins, starfish, brittle stars, the jumping sea anemone *Stomphia coccinea* (Marine Species identification portal, 2019a) and the sea feather *Heliometra glacialis* (Marine Species identification portal, 2019b)). It is therefore likely, that a large part of the benthic community is able to cope with the relatively low net deposition of 2 cm to 1 mm year^{-1} discharged from the mine in the minor impact zone. It is therefore likely, that a large part of the benthic community is able to cope with annual depositions up to c. 20 mm (see Section 6.2.1).

6.2.3 Definition of sedimentation thresholds

Although there are several significant differences, in the following the observed effects on the benthic fauna following the discharge of tailings into Jøssingfjord is used to determine conservative estimates of the seafloor area that potentially will be affected by discharge of silt into Wolstenholme Fjord.

Based on the observation at Jøssingfjord we define the following expected zones:

- No-effects are expected where the sedimentation is less than 1 mm year^{-1};

- Minor effects with decreased diversity and possibly lower biomass is expected in areas with a sedimentation rate between ~1 mm and ~40mm year^{-1}; and

- Major effects with significant effects including high mortality among benthos organisms are expected where the annual sediment deposition exceeds 40 mm.

Although this is a conservative estimate, it includes several uncertainties. A monitoring program has therefore been developed to assure that the impact estimate is controlled and verified during the mining activity (see EIA report chapter 15).

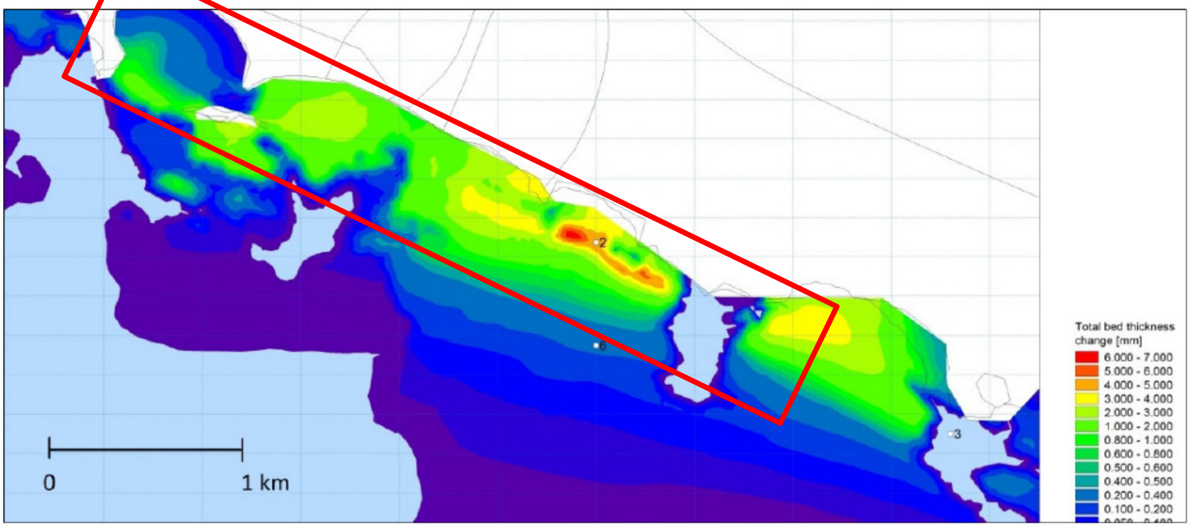


Figure 32. Sediment modelling of net sedimentation at discharge point 2 and the method used to assess the main and minor impact area. The red oval covers <1 km to the west and <1.5 km to the east.

6.2.4 Delimitating the affected area

By combining the threshold values of the affected zones defined above with maps of the modelled sedimentation at the four discharge point (from TT Hydraulics 2019) it is possible to determine the approximate boundaries and the size of the two affected zones – see Figure 34. The figure shows the total areas to be affected by discharge at all four discharge points. However, it should be noted that discharge only takes place at one point at a time. This implies – for example - that when discharge commence at point 4, it will be five years since the discharge ended at point 1.

For each discharge point an outline is drawn based of the 0,6 mm per 6 day contour equal to 40 mm per year and 0,005 mm per 6 days contour equal to <1 mm per year. The maps presented in figure 5, 9, 19 and 23 in the background report (TT Hydraulics 2019) are used for this extrapolation. The outlines of all area are merged into one area of major impact and one area of minor impact. This outer outline includes some small areas with overlap between the discharge points as well as area in between the discharge point with less expected impact.

Due to the oscillating tidal current which moved parallel to the coastline and dominates the hydraulic conditions in the fjord the extent of the main and minor affected areas is in both cases relatively narrow zones close to the shore.

The total area with minor effects (affected by discharge from all four points) extent c. 20 kilometers along the coast and about 1 – 1.5 km off the coast and covers c. 25 km^2.

The total area with major effects stretches about 9 km along the coast and about 1 km off the coast. The size of this area is c. 7 km^2. Within this zone all or most benthic organisms are expected to perish. This area is small compared to the total fjord area at the same depth range (0-25 m) and in particular the shallowest parts are strongly affected by ice and natural disturbances.

Species numbers, individual numbers and biomass generally increases with depth in the Assessment area from 0-20 depth and higher coverage of benthic fauna was observed in the deeper parts >10 m and down to 70 m on the ROV-video (Figure 33). Thus, the deeper and richest part of the seafloor in the assessment area is impacted less.

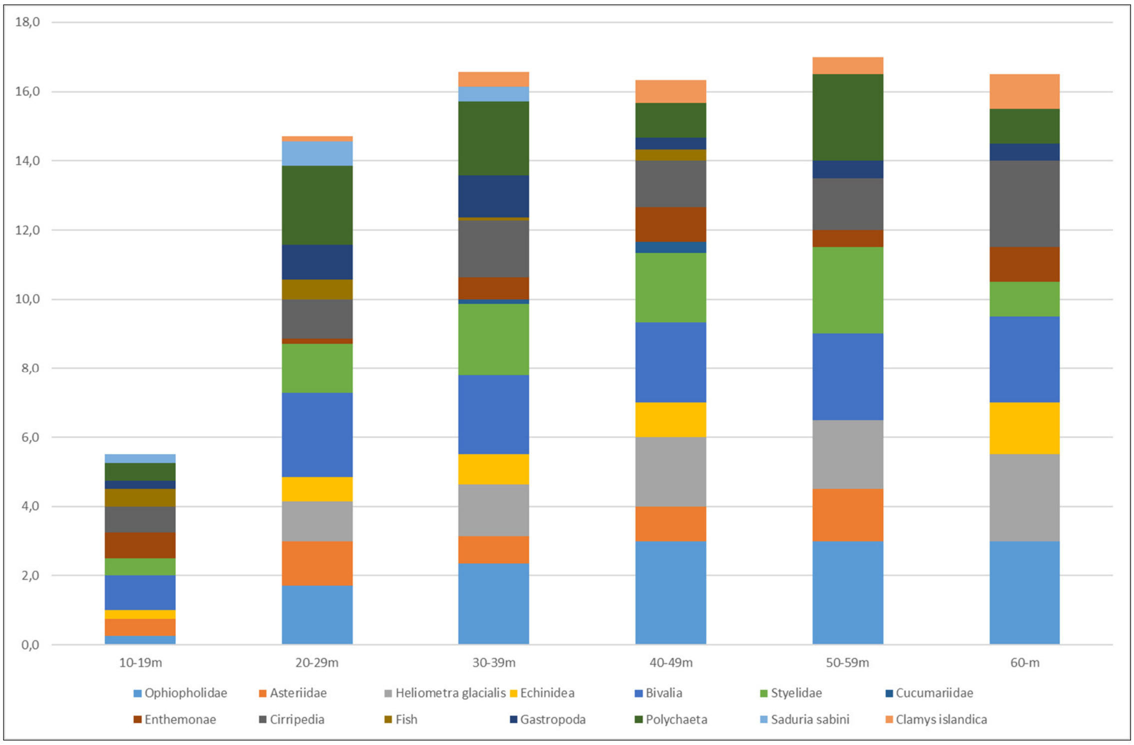


Figure 33 - Summarized relative frequency (1-3) for fourteen different species and families identifiable from the 39 ROV-video points according to depth.

