Hafrannsóknir nr. 179

Benthic communities in Tálknafjörður and Patreksfjörður

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Hafrannsóknastofnun

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Steinunn Hilma Ólafsdóttir, Botndýrasamfélög í Tálknafirði og Patreksfirði, Hafrannsóknir nr. 179.
Vegna fyrirhugaðs fiskeldis í Patreksfirði og Tálknafirði gerði Hafrannsóknastofnun rannsókn á botndýralífi fjarðanna tveggja sem hluti af stærri úttekt þar sem meðal annars voru skoðaðir eðlis- efna- og líffræðilegir þættir. Áhersla var á að skoða tegundasamsetningu og fjölbreytileika botndýrasamfélaga þannig að betur megi meta áhrif fiskeldis á botndýralíf. Tekin voru 69 botndýrasýni á 23 stöðvum auk sýna til kornastærðamælinga.

Alls voru greindar 128 tegundir/hópar í Patreksfirði og 96 tegundir/hópar í Tálknafirði. Líkt og víða í íslenskum fjörðum var stór hluti þeirra burstormar. Samlokur voru einnig áberandi en minna af öðrum dýrahópum. Mælingar á kornastærð sýndu að mjög fínt set eða leir var ríkjandi á flestum stöðvunum í báðum fjörðum en sandur og grófari botn var einkum nær landi.

Fjölbreytileiki var meiri á sandbotni en á leirbotni en þéttleiki var mun meiri á leirbotni. Tegundasamsetning botndýra á leirbotni í báðum fjörðunum var mjög lík og myndar ákveðið botndýrasamfélag. Burstaormurinn *Galathowenia oculata* var algengasta tegundin en aðrar algengar tegundir á leirbotni voru gljáhytla *Ennucula tenuis* og burstaormurinn *Cossura longocirrata*. Tegundasamsetning var ólík milli stöðva á sandbotni og einkennandi var hversu fjölbreytt lífríkið var en fá eintök af hverri tegund. Tegundasamsetning milli stöðva á sandbotni var breytileg þannig að ekki er hægt að fullyrða að um eitt botndýrasamfélag sé að ræða á slíkum botni í þessum fjörðum.

ABSTRACT

Steinunn Hilma Ólafsdóttir, Benthic communities in Tálknafjörður and Patreksfjörður, Hafrannsóknir nr. 179.
The Marine Research Institute (MRI) conducted a study on the benthic fauna in Patreksfjörður and Tálknafjörður, in relation to planned fish farming in these fjords. This study was a part more extensive research on chemical-physical- and biological factors. Such baseline knowledge is an important reference point for later evaluation of the effects of organic effluents from salmon farming on benthic species composition. A total of 69 samples from 23 stations plus samples for grain size analysis were collected. A total 128 species/groups were analysed in Patreksfjörður and 96 species/groups in Tálknafjörður. As is common in Icelandic fjords, polychaetes were usually most abundant. The abundance of bivalves was also high but low in other groups. Measurements of grain size showed that fine sediment, or mud, was the dominant bottom type of most stations in both fjords, with sand usually near the shoreline. Diversity was higher on sandy bottom, but with lower abundance, than on mud. Species composition on mud bottom showed high similarity, amongst stations, showing that the same benthic community exists on this type of bottom for both fjord. The polychaete *Galathowenia oculata* was the most dominant species along with *Ennucula tenuis* and *Cossura longocirrata.* Similarity of stations on sand bottoms was not very high, indicating no clear community types on such bottom types within the fjords.