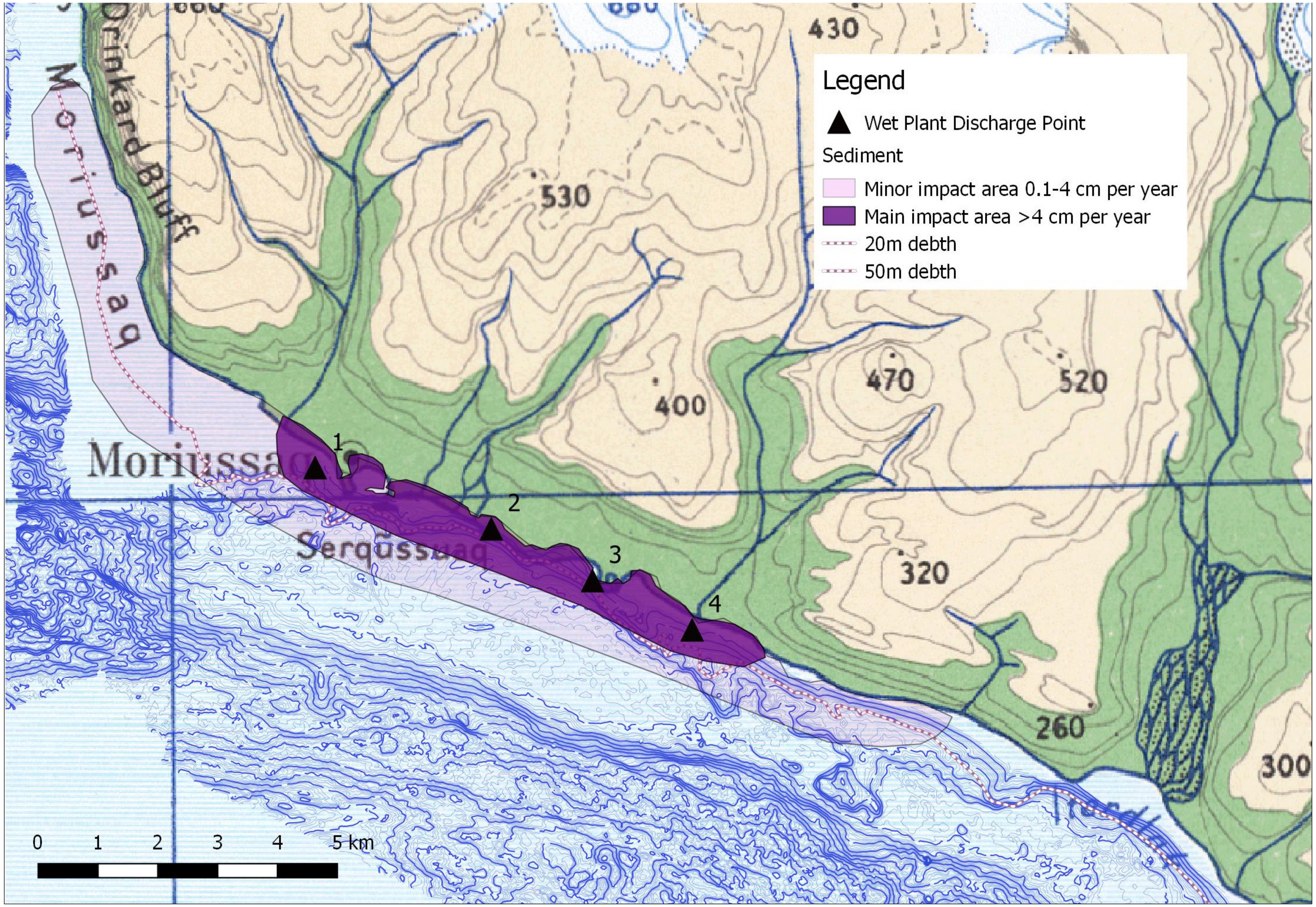


Figure 34. Major and minor effect areas around the four discharge points

6.3 Recovery time

Recovery time for benthos after discharge of tailings from the titanium mine in Jøssingfjorden has been studied by Olsgard and Hasle (1993). They concluded that re-colonization on the old tailings deposit within the Jøssingfjord commenced within one year after cessation of discharge, and within 4 years all the major benthic macrofauna phyla were present (Ramirez-Llodra et al, 2015). The recolonization process of areas affected by discharge of mine tailings will depend both on characteristics of receiving sediments and tailings (grain size, angularity, organic matter content, metal and chemical concentrations) as well as on the natural sedimentation rate (Vogt, 2013), the season and availability of larvae and also on the spatial area affected (Thrush et al., 1996; Lu and Wu, 2007). The colonization of tailing-impacted sediments as such has been observed to be quite rapid and often within 1–2 years (e.g. Olsgard and Hasle, 1993; Burd, 2002).

In general, polychaetas tolerate sedimentation stress better than crustaceans and mollusks (Chou et al., 2004). Often, polychaetas are the first organisms to recolonize sediments covered by tailings, while the early stages of amphipods and ophiuroids are the last ones to occur (Burd, 2002). Despite an initial rapid colonization, differences in faunal composition and structure may persist for a much longer time and the ecosystem may take decades to recover to its original state (Burd, 2002; Josefsson et al., 2012). This is particularly true for many deep-sea and Arctic species, which often have slow growth rates, are long lived, and have delayed maturity and low reproductive output with a variable larval and juvenile survival (Young, 2003). The early life stages of invertebrates are the most sensitive stages in their life history, strongly affected by environmental characteristics, such as hydrodynamics, temperature, turbidity, oxygen, dissolved organic matter, food availability and predation (Ramirez-Llodra, 2002; Young, 2003).

Recovery in both the main impact and minor affected area in connection with the Dundas project is therefore also expected to commence within a year of discharge. The sediment composition in the project area after 10 years is not expected to be significantly different from the natural seabed as the discharge consists of particles that are also naturally discharged during the spring and summer melt off. The discharged may have a lower organic content but is mixed with the discharge from the yearly melt off and resuspended and mixed over the bottom due to the dynamic character of the tidal zone. After discharge stop the next yearly melt off will provide large amounts of organic matter covering the tailings. The sediment composition does, therefore, not hinder the commencement of recovery after one year of discharge stop. The impacted area (major and minor impact) is small compared to the surrounding fjord area and larvae settling from the surrounding and unaffected benthic communities should be available for settling also within one year of discharge stop. Thus, full recovery time for the benthic community including full recovery of biodiversity, abundances and biomass is mainly dependent on the age range of the benthic fauna in the impact area.

The size distribution of the thick shelled and dominating bivalves found in the grab samples are presented in section 5.7. The size distribution shows that adult specimens of *Mya truncate* and *Serripes groenlandica* and of *Hiatella* sp. (up to 45 mm) were found in the samples. Few studies on the age of arctic bivalves can be found. However, one study on the size and age distribution of *Hiatella arctica* exists from Northeast Greenland (Sejr et al, 2002). Sejr et al (2002) found very old specimens of *Hiatella arctica.* The oldest was 126 years and 33 mm long. Thus, the *Hiatella* specimens of up to 45 mm found in the investigated area at the Dundas mine may well be of an equal or higher age! For *Serripes groenlandicus* a study from Canada found adult specimens a maximum size of 95 mm, which was approximately 40 years old (Kilada et al, 2007). The lifespan of bivalves at the northeastern coast of Sakhalin Island were likewise found to be 2-41 years for among others *Serripes groenlandicus* and *Macoma* spp (Selin NI, 2010). A conservative estimate of the time it will take for a full recovery of the benthos at Dundas including the same age variation is therefore >150 years, however much of the community is likely reestablished after c. 40 years.

6.3.1 Increased turbidity caused by the discharge

The discharge of silt material to the sea will lead to enhanced concentrations of suspended solids (SS) consisting of fine particulate matter in the seawater near the outlet. Exposure to high turbidity for longer periods can affect benthic invertebrates by subjecting them to clogged gills and guts and ultimately increase mortality. High concentrations of suspended solids can also influence macro algae, primarily through limiting the amount of light penetration through the water column. This in turn reduces photosynthetic activity and limits primary production.

Figure 35 shows the mean SS concentration in the middle water layer at discharge point 2 and the maximum SS concentration at slack tides. The highest mean SS concentration values are around 0.05 – 0.08 kg/m^3 (TT-Hydraulics 2019) corresponding to 50-80 mg/l. The modelled maximum value in a small area around the discharge point during slack tides is up to c. 0.4 kg/m^3 (TT-Hydraulics 2019) or 400 mg/l.

The Greenland Water Quality Criteria for suspended solids in seawater is 50 mg/l. The discharge of sediment to the sea will exceed this value in some areas (Figure 35). The size of the area around the outlet pipe, where the mean SS concentration will exceed 50 mg/l is estimated to 0.9 km^2. Since the tidal current and the seafloor topography is generally similar along the project coast the size of the area where the water quality criteria is exceeded is believed to be of the same order of magnitude at the other three discharge points (i.e. c. 1 km^2).

The areas with high (over 50 mg/l) concentrations of suspended solids will be identical to the zones with high sedimentation and the high turbidity will probably be an extra stressor to the challenged benthos organisms and will probably lead to additional mortality.

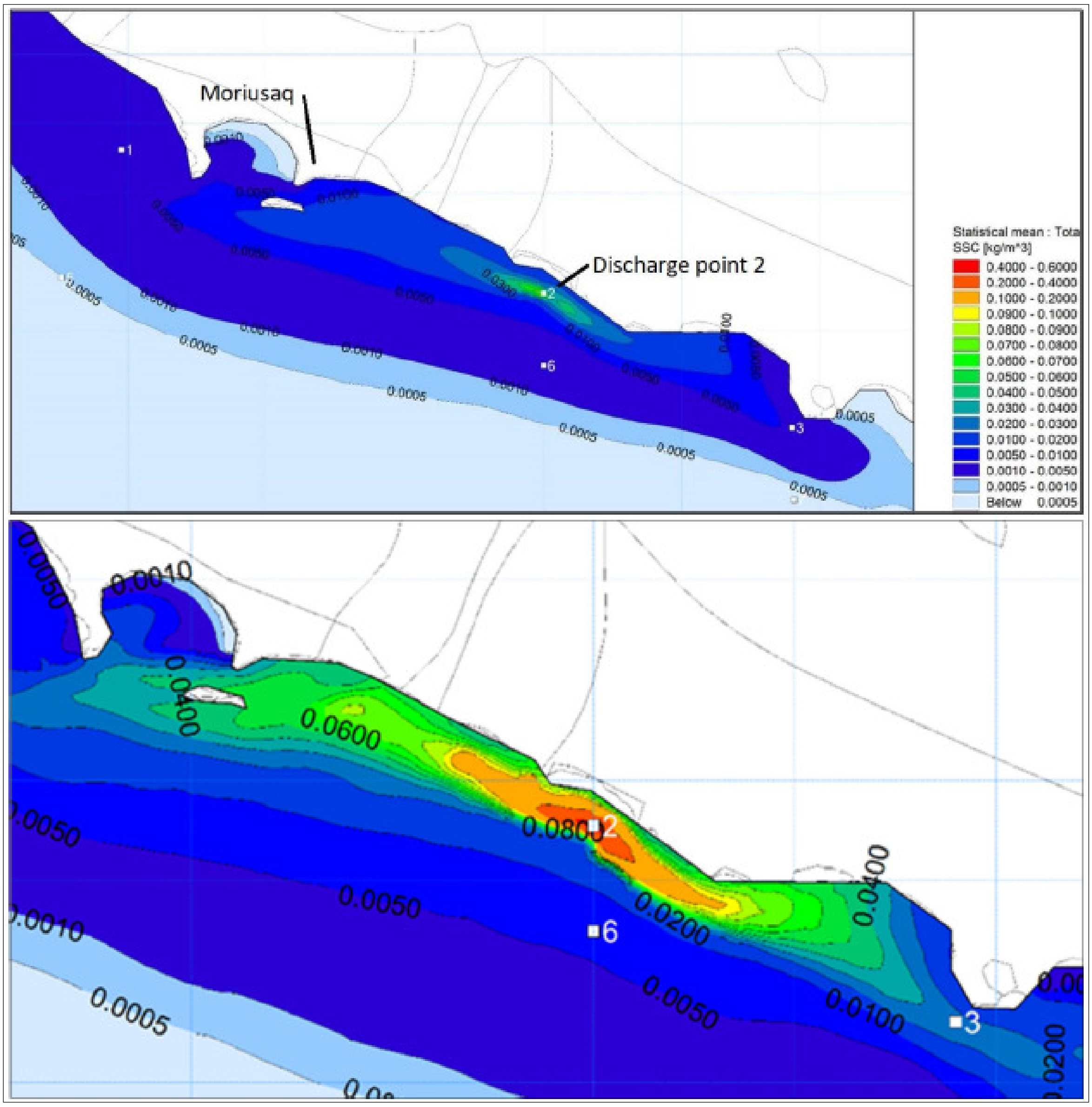


Figure 35. Modelling of suspended sediment in the water column from the discharge. The upper figure shows the modelled mean concentration of suspended solid (middle of water column) at discharge point 2. The lower figure shows the maximum SS concentration at slack tides (from TT-Hydraulic 2019).

In areas where the turbidity is lower little effects are expected because suspended sediment concentrations of for example <10 mg/l are within the normal tolerance levels for benthic fauna in dynamic environments such as the soft bottom off the project area. The benthic community in the Assessment area is also believed to be adapted to high turbidity during spring and summer run-off when large amount of fine material is washed into the fjord by the glacial rivers. During winter some resuspension of the soft bottom sediments under the ice is also expected to take place due to the tidal currents. Concentrations of suspended solids of 10 mg/l is therefore considered within normal levels and not expected to cause significant effects on the benthic fauna.

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8 APPENDIX 1

Relationship between length and biomass (Individual shell-free dry weight (SFDW) for the six most numerous mussels recorded from the assessment area.

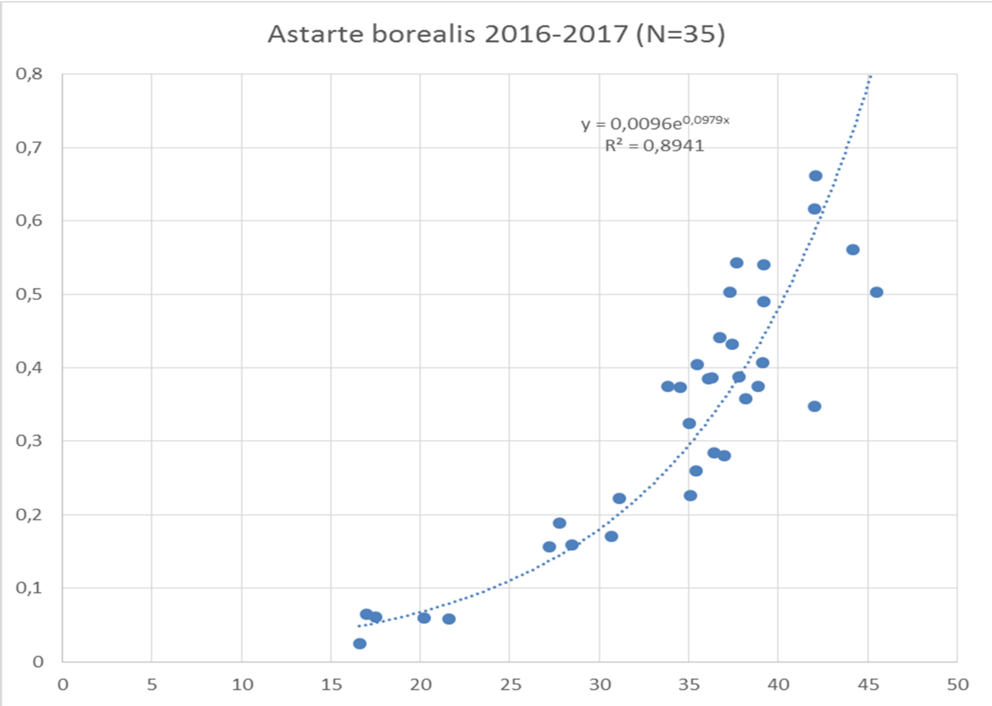

Figure 1. Length (mm) biomass (g) relation for *Astarte borealis*

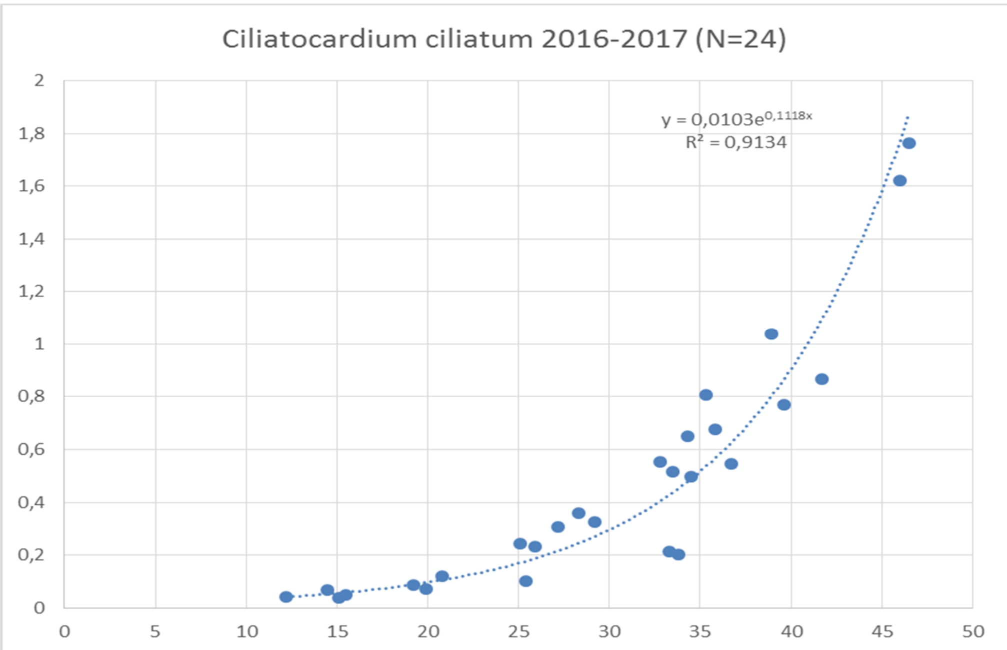

Figure 2. Length (mm) biomass (g) relation for *Ciliatocardium ciliatum*

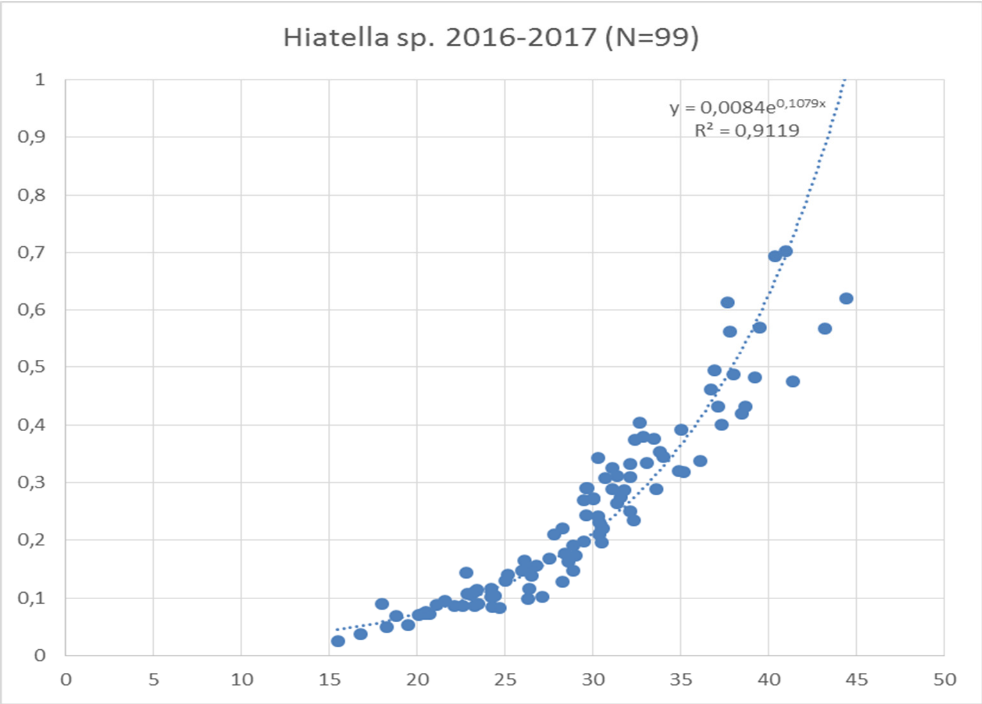

Figure 3. Length (mm) biomass (g) relation for *Hiatella sp.*

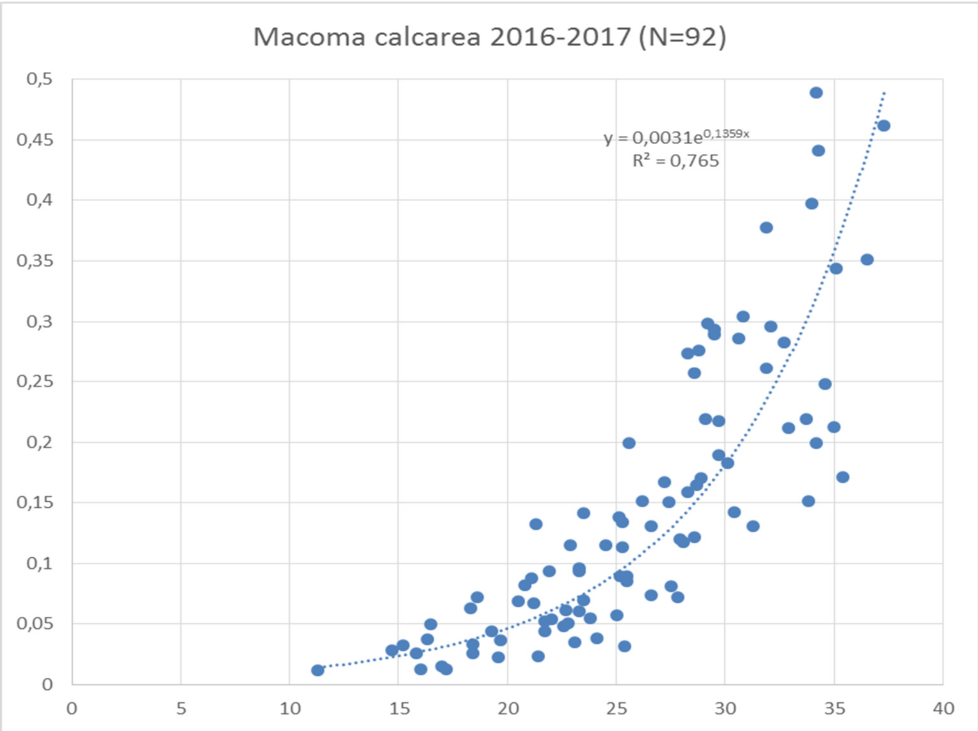

Figure 4. Length (mm) biomass (g) relation for *Macoma calcarea.*

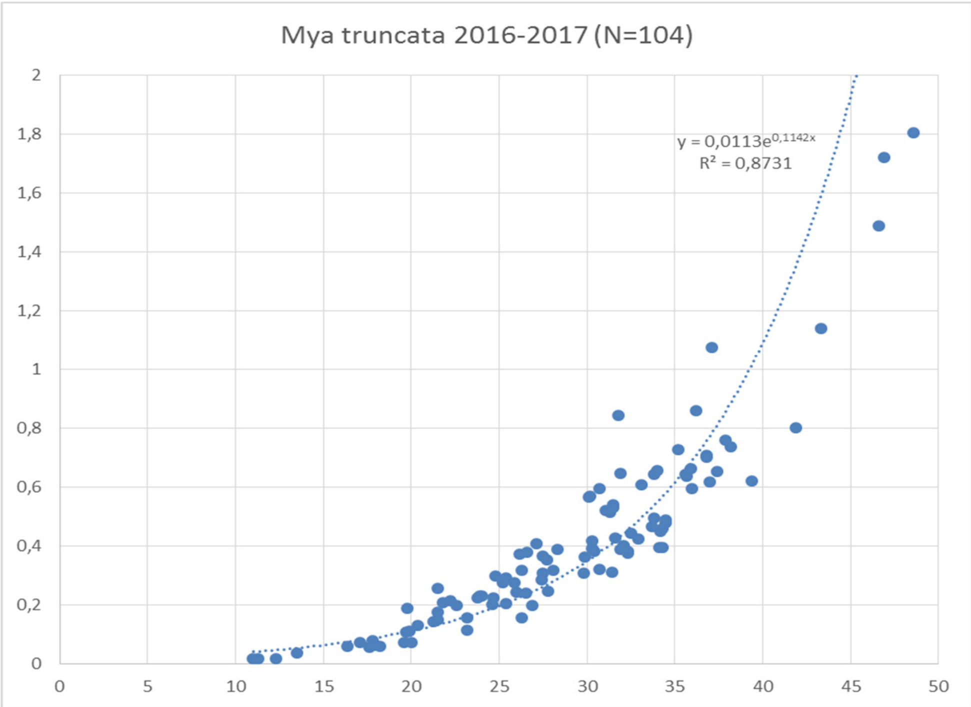

Figure 5. Length (mm) biomass (g) relation for *Mya truncate*.