INTRODUCTION

Due to the planned development of aquaculture in Tálknafjörður and Patreksfjörður, the Marine Research Institute (MRI), in collaboration with Atvinnuþróunarfélag Vestfjarða (Atvest), conducted an extensive study of the benthic fauna of these two fjords. The main objective was to describe the benthic fauna and the communities within these fjords in order to give an overview of the whole benthic ecosystem of the seafloor. Benthic fauna in the Vestfirðir has been studied quite extensively in the recent years. Sampling has been conducted in Dýrafjörður (Jörundur Svavarsson & Arnþór Garðarsson 1986; Þorleifur Eiríksson & Böðvar Þórisson 2008; Böðvar Þórisson *et al*. 2010a), Arnarfjörður (Þorleifur Eiríksson *et al*. 2010; Böðvar Þórisson *et al*. 2010b) and at many locations in Ísafjarðadjúp (Þorleifur Eiríksson *et al*. 2012). Fish farming has started in these fjords and the effect of the farming on the benthic fauna in the area of the cages has recently been studied in Tálknafjörður (Böðvar Þórisson *et al*. 2012a).

Description of the study area

Tálknafjörður and Patreksfjörður are similar in many ways. Outside the mouths of the fjords, water depth ranges from 30–35 m. However, deep channels run the length of the fjords, with maximum depth range of 20–60 m in Patreksfjörður and 30–60 in Tálknafjörður (see nautical charts from the Hydrographic Department, Icelandic Coast Guard). For the most part, the bottom of these channels is muddy. The floor of Tálknafjörður slopes steeply downward to the bottom of the channel from both northern and southern shorelines. Patreksfjörður is steeply sloped from the northern shore and less steeply sloped from the southern shore to the bottom of the channel.

MATERIALS AND METHODS

Sampling

Transects were laid out across the fjords in order to collect information at different depths and along the length of the fjords. Sampling was conducted on May 13–14, 2009. A local boat, Tálkni from Tálknafjörður, was used for the sampling.

A Shipek bottom grab was used to collect samples of the bottom. Sampling conditions were good and grab sampling was successful. In all, 9 stations were sampled in Tálknafjörður and 14 in Patreksfjörður (fig. 1). Three grabs were taken at each station, each grab sample covering 0.04 m^2 area of bottom. From one grab sample at each station a sub-sample was taken for grain size analysis (table 1). Exact coordinates and depth was recorded just before sampling at each station (table 2). A total of 69 samples were taken from 23 stations.

Sample processing

For each sample care was taken to record volume, colour, texture, and presence of H_2S odour. Except for sediment subsamples, all samples were washed through a 0.5 mm mesh sieve on board. All organisms were placed in plastic containers and fixed in a solution of 4% formalin in seawater, buffered with borax. Sediment samples were also placed in plastic containers.

At the MRI laboratory in Reykjavík, the samples were rinsed using a 0.25 mm sieve to remove formalin and then placed in a 70% ethanol solution. At the Research Station in Sandgerði samples were sorted into higher taxa. In addition, polychaetes were sorted into families. Polychaetes, echinoderms, molluscs (bivalves, gastropods, and aplacophorans), and crustaceans (amphipods, cumaceans, and isopods) were identified to species level where possible. The number of animals in each group was recorded for each sample.

Table 1. Number of stations and samples in Tálknafjörður and Patreksfjörður. *Fjöldi stöðva og sýna sem tekin voru í Tálknafirði og í Patreksfirði.*

Location *Staðsetning*	Number of stations *Fjöldi stöðva*	Number of grabs *Fjöldi greipa*	Number of sediment samples *Fjöldi setsýna*
Tálknafjörður	9	27	9
Patreksfjörður	14	42	14

Table 2. Sampling date, location of stations, depth, description of bottom type, and presence (+)/absence (-) of H2S odor (one + or - for each sample at each station). *Sýnatökudagur, staðsetningar stöðva, dýpi, lýsing á botngerð og hvort H2S lykt var til staðar (þrjú tákn þýða hvert greiparsýni sem tekið var á hverri stöð).*