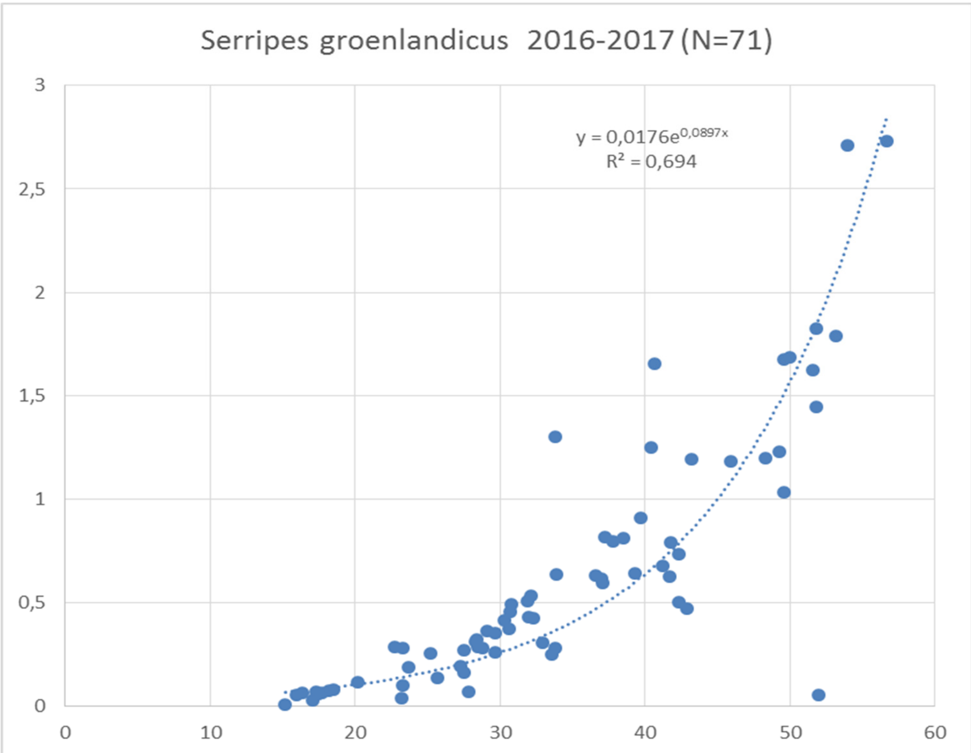

Figure 6. Length (mm) biomass (g) relation for *Serripes groenlandicus*

9 APPENDIX 2

Table 1 – Species list of all recorded marine invertebrates

Species	10 mm grab samples	1 mm grab samples	ROV video	Classification
Polychaeta				
Ampharete acutifrons		X		Annelida (Phylum), Polychaeta (Class)
Amphitrite cirrata		X		Annelida (Phylum), Polychaeta (Class)
Aricidea sp.		X		Annelida (Phylum), Polychaeta (Class)
Ascidiacea indet.		X		Annelida (Phylum), Polychaeta (Class)
Axionice flexuosa	X	X		Annelida (Phylum), Polychaeta (Class)
Capitella capitata		X		Annelida (Phylum), Polychaeta (Class)
Chaetozone setosa		X		Annelida (Phylum), Polychaeta (Class)
Chone sp.	X			Annelida (Phylum), Polychaeta (Class)
Cirratulidae indet.		X		Annelida (Phylum), Polychaeta (Class)
Cistenides granulata	X	X		Annelida (Phylum), Polychaeta (Class)
Cistenides hyperborea	X	X		Annelida (Phylum), Polychaeta (Class)
Eteone flava		X		Annelida (Phylum), Polychaeta (Class)
Eteone longa		X		Annelida (Phylum), Polychaeta (Class)
Euchone papillosa		X		Annelida (Phylum), Polychaeta (Class)
Galathowenia oculata		X		Annelida (Phylum), Polychaeta (Class)
Gattyana cirrhosa	X	X		Annelida (Phylum), Polychaeta (Class)
Goniadidae indet.		X		Annelida (Phylum), Polychaeta (Class)
Harmothoe imbricata		X		Annelida (Phylum), Polychaeta (Class)
Harmothoe sp.	X	X		Annelida (Phylum), Polychaeta (Class)
Maldane sarsi		X		Annelida (Phylum), Polychaeta (Class)
Mediomastus sp.		X		Annelida (Phylum), Polychaeta (Class)
Nephtys ciliata	X	X		Annelida (Phylum), Polychaeta (Class)
Nephtys sp.		X		Annelida (Phylum), Polychaeta (Class)
Ophelia borealis		X		Annelida (Phylum), Polychaeta (Class)
Orbiniidae indet.		X		Annelida (Phylum), Polychaeta (Class)
Owenia fusiformis	X	X		Annelida (Phylum), Polychaeta (Class)
Paroediceros curvirostris?		X		Annelida (Phylum), Polychaeta (Class)
Pherusa plumosa		X		Annelida (Phylum), Polychaeta (Class)
Pholoe minuta		X		Annelida (Phylum), Polychaeta (Class)
Phyllodoce groenlandica	X	X		Annelida (Phylum), Polychaeta (Class)
Phyllodocidae indet.		X		Annelida (Phylum), Polychaeta (Class)

Polydora caeca		X		Annelida (Phylum), Polychaeta (Class)
Polydora sp.		X		Annelida (Phylum), Polychaeta (Class)
Praxillella praetermissa		X		Annelida (Phylum), Polychaeta (Class)
Prionospio sp.		X		Annelida (Phylum), Polychaeta (Class)
Psamathe fusca		X		Annelida (Phylum), Polychaeta (Class)
Sabellidae indet.		X		Annelida (Phylum), Polychaeta (Class)
Scalibregma inflatum		X		Annelida (Phylum), Polychaeta (Class)
Scoloplos armiger		X		Annelida (Phylum), Polychaeta (Class)
Terebellides stroemi	X	X		Annelida (Phylum), Polychaeta (Class)
Arthropoda				
Aeginnina longicornis			X	Arthropoda (Phylum)
Ampelisca macrocephala		X		Arthropoda (Phylum)
Ampelisca sp.	X	X		Arthropoda (Phylum)
Atylidae indet?		X		Arthropoda (Phylum)
Caprella septentrionalis		X		Arthropoda (Phylum)
Caprella sp.		X		Arthropoda (Phylum)
Diastylis goodsiri		X		Arthropoda (Phylum)
Diastylis oxyrhyncha?		X		Arthropoda (Phylum)
Diastylis sp.		X		Arthropoda (Phylum)
Diastyloides biplicatus?		X		Arthropoda (Phylum)
Gammaridae indet.	X	X		Arthropoda (Phylum)
Hippomedon sp?		X		Arthropoda (Phylum)
Lamprops fuscatus?		X		Arthropoda (Phylum)
Megamoera sp.?		X		Arthropoda (Phylum)
Nymphon sp.		X		Arthropoda (Phylum)
Onisimus sp?		X		Arthropoda (Phylum)
Saduria sabini	X	X	X	Arthropoda (Phylum)
Cephalorhyncha				
Halicryptus spinulosus		X		Cephalorhyncha (Phylum)
Priapulus caudatus		X		Cephalorhyncha (Phylum)
Chordata				
Styela cf. rustica			X	Chordata (Phylum)
Dendrodoa grossularia?		X		Chordata (Phylum)
Molgula siphonalis	X			Chordata (Phylum), Ascidiacea (Class)
Myriotrochus sp.		X		Chordata (Phylum), Ascidiacea (Class)

Pelonaia sp?		X		Chordata (Phylum), Ascidiacea (Class)
Pentamera cf. calcigera			X	Chordata (Phylum), Ascidiacea (Class)
Phyllophoridae indet.		X		Chordata (Phylum), Ascidiacea (Class)
Cnidaria				
Anthozoa sp.	X			Cnidaria (Phylum)
Hormathia nodosa			X	Cnidaria (Phylum)
Ophiurida sp.			X	Cnidaria (Phylum)
Stomphia coccinea			X	Cnidaria (Phylum)
Echinodermata				
Amphiuridae sp.	X			Echinodermata (Phylum)
Antedonidae indet.		X		Echinodermata (Phylum)
Astaias cf. rubens			X	Echinodermata (Phylum)
Asterias sp.		X		Echinodermata (Phylum)
Asteridae sp.	X			Echinodermata (Phylum)
Crossaster cf. squamatus			X	Echinodermata (Phylum)
Heliometra glacialis			X	Echinodermata (Phylum)
Leptasterias cf. groenlandicus			X	Echinodermata (Phylum)
Ophiura sp.	X	X	X	Echinodermata (Phylum)
Solaster sp.			X	Echinodermata (Phylum)
Strongylocentrotus droebachiensis?		X		Echinodermata (Phylum)
Mollusca, Bivalvia				
Astarte borealis	X	X		Mollusca (Phylum), Bivalvia (Class)
Chlamys islandica	X		X	Mollusca (Phylum), Bivalvia (Class)
Ciliatocardium ciliatum	X	X		Mollusca (Phylum), Bivalvia (Class)
Hiatella sp.	X	X		Mollusca (Phylum), Bivalvia (Class)
Lyonsia arenosa	X	X		Mollusca (Phylum), Bivalvia (Class)
Macoma balthica	X			Mollusca (Phylum), Bivalvia (Class)
Macoma calcarea	X	X		Mollusca (Phylum), Bivalvia (Class)
Musculus discors	X			Mollusca (Phylum), Bivalvia (Class)
Musculus niger	X	X		Mollusca (Phylum), Bivalvia (Class)
Musculus sp?		X		Mollusca (Phylum), Bivalvia (Class)
Mya arenaria	X			Mollusca (Phylum), Bivalvia (Class)
Mya truncata	X	X		Mollusca (Phylum), Bivalvia (Class)
Nuculana minuta	X	X		Mollusca (Phylum), Bivalvia (Class)
Serripes groenlandicus	X	X		Mollusca (Phylum), Bivalvia (Class)

Thyasira flexuosa		X		Mollusca (Phylum), Bivalvia (Class)
Mollusca, Gastropoda				
Ariadnaria borealis		X		Mollusca (Phylum), Gastropoda (Class)
Buccinum undatum		X		Mollusca (Phylum), Gastropoda (Class)
Colus pubescens	X	X		Mollusca (Phylum), Gastropoda (Class)
Cryptonatica affinis		X		Mollusca (Phylum), Gastropoda (Class)
Dendronotus frondosus			X	Mollusca (Phylum), Gastropoda (Class)
Gastropoda indet.		X		Mollusca (Phylum), Gastropoda (Class)
Oenopota turricula?		X		Mollusca (Phylum), Gastropoda (Class)
Retusa obtusa		X		Mollusca (Phylum), Gastropoda (Class)
Nemertea				
Nemertea indet.		X		Nemertea (Phylum)
Sipuncula				
Golfingia margaritacea	X	X		Sipuncula (Phylum), Sipunculidea (Class)

10 APPENDIX 3 - AVERAGE RELATIVE FREQUENCY

Table 1 – Average relative frequency (1-3) of selected marine species and groups in different position along the coast. Data extracted from ROV video transects.

Transect	M1	M1.5	M2	M2.5	M3	M3.5	M4	M4.5	M5
Ophiopholidae	2,4	2,2	2,3	2,0	2,3	1,0	0,7	1,5	2,3
Asteriidae	1,3	1,2	0,8	0,0	0,5	0,3	0,3	2,0	1,5
Heliometra glacialis	1,9	1,4	1,5	1,8	1,5	0,3	0,3	0,0	0,8
Echinidea	1,7	0,4	0,7	0,6	0,3	0,7	0,7	1,0	0,0
Bivalia	2,0	1,6	2,7	2,8	2,3	2,3	1,3	3,0	2,0
Styelidae	1,9	1,8	1,8	2,0	1,0	1,0	1,3	1,5	1,0
Cucumariidae	0,4	0,0	0,0	0,0	0,0	0,0	0,3	0,0	0,0
Enthemonae	1,0	0,4	0,5	0,2	0,3	0,0	1,7	0,0	0,8
Cirripedia	1,1	1,8	1,3	2,4	1,3	2,0	1,3	1,5	0,0
Fish	0,6	0,2	0,2	0,0	0,0	0,3	0,0	0,0	0,5
Gastropoda	0,6	1,2	1,3	1,0	1,5	1,0	0,7	0,5	0,5
Polychaeta	1,7	2,0	2,2	1,8	1,5	0,7	1,3	1,0	2,8
Saduria sabini	0,1	0,6	0,8	1,0	0,0	1,0	0,3	0,5	0,0
Clamys islandica	0,6	0,2	0,5	1,0	0,5	0,0	0,7	0,0	0,0

Table 2 – Average relative frequency (1-3) of selected marine species and groups on different depth. Data extracted from ROV video transects.

Depth (m)	10-19m	20-29m	30-39m	40-49m	50-59m	60-69m	70-79m
Ophiopholidae	0,3	1,7	2,4	3,0	3,0	3,0	3,0
Asteriidae	0,5	1,3	0,8	1,0	1,5	0,0	0,0
Heliometra glacialis	0,0	1,1	1,5	2,0	2,0	2,0	3,0
Echinidea	0,3	0,7	0,9	1,0	0,0	1,0	2,0
Bivalia	1,0	2,4	2,3	2,3	2,5	2,0	3,0
Styelidae	0,5	1,4	2,1	2,0	2,5	0,0	2,0
Cucumariidae	0,0	0,0	0,1	0,3	0,0	0,0	0,0
Enthemonae	0,8	0,1	0,6	1,0	0,5	0,0	2,0
Cirripedia	0,8	1,1	1,6	1,3	1,5	3,0	2,0
Fish	0,5	0,6	0,1	0,3	0,0	0,0	0,0
Gastropoda	0,3	1,0	1,2	0,3	0,5	0,0	1,0
Polychaeta	0,5	2,3	2,1	1,0	2,5	0,0	2,0
Saduria sabini	0,3	0,7	0,4	0,0	0,0	0,0	0,0
Clamys islandica	0,0	0,1	0,4	0,7	0,5	1,0	1,0

11 APPENDIX 4

Table 1 – Results from 1mm grab samples.

Sample no.	Year	*Species*	number
M10A6	2016	*Ampelisca macrocephala*	15
M10A6	2016	*Astarte borealis*	6
M10A6	2016	*Cryptonatica affinis*	1
M10A6	2016	*Galathowenia oculata*	1
M10A6	2016	*Hiatella sp.*	2
M10A6	2016	*Hippomedon sp?*	1
M10A6	2016	*Mya truncata*	14
M10A6	2016	*Oenopota turricula?*	1
M10A6	2016	*Ophiura sp.*	1
M10A6	2016	*Owenia fusiformis*	3
M10A6	2016	*Paroediceros curvirostris?*	1
M10A6	2016	*Pectinaria granulata*	25
M10A6	2016	*Phyllodoce groenlandica*	1
M10A6	2016	*Serripes groenlandicus*	1
M10A6	2016	*Thyasira flexuosa*	1
M10A7	2016	*Ampelisca macrocephala*	1
M10A7	2016	*Astarte borealis*	10
M10A7	2016	*Asterias sp.*	1
M10A7	2016	*Caprella septentrionalis*	1
M10A7	2016	*Colus pubescens*	2
M10A7	2016	*Gammaridae indet.*	2
M10A7	2016	*Gastropoda indet.*	2
M10A7	2016	*Gattyana cirrosa*	4
M10A7	2016	*Harmothoe sp.*	7
M10A7	2016	*Hiatella sp.*	4
M10A7	2016	*Musculus niger*	7
M10A7	2016	*Mya truncata*	3
M10A7	2016	*Nephtys ciliata*	1
M10A7	2016	*Nuculana minuta*	3
M10A7	2016	*Owenia fusiformis*	2
M10A7	2016	*Pectinaria granulata*	23
M10A7	2016	*Pherusa plumosa*	1
M10A7	2016	*Pholoe minuta*	2
M10A7	2016	*Polydora sp.*	1
M10A7	2016	*Strongylocentrotus droe-bachiensis?*	1
M10B6	2016	*Ampelisca macrocephala*	2
M10B6	2016	*Colus pubescens*	7
M10B6	2016	*Harmothoe sp.*	3
M10B6	2016	*Hiatella sp.*	3

M10B6	2016	*Mya truncata*	1
M10B6	2016	*Nephtys sp.*	1
M10B6	2016	*Oenopota turricula?*	1
M10B6	2016	*Owenia fusiformis*	14
M10B6	2016	*Paroediceros curvirostris?*	7
M10B6	2016	*Pectinaria granulata*	32
M10B6	2016	*Thyasira flexuosa*	1
M10B7	2016	*Ampelisca macrocephala*	2
M10B7	2016	*Caprella septentrionalis*	1
M10B7	2016	*Colus pubescens*	2
M10B7	2016	*Diastylis oxyrhyncha?*	1
M10B7	2016	*Galathowenia oculata*	1
M10B7	2016	*Gastropoda indet.*	2
M10B7	2016	*Harmothoe sp.*	1
M10B7	2016	*Hiatella sp.*	1
M10B7	2016	*Hippomedon sp?*	1
M10B7	2016	*Macoma calcarea*	2
M10B7	2016	*Musculus niger*	1
M10B7	2016	*Mya truncata*	9
M10B7	2016	*Orbiniidae indet.*	1
M10B7	2016	*Owenia fusiformis*	ca.400
M10B7	2016	*Paroediceros curvirostris?*	5
M10B7	2016	*Pectinaria granulata*	43
M10B7	2016	*Pelonaia sp?*	9
M10B7	2016	*Phyllodoce groenlandica*	1
M10B7	2016	*Praxillella praetermissa*	2
M10B7	2016	*Saduria sabini*	1
M10B7	2016	*Serripes groenlandicus*	1
M10C6	2016	*Ampelisca macrocephala*	1
M10C6	2016	*Dendrodoa grossularia?*	1
M10C6	2016	*Gattyana cirrosa*	3
M10C6	2016	*Harmothoe sp.*	4
M10C6	2016	*Mya truncata*	6
M10C6	2016	*Padalidae indet.*	2
M10C6	2016	*Pectinaria granulata*	34
M10C6	2016	*Pholoe minuta*	1
M10C6	2016	*Phyllodocidae indet.*	1
M10C6	2016	*Thyasira flexuosa*	1
M10C7	2016	*Caprella septentrionalis*	50
M10C7	2016	*Colus pubescens*	1
M10C7	2016	*Eteone longa*	1
M10C7	2016	*Gammaridae indet.*	Ca.60
M10C7	2016	*Gastropoda indet.*	1
M10C7	2016	*Harmothoe sp.*	2
M10C7	2016	*Hiatella sp.*	1
M10C7	2016	*Musculus niger*	2
M10C7	2016	*Musculus sp?*	3