TÁLKNAFJÖRÐUR

Date *Dagsetning*	Station *Stöð*	Time *Tími*	Latitude *Breidd*	Longitude *Lengd*	Depth (f) *Dýpi (f)*	Depth (m) *Dýpi (m)*	Bottom type *Botngerð*	H_2S
13.5.2009	1	15:15	65°38.20	23°55.20	24	43.8	mud	---
13.5.2009	2	15:45	65°38.37	23°54.05	23.6	43.1	mud	---
13.5.2009	3	16:00	65°38.50	23°53.23	8	14.6	sand	---
13.5.2009	4	17:10	65°39.79	23°58.74	12	21.9	sand	---
13.5.2009	5	17:20	65°39.38	23°59.82	31	56.6	mud	---
13.5.2009	6	17:44	65°38.97	24°00.56	24	43.8	mud	---
13.5.2009	7	18:08	65°39.78	24°02.46	34.6	63.1	mud	---
14.5.2009	8	15:00	65°37.14	23°49.89	23	42.0	sand	---
14.5.2009	9	15:15	65°37.31	23°48.98	15	27.4	shells	---

PATREKSFJÖRÐUR

Date *Dagsetning*	Station *Stöð*	Time *Tími*	Latitude *Breidd*	Longitude *Lengd*	Depth f *Dýpi (f)*	Depth m *Dýpi (m)*	Bottom type *Botngerð*	H_2S
13.5.2009	1	18:50	65°37.15	24°03.06	13	23.7	sand/mud	---
13.5.2009	2	19:20	65°36.47	24°04.65	32	58.4	mud	---
13.5.2009	3	20:00	65°36.02	24°05.95	20	36.5	sand/mud	---
14.5.2009	4	08:40	65°35.14	23°58.91	14	25.6	shell sand	---
14.5.2009	5	08:56	65°34.64	23°59.43	29	52.9	muddy sand	+--
14.5.2009	6	09:10	65°34.03	24°00.14	11	20.1	sand	---
14.5.2009	7	10:15	65°31.81	23°49.05	12	21.9	mud	--+
14.5.2009	8	10:25	65°31.18	23°51.78	11	20.1	muddy sand	---
14.5.2009	9	10:48	65°32.04	23°51.53	10	18.3	muddy sand	---
14.5.2009	10	11:05	65°31.45	23°53.21	20	36.5	muddy sand	---
14.5.2009	11	11:36	65°33.04	23°53.76	20	36.5	muddy sand	++-
14.5.2009	12	11:55	65°32.66	23°54.64	28	51.1	muddy sand	+--
14.5.2009	13	12:00	65°32.33	23°55.08	14	25.6	muddy sand	---
14.5.2009	14	13:30	65°38.35	24°05.44	36	65.7	muddy sand	+--

Grain size analysis was conducted according to the following protocol:

1) Wet weight recorded.
2) About 100 g (wet weight) was set in water and allowed to stand, with occasional stirring, for a few hours.
3) When the sample was well mixed with the water, it was filtered through a 1 mm mesh and a 0.063 mm mesh and rinsed until run-off water was no longer cloudy.
4) Buckets containing run-off water (sediment < 0.063 mm) were allowed to stand until the sediment settled to the bottom. Then, water was drained off and sediment was put into a beaker, dried at 50°C and weighed.
5) Sediment > 0.063 mm was dried at 50°C. Then, the dried sample was put into an agitator over a series of sieves (4, 2, 1, 0.5, 0.125, mm and bottom). Samples were agitated for 5–10 minutes.
6) Sediment caught in each sieve was weighed and recorded.

Data analysis

Polychaeta, most all Crustacea, Mollusca and Echinodermata were identified to species level when possible. Other taxonomic groups were not identified to species level, but number of specimens were recorded. These taxa were Foraminifera, Hydrozoa, Nemertina, Kinorhyncha, Nematoda, Platyhelminthes, Oligochaeta, Porifera, Sipuncula, Bryozoa, Ostracoda, Copepoda, and larvae. Bryozoa and hydrozoan are colonial animals and the frequencies of these are the numbers of colonies or parts of colonies observed. Forminiferans and ostracods were counted up to 200 individuals from each sample, but these were often present in greater abundance. For purposes of analysis, all frequency data for each species were summed across samples for each station to achieve density data of individuals per 0.12 m^2 (3*0.041 m^2) (see Appendix I and II).