M10C7	2016	*Mya truncata*	4
M10C7	2016	*Owenia fusiformis*	11
M10C7	2016	*Pectinaria granulata*	31
M10C7	2016	*Pholoe minuta*	1
M10C7	2016	*Saduria sabini*	1
M10C7	2016	*Thyasira flexuosa*	2
M10D6	2016	*Gastropoda indet. (juv)*	3
M10D6	2016	*Mya truncata*	2
M10D6	2016	*Owenia fusiformis*	15
M10D6	2016	*Paroediceros curvirostris?*	9
M10D6	2016	*Pectinaria granulata*	26
M10D6	2016	*Pholoe minuta?*	1
M10D6	2016	*Thyasira flexuosa*	3
M10D7	2016	*Astarte borealis*	1
M10D7	2016	*Eteone longa*	1
M10D7	2016	*Gammaridae indet.*	5
M10D7	2016	*Gastropoda indet. (juv)*	1
M10D7	2016	*Lamprops fuscatus?*	6
M10D7	2016	*Mya truncata*	15
M10D7	2016	*Owenia fusiformis*	71
M10D7	2016	*Paroediceros curvirostris?*	15
M10D7	2016	*Pectinaria granulata*	46
M10D7	2016	*Pelonaia sp?*	1
M10D7	2016	*Pholoe minuta*	5
M10D7	2016	*Saduria sabini*	1
M10D7	2016	*Serripes groenlandicus*	2
M10D7	2016	*Thyasira flexuosa*	7
M15A6	2017	*Ampelisca sp.*	1
M15A6	2017	*Chaetozone setosa*	1
M15A6	2017	*Gammaridae indet.*	5
M15A6	2017	*Gattyana cirrosa*	1
M15A6	2017	*Hippomedon sp?*	9
M15A6	2017	*Musculus niger*	1
M15A6	2017	*Owenia fusiformis*	1
M15A6	2017	*Scalibregma inflatum*	4
M15A7	2017	*Ampelisca sp.*	5
M15A7	2017	*Capitella capitata*	1
M15A7	2017	*Chaetozone setosa*	1
M15A7	2017	*Diastylis sp.*	1
M15A7	2017	*Gastropoda indet.*	1
M15A7	2017	*Hiatella sp.*	1
M15A7	2017	*Hippomedon sp?*	2
M15A7	2017	*Musculus niger*	1
M15A7	2017	*Mya truncata*	1
M15A7	2017	*Myriotrochus sp.*	1
M15A7	2017	*Owenia fusiformis*	2
M15A7	2017	*Pectinaria hyperboria*	1

M15A7	2017	*Saduria sabini*	1
M15A7	2017	*Scalibregma inflatum*	4
M15A7	2017	*Scoloplos armiger*	1
M15B6	2017	*Ampelisca sp.*	2
M15B6	2017	*Astarte borealis*	3
M15B6	2017	*Ciliatocardium ciliatum*	1
M15B6	2017	*Colus pubescens*	1
M15B6	2017	*Eteone longa*	1
M15B6	2017	*Gammaridae indet.*	1
M15B6	2017	*Gastropoda indet.*	1
M15B6	2017	*Gattyana cirrosa*	1
M15B6	2017	*Harmothoe sp.*	1
M15B6	2017	*Musculus niger*	8
M15B6	2017	*Myriotrochus sp.*	1
M15B6	2017	*Nemertini indet.*	1
M15B6	2017	*Nephtys ciliata*	1
M15B6	2017	*Nuculana minuta*	17
M15B6	2017	*Owenia fusiformis*	82
M15B6	2017	*Paroediceros curvirostris?*	3
M15B6	2017	*Pectinaria granulata*	63
M15B6	2017	*Phascolosoma margaritaceum*	1
M15B6	2017	*Phascolosoma margaritaceum*	1
M15B6	2017	*Pholoe minuta*	4
M15B6	2017	*Phyllodoce groenlandica*	1
M15B6	2017	*Sabellidae indet.*	1
M15B6	2017	*Scalibregma inflatum*	1
M15B6	2017	*Serripes groenlandicus*	1
M15B6	2017	*Terebellides stroemi*	1
M15B7	2017	*Colus pubescens*	1
M15B7	2017	*Gattyana cirrosa*	1
M15B7	2017	*Harmothoe sp.*	1
M15B7	2017	*Macoma calcarea*	1
M15B7	2017	*Mya truncata*	1
M15B7	2017	*Myriotrochus sp.*	1
M15B7	2017	*Nephtys ciliata*	1
M15B7	2017	*Nuculana minuta*	1
M15B7	2017	*Oenopota turricula?*	2
M15B7	2017	*Owenia fusiformis*	13
M15B7	2017	*Paroediceros curvirostris?*	4
M15B7	2017	*Pectinaria granulata*	54
M15B7	2017	*Phascolosoma margaritaceum*	1
M15B7	2017	*Pholoe nminuta*	1
M15B7	2017	*Polydora caeca*	1
M15B7	2017	*Saduria sabini*	2
M15C6	2017	*Ampelisca sp.*	1
M15C6	2017	*Ariadnaria borealis*	1
M15C6	2017	*Axionice flexuosa*	1

M15C6	2017	*Colus pubescens*	2
M15C6	2017	*Gammaridae indet.*	1
M15C6	2017	*Gastropoda indet.*	1
M15C6	2017	*Hiatella sp.*	1
M15C6	2017	*Lyosea arenosa*	2
M15C6	2017	*Macoma calcarea*	1
M15C6	2017	*Musculus niger*	9
M15C6	2017	*Mya truncata*	3
M15C6	2017	*Myriotrochus sp.*	1
M15C6	2017	*Nuculana minuta*	1
M15C6	2017	*Ophelia borealis*	1
M15C6	2017	*Owenia fusiformis*	ca.150
M15C6	2017	*Paroediceros curvirostris?*	1
M15C6	2017	*Pectinaria granulata*	53
M15C6	2017	*Phioloe minuta*	1
M15C6	2017	*Retusa obtusa*	3
M15C6	2017	*Saduria sabini*	1
M15C7	2017	*Astarte borealis*	2
M15C7	2017	*Capitella capitata*	2
M15C7	2017	*Chaetozone setosa*	1
M15C7	2017	*Ciliatocardium ciliatum*	2
M15C7	2017	*Cryptonatica affinis*	1
M15C7	2017	*Diastylis sp.*	1
M15C7	2017	*Harmothoe imbricata*	3
M15C7	2017	*Hiatella sp.*	3
M15C7	2017	*Macoma calcarea*	1
M15C7	2017	*Mediomastus sp.*	1
M15C7	2017	*Musculus niger*	22
M15C7	2017	*Mya truncata*	11
M15C7	2017	*Onisimus sp?*	2
M15C7	2017	*Owenia fusiformis*	7
M15C7	2017	*Paroediceros curvirostris?*	4
M15C7	2017	*Pectinaria granulata*	49
M15C7	2017	*Pholoe minuta*	1
M15C7	2017	*Prionospio sp.*	2
M15C7	2017	*Saduria sabini*	1
M15C7	2017	*Scalibregma inflatum*	1
M15C7	2017	*Serripes groenlandicus*	3
M15C7	2017	*Thyasira flexuosa*	1
M20A6	2016	*Ampelisca macrocephala*	12
M20A6	2016	*Astarte borealis*	1
M20A6	2016	*Dendrodoa grossularia?*	1
M20A6	2016	*Diastyloides biplicatus?*	1
M20A6	2016	*Gammaridae indet.*	3
M20A6	2016	*Gastropoda indet. (juv)*	3
M20A6	2016	*Harmothoe sp.*	3
M20A6	2016	*Hippomedon sp?*	8

M20A6	2016	*Macoma calcarea*	4
M20A6	2016	*Musculus niger*	2
M20A6	2016	*Nuculana minuta*	2
M20A6	2016	*Oenopota turricula?*	1
M20A6	2016	*Owenia fusiformis*	78
M20A6	2016	*Paroediceros curvirostris?*	14
M20A6	2016	*Pectinaria granulata*	71
M20A6	2016	*Pholoe minuta*	4
M20A6	2016	*Serripes groenlandicus*	2
M20A7	2016	*Ampelisca macrocephala*	5
M20A7	2016	*Astarte borealis*	2
M20A7	2016	*Ciliatocardium ciliatum*	1
M20A7	2016	*Colus pubescens*	2
M20A7	2016	*Diastylis oxyrhyncha?*	1
M20A7	2016	*Hiatella sp.*	2
M20A7	2016	*Macoma calcarea*	14
M20A7	2016	*Musculus niger*	7
M20A7	2016	*Mya truncata*	1
M20A7	2016	*Nephtys sp.*	1
M20A7	2016	*Nuculana minuta*	2
M20A7	2016	*Owenia fusiformis*	95
M20A7	2016	*Paroediceros curvirostris?*	1
M20A7	2016	*Pectinaria granulata*	27
M20A7	2016	*Pelonaia sp?*	1
M20A7	2016	*Saduria sabini*	1
M20A7	2016	*Serripes groenlandicus*	3
M20B6	2016	*Astarte borealis*	1
M20B6	2016	*Cryptonatica affinis*	1
M20B6	2016	*Eteone longa*	1
M20B6	2016	*Goniadidae indet.*	1
M20B6	2016	*Hiatella sp.*	9
M20B6	2016	*Macoma calcarea*	2
M20B6	2016	*Mya truncata*	8
M20B6	2016	*Oenopota turricula?*	1
M20B6	2016	*Owenia fusiformis*	97
M20B6	2016	*Pectinaria granulata*	66
M20B6	2016	*Saduria sabini*	1
M20B6	2016	*Serripes groenlandicus*	2
M20B7	2016	*Amphitrite cirrata*	1
M20B7	2016	*Astarte borealis*	1
M20B7	2016	*Ciliatocardium ciliatum*	1
M20B7	2016	*Eteone flava*	1
M20B7	2016	*Hiatella sp.*	8
M20B7	2016	*Macoma calcarea*	1
M20B7	2016	*Musculus niger*	1
M20B7	2016	*Mya truncata*	10
M20B7	2016	*Owenia fusiformis*	42

M20B7	2016	*Pectinaria granulata*	51
M20B7	2016	*Saduria sabini*	2
M20C6	2016		
M20C7	2016	*Chaetozone setosa*	1
M20C7	2016	*Colus pubescens*	6
M20C7	2016	*Cryptonatica affinis*	1
M20C7	2016	*Dendrodoa grossularia?*	1
M20C7	2016	*Gastropoda indet.*	4
M20C7	2016	*Harmothoe sp.*	3
M20C7	2016	*Hiatella sp.*	7
M20C7	2016	*Musculus niger*	1
M20C7	2016	*Mya truncata*	95
M20C7	2016	*Owenia fusiformis*	4
M20C7	2016	*Pectinaria granulata*	57
M30A1	2016	*Ampelisca sp.*	ca.100
M30A1	2016	*Ampharete acutifrons*	1
M30A1	2016	*Amphitrite cirrata*	2
M30A1	2016	*Antedonidae indet.*	1
M30A1	2016	*Buccinum undatum*	1
M30A1	2016	*Chaetozone setosa*	1
M30A1	2016	*Cumacea indet.*	5
M30A1	2016	*Euchone papillosa*	2
M30A1	2016	*Gattyana cirrosa*	4
M30A1	2016	*Halicryptus spinulosus*	1
M30A1	2016	*Harmothoe sp.*	3
M30A1	2016	*Hiatella sp.*	18
M30A1	2016	*Macoma calcarea*	7
M30A1	2016	*Musculus niger*	11
M30A1	2016	*Mya truncata*	46
M30A1	2016	*Nephtys ciliata*	1
M30A1	2016	*Oenopota turricula?*	1
M30A1	2016	*Onisimus sp?*	5
M30A1	2016	*Owenia fusiformis*	10
M30A1	2016	*Phascolosoma margaritaceum*	2
M30A1	2016	*Pholoe minuta*	2
M30A1	2016	*Praxillella praetermissa*	3
M30A1	2016	*Priapulus caudatus*	1
M30A1	2016	*Saduria sabini*	1
M30A1	2016	*Serripes groenlandicus*	2
M30A1	2016	*Terebellides stroemi*	1
M30A7	2016	*Ampelisca sp.*	ca.25
M30A7	2016	*Amphitrite cirrata*	3
M30A7	2016	*Ascidiacea indet.*	9
M30A7	2016	*Caprella sp.*	ca.150
M30A7	2016	*Euchone papillosa*	1
M30A7	2016	*Galathowenia oculata*	1
M30A7	2016	*Gammaridae indet.*	2

M30A7	2016	*Gattyana cirrosa*	5
M30A7	2016	*Hiatella sp.*	19
M30A7	2016	*Lyosea arenosa*	1
M30A7	2016	*Macoma calcarea*	1
M30A7	2016	*Musculus niger*	7
M30A7	2016	*Mya truncata*	66
M30A7	2016	*Nymphon sp.*	1
M30A7	2016	*Ophiura sp.*	1
M30A7	2016	*Pectinaria granulata*	3
M30A7	2016	*Phascolosoma margaritaceum*	2
M30A7	2016	*Pholoe minuta*	1
M30A7	2016	*Polydora sp.*	1
M30A7	2016	*Praxillella praetermissa*	2
M30A7	2016	*Saduria sabini*	7
M30A7	2016	*Serripes groenlandicus*	1
M30B6	2016	*Ampelisca sp.*	ca.10
M30B6	2016	*Colus pubescens*	1
M30B6	2016	*Euchone papillosa*	1
M30B6	2016	*Gammaridae indet.*	5
M30B6	2016	*Harmothoe sp.*	3
M30B6	2016	*Hiatella sp.*	12
M30B6	2016	*Hippomedon sp?*	Ca.20
M30B6	2016	*Macoma calcarea*	5
M30B6	2016	*Maldane sarsi*	4
M30B6	2016	*Megamoera sp.?*	1
M30B6	2016	*Musculus niger*	22
M30B6	2016	*Mya truncata*	68
M30B6	2016	*Myriotrochus sp.*	1
M30B6	2016	*Owenia fusiformis*	Ca.500
M30B6	2016	*Pectinaria granulata*	2
M30B6	2016	*Pholoe minuta*	4
M30B6	2016	*Phyllodoce groenlandica*	1
M30B6	2016	*Praxillella praetermissa*	1
M30B6	2016	*Saduria sabini*	2
M30B6	2016	*Serripes groenlandicus*	1
M30B6	2016	*Thyasira flexuosa*	2
M30B7	2016	*Ampelisca sp.*	ca.10
M30B7	2016	*Buccinum undatum*	3
M30B7	2016	*Hiatella sp.*	23
M30B7	2016	*Hippomedon sp?*	ca.10
M30B7	2016	*Macoma calcarea*	2
M30B7	2016	*Musculus niger*	25
M30B7	2016	*Mya truncata*	88
M30B7	2016	*Owenia fusiformis*	ca.250
M30B7	2016	*Pectinaria granulata*	1
M30B7	2016	*Phascolosoma margaritaceum*	2
M30B7	2016	*Pholoe minuta*	1

M30B7	2016	*Praxillella praetermissa*	1
M30B7	2016	*Priapulus caudatus*	1
M30B7	2016	*Saduria sabini*	2
M30B7	2016	*Scalibregma inflatum*	1
M30B7	2016	*Scoloplos armiger*	1
M30B7	2016	*Serripes groenlandicus*	1
M30B7	2016	*Terebellides stroemi*	1
M30B7	2016	*Thyasira flexuosa*	1
M30C6	2016	*Ampelisca sp.*	4
M30C6	2016	*Ampharete acutifrons*	5
M30C6	2016	*Aricidae sp.*	2
M30C6	2016	*Gammaridae indet.*	27
M30C6	2016	*Harmothoe sp.*	1
M30C6	2016	*Hiatella sp.*	4
M30C6	2016	*Hippomedon sp?*	6
M30C6	2016	*Megamoera sp.?*	1
M30C6	2016	*Musculus niger*	31
M30C6	2016	*Mya truncata*	80
M30C6	2016	*Onisimus sp?*	21
M30C6	2016	*Owenia fusiformis*	ca.700
M30C6	2016	*Pholoe minuta*	2
M30C6	2016	*Scalibregma inflatum*	1
M30C6	2016	*Serripes groenlandicus*	1
M30C6	2016	*Thyasira flexuosa*	2
M30C7	2016	*Ampelisca sp.*	ca.20
M30C7	2016	*Ampharete acutifrons*	2
M30C7	2016	*Atylidae indet?*	4
M30C7	2016	*Capitella capitata*	1
M30C7	2016	*Gammaridae indet.*	ca.15
M30C7	2016	*Hiatella sp.*	16
M30C7	2016	*Hippomedon sp?*	ca.30
M30C7	2016	*Lyosea arenosa*	1
M30C7	2016	*Macoma calcarea*	3
M30C7	2016	*Musculus niger*	9
M30C7	2016	*Mya truncata*	87
M30C7	2016	*Owenia fusiformis*	ca.350
M30C7	2016	*Pectinaria granulata*	1
M30C7	2016	*Pelonaia sp?*	1
M30C7	2016	*Pholoe minuta*	2
M30C7	2016	*Polydora sp.*	1
M30C7	2016	*Priapulus caudatus*	1
M30C7	2016	*Saduria sabini*	2
M30C7	2016	*Scalibregma inflatum*	2
M30C7	2016	*Serripes groenlandicus*	2
M30C7	2016	*Thyasira flexuosa*	1
M30D6	2016	*Ampelisca sp.*	ca.20
M30D6	2016	*Ampharete acutifrons*	62

M30D6	2016	*Atylidae indet?*	2
M30D6	2016	*Hiatella sp.*	5
M30D6	2016	*Hippomedon sp?*	ca.60
M30D6	2016	*Musculus niger*	3
M30D6	2016	*Mya truncata*	76
M30D6	2016	*Nephtys ciliata*	1
M30D6	2016	*Onisimus sp?*	6
M30D6	2016	*Owenia fusiformis*	Ca.500
M30D6	2016	*Paroediceros curvirostris?*	4
M30D6	2016	*Pholoe minuta*	1
M30D6	2016	*Saduria sabini*	4
M30D6	2016	*Scoloplos armiger*	1
M30D7	2016	*Ampharete acutifrons*	49
M30D7	2016	*Atylidae indet?*	ca.10
M30D7	2016	*Capitella capitata*	1
M30D7	2016	*Harmothoe sp.*	1
M30D7	2016	*Hiatella sp.*	2
M30D7	2016	*Hippomedon sp?*	ca80
M30D7	2016	*Macoma calcarea*	1
M30D7	2016	*Musculus niger*	1
M30D7	2016	*Mya truncata*	41
M30D7	2016	*Onisimus sp?*	ca.40
M30D7	2016	*Owenia fusiformis*	ca.200
M30D7	2016	*Paroediceros curvirostris?*	ca.30
M30D7	2016	*Pholoe minuta*	1
M30D7	2016	*Priapulus caudatus*	2
M30D7	2016	*Saduria sabini*	5
M30D7	2016	*Serripes groenlandicus*	1
M35A6	2017	*Aricidae sp.*	4
M35A6	2017	*Chaetozone setosa*	2
M35A6	2017	*Gammaridae indet.*	1
M35A6	2017	*Hippomedon sp?*	48
M35A6	2017	*Mya truncata*	1
M35A6	2017	*Serripes groenlandicus*	1
M35A7	2017	*Ampelisca sp-.*	3
M35A7	2017	*Aricidae sp.*	5
M35A7	2017	*Chaetozone setosa*	1
M35A7	2017	*Ciliatocardium ciliatum*	2
M35A7	2017	*Gammaridae indet.*	3
M35A7	2017	*Hippomedon sp?*	46
M35A7	2017	*Lyosea arenosa*	2
M35A7	2017	*Mya truncata*	30
M35A7	2017	*Pholoe minuta*	1
M35A7	2017	*Saduria sabini*	2
M35A7	2017	*Scalibregma inflatum*	3
M35B6	2017	*Aricidae sp.*	2
M35B6	2017	*Hippomedon sp?*	21

M35B6	2017	*Mya truncata*	10
M35B6	2017	*Saduria sabini*	3
M35B6	2017	*Scalibregma inflatum*	2
M35B7	2017	*Ampelisca sp.*	3
M35B7	2017	*Aricidae sp.*	2
M35B7	2017	*Capitella capitata*	4
M35B7	2017	*Chaetozone setosa*	2
M35B7	2017	*Gammaridae indet.*	1
M35B7	2017	*Hippomedon sp?*	118
M35B7	2017	*Macoma calcarea*	1
M35B7	2017	*Mya truncata*	15
M35B7	2017	*Pholoe mionuta*	2
M35B7	2017	*Polydora caeca*	1
M35B7	2017	*Scalibregma inflatum*	8
M35B7	2017	*Serripes groenlandicus*	1
M35C6	2017	*Capitella capitata*	1
M35C6	2017	*Hippomedon sp?*	5
M35C6	2017	*Macoma calcarea*	5
M35C6	2017	*Megamoera sp.?*	1
M35C6	2017	*Mya truncata*	18
M35C6	2017	*Nephtys ciliata*	1
M35C6	2017	*Paroediceros curvirostris?*	1
M35C6	2017	*Pholoe minuta*	1
M35C7	2017	*Aricidae sp.*	1
M35C7	2017	*Capitella capitata*	1
M35C7	2017	*Chaetozone setosa*	1
M35C7	2017	*Gammaridae indet.*	1
M35C7	2017	*Hippomedon sp?*	17
M35C7	2017	*Lyosea arenosa*	8
M35C7	2017	*Macoma calcarea*	5
M35C7	2017	*Mya truncata*	55
M35C7	2017	*Nephtys ciliata*	1
M35C7	2017	*Pholoe minuta*	4
M35C7	2017	*Scalibregma inflatum*	1
M35C7	2017	*Serripes groenlandicus*	2
M35C7	2017	*Thyasira flexuosa*	7
M40A6	2016	*Ampelisca sp.*	ca.5
M40A6	2016	*Astarte borealis*	13
M40A6	2016	*Ciliatocardium ciliatum*	1
M40A6	2016	*Cumacea indet.*	1
M40A6	2016	*Galathowenia oculata*	3
M40A6	2016	*Gammaridae indet.*	1
M40A6	2016	*Gattyana cirrosa*	5
M40A6	2016	*Harmothoe sp.*	8
M40A6	2016	*Hiatella sp.*	3
M40A6	2016	*Macoma calcarea*	8
M40A6	2016	*Maldane sarsi*	4