Foraminiferans, Porifera, Hydrozoa, Bryozoa, Nematoda, larvae, and unidentified specimens were omitted in analysis.

The diversity of each sample was analysed using the Shannon's diversity index: $H' = - \Sigma P_i \log(P_i)$ (Magurran 1988) where P_i is the proportional number of species i in the sample ($P_i = n_i/N$, where n_i = number of species/taxa i, N = total number of animals in the sample). Such a standard gives an indication of how complex the faunal community is at a given location at a given time. For comparative purposes H'_{log2} was calculated. Evenness of the communities at each station was estimated using Pielou's evenness index $J' = H'/Log(S)$ (where S is the total number of species in the community). Evenness is low if there is discrepancy between these two factors. Thus, evenness is low if a small number of species have high density but if the densities of most species are fairly equal, evenness is high.

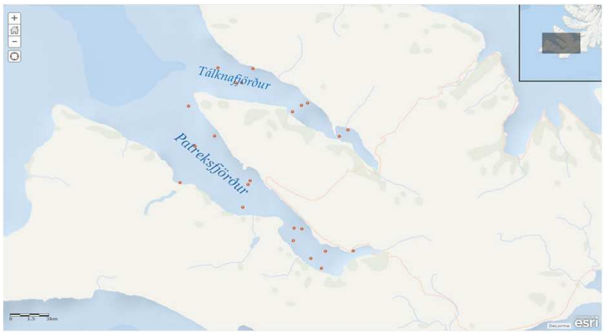

Figure 1. Locations of samples (red dots) in the study area in North-western Iceland. *Sýnatökustöðvar (rauðir deplar) á sunnanverðum Vestfjörðum.*

Hierarchical cluster analysis with group-average linking (Clarke and Warwick 1994) was used to estimate similarity of stations to see if there was one or more community type in the study area. The Bray-Curtis similarity coefficient (S) was calculated for each pair of stations to see on a scale of 0–100% (with 0% being not similar and 100% being identical). Stations were thus arranged in order of similarity, comprising taxonomic composition and density. To examine this further, multidimensional scaling (MDS) was applied and one-way analysis of similarity (ANOSIM) (Clark and Warwick 1994) was used to support the findings. Analysis included examination of variation in community types (community composition and density) and whether variation of species composition varied in relation to bottom type.

Where the results showed that more than one community type was present, the composition of the area was examined to try to find characteristic species for each community type and the species that had the greatest effect on similarity were singled out (SIMPER, Clark and Warwick 1994). The SIMPER test evaluates average similarity within groups, here the community types, and average dissimilarity between groups, here the community types. It allows evaluation of which species explain the highest proportion of similarity. Average abundance ($\overline{x}$) was calculated for each species ($_i$) as well as average similarity within groups ($\overline{s}_i$) and standard deviation (SD($\overline{s}_i$)). A species with an even distribution within a group, has a low standard deviation, and so the $\overline{s}_i$ /(SD($\overline{s}_i$)) value will be high, indicating the species role in characterizing a community.

Table 3. Results of grain size analysis. Proportional weights (%) of sediment in each size category (mm). Gray area indicates the range of grain size identified as sand. *Niðurstöður úr kornastærðamælingu. Hlutfallsleg þyngd (%) sets í hverri sigtisstærð (mm). Gráa svæðið sýnir hvaða kornastærð telst sandur.*

Station *Stöð*	Wet weight (g) *Votvigt (g)*	8	4	2	1	0.5	0.25	0.125	0.063	<0.063 decant
Tal-1	94.17	1.0	14.4	0.6	0.2	0.2	0.1	0.3	20.3	62.9
Tal-2	82.14		3.8	1.5	1.5	1.5	2.5	3.7	9.8	75.6
Tal-4	55.07	4.0	6.2	2.8	1.7	3.4	9.4	24.4	45.2	3.0
Tal-5	142.46		3.1	4.1	2.1	1.8	2.4	2.3	4.0	80.2
Tal-7	179.59	1.0	4.7	0.3	0.4	0.6	1.4	2.8	6.3	82.4
Tal-8	223.24		0.6	0.6	0.5	1.0	29.0	45.7	8.2	14.3
Tal-9	224.54	1.3	3.9	0.3	0.9	1.4	3.3	4.1	6.2	78.6
Pat-1	199.49	19.5	1.2	0.2	0.2	1.5	3.3	6.6	25.4	42.1
Pat-2	137.40		6.0	0.6	0.4	0.6	1.8	4.4	7.8	78.4
Pat-4	97.50	24.8	1.2	0.2	0.3	6.5	14.1	8.1	18.5	26.2
Pat-5	112.66		1.3	0.9	1.6	1.2	1.9	2.4	3.3	87.5
Pat-6	149.16		1.7	0.3	0.4	0.7	4.2	33.4	55.4	3.9
Pat-7	211.77	0.3	1.1	0.3	0.2	1.0	3.9	24.0	20.1	49.0
Pat-8	109.47	1.6	1.0	1.5	1.2	1.4	1.8	2.0	3.6	86.0
Pat-9	144.41	1.2	4.4	4.5	3.1	5.1	10.2	8.2	8.2	55.0
Pat-10	93.75		7.0	1.1	1.2	2.5	4.6	6.3	9.5	67.9
Pat-11	190.9	0.4	5.5	0.6	0.6	0.7	1.0	1.1	1.8	88.3
Pat-12	146.86		8.4	1.8	1.1	0.5	0.6	0.8	1.4	85.3
Pat-13	184.67	7.5	2.0	0.3	0.3	0.4	0.7	0.8	1.8	86.2
Pat-14	137.1	0.8	8.3	0.2	0.1	0.3	0.7	2.0	4.3	83.3

Average dissimilarity and subsequently identification of species, explaining most of the dissimilarity, was calculated in the same way. A dissimilarity index was calculated for each species ($_i$) in all pairs of benthic faunal community samples (for instance, communities A and B: Bray-Curtis dissimilarity coefficient, $\delta_{AB}(_i)$, Clarke 1993) and average dissimilarity between groups ($\overline{\delta_i}$) and standard deviation (SD($\overline{\delta_i}$)). The proportional relationship of average dissimilarity and standard deviation from the mean ($\overline{\delta_i}$/SD($\overline{\delta_i}$)) indicated which species explained best the dissimilarity. The software package Primer 5v (Clarke and Gorley 2001) was used for this analysis. Maps were produced with ArcGIS online.

RESULTS

Bottom types in Tálknafjörður and Patreksfjörður

Measurements of grain size showed that in both fjords fine sediment (<0.063 mm/mud) was the dominant bottom type (table 3). Sediment with more than 55% mud was found at nine stations in Patreksfjörður and five stations in Tálknafjörður. Sand (0.063–2 mm) was dominant at stations 4 and 8 in Tálknafjörður (86.9 and 85.1%) and stations 4 and 6 in Patreksfjörður (47.8 and 94.4%). In Patreksfjörður, there was an equal proportion of sand and mud at station 7 and very mixed grain size was measured at stations 1 and 4. Comparison of quantitative grain size analysis and qualitative sediment descriptions during sampling, reveals that both methods readily distinguish between sand and mud, whereas mixed sediments (muddy sand) and mud are difficult to distinguish without grain size analysis.