M40A6	2016	*Musculus niger*	2
M40A6	2016	*Mya truncata*	9
M40A6	2016	*Nephtys ciliata*	2
M40A6	2016	*Nuculana minuta*	2
M40A6	2016	*Pectinaria granulata*	40
M40A6	2016	*Pholoe minuta*	2
M40A6	2016	*Serripes groenlandicus*	4
M40A6	2016	*Thyasira flexuosa*	1
M40A7	2016	*Ampelisca sp.*	7
M40A7	2016	*Astarte borealis*	30
M40A7	2016	*Asterias sp.*	1
M40A7	2016	*Ciliatocardium ciliatum*	4
M40A7	2016	*Galathowenia oculata*	2
M40A7	2016	*Gattyana cirrosa*	1
M40A7	2016	*Harmothoe sp.*	2
M40A7	2016	*Hiatella sp.*	5
M40A7	2016	*Macoma calcarea*	9
M40A7	2016	*Musculus niger*	6
M40A7	2016	*Mya truncata*	6
M40A7	2016	*Nuculana minuta*	1
M40A7	2016	*Ophiura sp.*	1
M40A7	2016	*Owenia fusiformis*	2
M40A7	2016	*Pectinaria granulata*	34
M40A7	2016	*Pholoe minuta*	1
M40A7	2016	*Polydora sp.*	1
M40A7	2016	*Saduria sabini*	1
M40A7	2016	*Serripes groenlandicus*	3
M40A7	2016	*Strongylocentrotus droe-bachiensis?*	1
M40B6	2016	*Ampelisca sp.*	2
M40B6	2016	*Astarte borealis*	9
M40B6	2016	*Colus pubescens*	1
M40B6	2016	*Cryptonatica affinis*	1
M40B6	2016	*Gammaridae indet.*	1
M40B6	2016	*Gattyana cirrosa*	7
M40B6	2016	*Harmothoe sp.*	13
M40B6	2016	*Macoma calcarea*	11
M40B6	2016	*Maldane sarsi*	1
M40B6	2016	*Musculus niger*	1
M40B6	2016	*Mya truncata*	6
M40B6	2016	*Nephtys ciliata*	5
M40B6	2016	*Nuculana minuta*	4
M40B6	2016	*Paroediceros curvirostris?*	1
M40B6	2016	*Pectuinaria granulata*	40
M40B6	2016	*Serripes groenlandicus*	4
M40B6	2016	*Thyasira flexuosa*	2
M40B7	2016	*Ariadnaria borealis*	2

M40B7	2016	*Astarte borealis*	12
M40B7	2016	*Harmothoe sp.*	2
M40B7	2016	*Lyosea arenosa*	1
M40B7	2016	*Macoma calcarea*	1
M40B7	2016	*Musculus niger*	1
M40B7	2016	*Mya truncata*	5
M40B7	2016	*Owenia fusiformis*	12
M40B7	2016	*Paroediceros curvirostris?*	2
M40B7	2016	*Pectinaria granulata*	51
M40B7	2016	*Pholoe minuta*	1
M40C6	2016	*Ampelisca sp.*	4
M40C6	2016	*Euchone papillosa*	2
M40C6	2016	*Hiatella sp.*	10
M40C6	2016	*Hippomedon sp?*	16
M40C6	2016	*Musculus niger*	2
M40C6	2016	*Mya truncata*	61
M40C6	2016	*Owenia fusiformis*	2
M40C6	2016	*Pectinaria granulata*	12
M40C6	2016	*Pelonaia sp?*	4
M40C6	2016	*Pholoe minuta*	9
M40C7	2016	*Ampelisca sp.*	4
M40C7	2016	*Cirratulidae indet.*	1
M40C7	2016	*Diastylis sp.*	1
M40C7	2016	*Gammaridae indet.*	4
M40C7	2016	*Hippomedon sp?*	5
M40C7	2016	*Macoma calcarea*	1
M40C7	2016	*Musculus niger*	1
M40C7	2016	*Onisimus sp?*	1
M40C7	2016	*Pholoe minuta*	1
M40C7	2016	*Scoloplos armiger*	1
M40D6	2016	*Ampelisca sp.*	25
M40D6	2016	*Ampharete acutifrons*	2
M40D6	2016	*Atylidae indet?*	1
M40D6	2016	*Capitella capitata*	2
M40D6	2016	*Euchone papillosa*	1
M40D6	2016	*Gammaridae indet.*	9
M40D6	2016	*Hiatella sp.*	7
M40D6	2016	*Hippomedon sp?*	24
M40D6	2016	*Musculus niger*	5
M40D6	2016	*Mya truncata*	18
M40D6	2016	*Nephtys ciliata*	2
M40D6	2016	*Owenia fusiformis*	Ca.200
M40D6	2016	*Phascolosoma margaritaceum*	4
M40D6	2016	*Pholoe minuta*	3
M40D6	2016	*Praxillella praetermissa*	1
M40D7	2016	*Ampelisca sp.*	1
M40D7	2016	*Gammaridae indet.*	7

M40D7	2016	*Hippomedon sp?*	24
M40D7	2016	*Mya truncata*	17
M40D7	2016	*Onisimus sp?*	1
M40D7	2016	*Owenia fusiformis*	36
M40D7	2016	*Paroediceros curvirostris?*	1
M40D7	2016	*Pectinaria hyperborea*	1
M40D7	2016	*Pelonaia sp?*	3
M40D7	2016	*Pholoe minuta*	1
M40D7	2016	*Priapulus caudatus*	1
M40D7	2016	*Terebellides stroemi*	1
M45A6	2017	*Ampelisca sp.*	34
M45A6	2017	*Capitella capitata*	1
M45A6	2017	*Chaetozone setosa*	3
M45A6	2017	*Hiatella sp.*	7
M45A6	2017	*Macoma calcarea*	1
M45A6	2017	*Megamoera sp.?*	1
M45A6	2017	*Musculus niger*	1
M45A6	2017	*Mya truncata*	2
M45A6	2017	*Nephtys ciliata*	4
M45A6	2017	*Pectinaria granulata*	2
M45A6	2017	*Pectinaria hyperboria*	2
M45A7	2017	*Chaetozone setosa*	1
M45A7	2017	*Gammaridae indet.*	1
M45A7	2017	*Hiatella sp.*	3
M45A7	2017	*Nephtys ciliata*	1
M45A7	2017	*Pectinaria hyperboria*	1
M45B6	2017	*Aricidae sp.*	1
M45B6	2017	*Chaetozone setosa*	1
M45B6	2017	*Hiatella sp.*	1
M45B6	2017	*Macoma calcarea*	1
M45B6	2017	*Megamoera sp.?*	1
M45B6	2017	*Mya truncata*	6
M45B6	2017	*Nephtys ciliata*	3
M45B6	2017	*Paroediceros curvirostris?*	1
M45B7	2017	*Aricidae sp.*	1
M45B7	2017	*Ciliatocardium ciliatum*	1
M45B7	2017	*Diastylis sp.*	1
M45B7	2017	*Hippomedon sp?*	2
M45B7	2017	*Macoma calcarea*	1
M45B7	2017	*Nephtys ciliata*	2
M45B7	2017	*Paroediceros curvirostris?*	2
M45B7	2017	*Saduria sabini*	3
M50A6	2017	*Ampelisca sp.*	1
M50A6	2017	*Chaetozone setosa*	1
M50A6	2017	*Diastylis sp.*	1
M50A6	2017	*Euchone papillosa*	1
M50A6	2017	*Gammaridae indet.*	1

M50A6	2017	*Hiatella sp.*	1
M50A6	2017	*Hippomedon sp?*	29
M50A6	2017	*Macoma calcarea*	2
M50A6	2017	*Mya truncata*	2
M50A6	2017	*Nephtys ciliata*	3
M50A6	2017	*Prionospio sp.*	1
M50A7	2017	*Diastylis sp.*	3
M50A7	2017	*Gammaridae indet.*	1
M50A7	2017	*Hiatella sp.*	1
M50A7	2017	*Hippomedon sp?*	2
M50A7	2017	*Nephtys ciliata*	2
M50A7	2017	*Serripes groenlandicus*	3
M50B6	2017	*Capitella capitata*	1
M50B6	2017	*Eteone longa*	5
M50B6	2017	*Gammaridae indet.*	1
M50B6	2017	*Harmothoe sp.*	2
M50B6	2017	*Mya truncata*	3
M50B6	2017	*Oenopota turricula?*	1
M50B6	2017	*Phyllodoce groenlandica*	1
M50B6	2017	*Serripes groenlandicus*	1
M50B7	2017	*Eteone longa*	9
M50B7	2017	*Gammaridae indet.*	6
M50B7	2017	*Harmothoe sp.*	9
M50B7	2017	*Hiatella sp.*	5
M50B7	2017	*Kefersteinia cirrata*	1
M50B7	2017	*Mya truncata*	1
M50B7	2017	*Prionospio sp.*	4
M50B7	2017	*Serripes groenlandicus*	1
M50C6	2017	*Diastylis goodsiri*	2
M50C6	2017	*eteone longa*	3
M50C6	2017	*Gammaridae indet.*	1
M50C6	2017	*Harmothoe sp.*	17
M50C6	2017	*Hiatella sp.*	3
M50C6	2017	*Hippomedon sp?*	1
M50C6	2017	*Oenopota turricula?*	4
M50C6	2017	*Onisimus sp?*	1
M50C6	2017	*Prionospio sp.*	8
M50C7	2017	*Gammaridae indet.*	3
M50C7	2017	*Harmothoe sp.*	8
M50C7	2017	*Prionospio sp.*	1
M50D6	2017	*Capitella capitata*	2
M50D6	2017	*Eteone longa*	2
M50D6	2017	*Gammaridae indet.*	6
M50D6	2017	*Harmothoe sp.*	7
M50D6	2017	*Hippomedon sp?*	1
M50D6	2017	*Kefersteinia cirrata*	1
M50D6	2017	*Paroediceros curvirostris?*	1

M50D6	2017	*Serripes groenlandicus*	1
M50D7	2017	*Ampelisca sp.*	1
M50D7	2017	*Ampharete acutifrons*	1
M50D7	2017	*Diastylis goodsiri*	1
M50D7	2017	*Diastylis sp.*	4
M50D7	2017	*Eteone flava*	1
M50D7	2017	*Euchone papillosa*	2
M50D7	2017	*Gammaridae indet.*	ca.10
M50D7	2017	*Harmothoe sp.*	1
M50D7	2017	*Hiatella sp.*	4
M50D7	2017	*Hippomedon sp?*	2
M50D7	2017	*Kefersteinia cirrata*	1
M50D7	2017	*Mediomastus sp.*	4
M50D7	2017	*Mya truncata*	17
M50D7	2017	*Nephtys ciliata*	1
M50D7	2017	*Oenopota turricula?*	1
M50D7	2017	*Pholoe minuta*	1
M50D7	2017	*Prionospio sp.*	1