TÁLKNAFJÖRÐUR

In all, 21.728 benthic animals from stations 1–9 (fig. 3) were counted and sorted into 146 taxa (see Appendix I). These animals represented 13 invertebrate phyla (table 4). Most animals were found at station eight, calculated to 38.900 animals pr. m^2. Fewest animals were at station 3 or 2.058 animals pr. m^2.

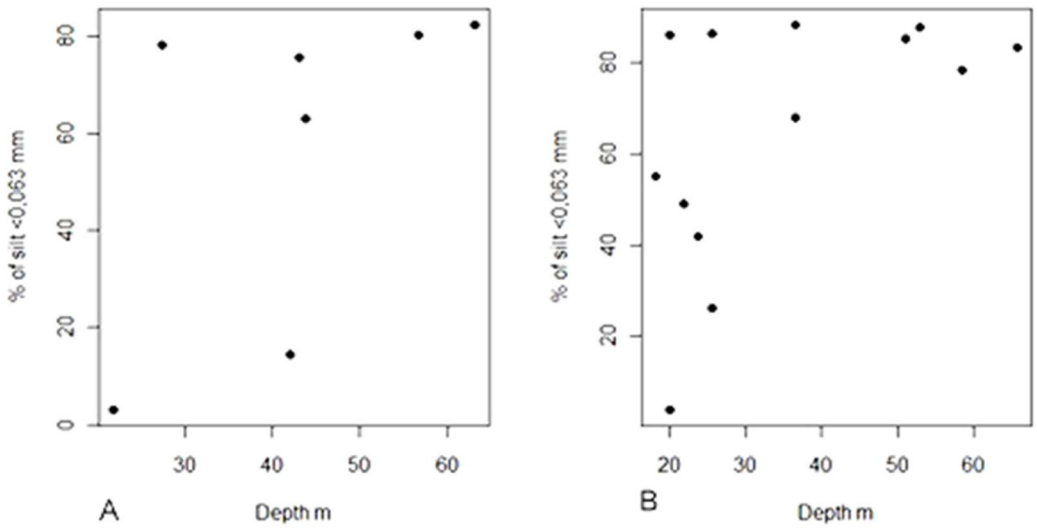

Figure 2. Correlation between proportion of fine sediment (<0,63um) and depth (m) in A) Tálknafjörður and B) Patreksfjörður. *Samband milli hlutfalls af leir (mm) og dýpis (m) í A) Tálknafirði og B) Patreksfirði.*

Table 4. Phyla found in Tálknafjörður (number of individuals or colonies per phylum). *Fylkingar á hverri stöð í Tálknafirði (fjöldi eintaka eða sambýla af hverri fylkingu).*

Phylum *Fylking*	Stations T1	T2	T3	T4	T5	T6	T7	T8	T9
Foraminifera	600	200	580	570	600	600	600	600	537
Porifera	1		1						41
Cnidaria	26	15	10		193		50		6
Nemertinea	21	1	12	6	9	23	5		
Nematoda	58	14	41	17	54	15	10	466	142
Kinorhynca	4				3		1		1
Sipuculida		1	1		1	1		7	2
Priapulida				1					
Mollusca	553	311	24	59	261	459	188	841	123
Annelida	1068	730	73	131	1057	744	680	3232	559
Crustacea	628	612	100	88	422	624	609	662	609
Echinodermata			2	11			2	1	3
Bryozoa	8	4	20	2	6	4	5	60	7

Species composition

Over 5000 foraminiferans were counted (limited counting to 200 pr. each sample) and the total number of ostracoda counted was over 4000 (also limited to 200 pr. sample), which is a high proportion of all counted individuals. When foraminiferans were omitted, the polychates belonging to phylum Annelida were dominant (fig. 4). Six taxa accounted for about 80% of the total abundance. Polychaetes and molluscs were dominant on this list (table 5). The polychaete *Galathowenia oculata* was most abundant (33% of all taxon frequency and 62% of the total number of polychaete specimens). *Cossura longocirrata* and *Eteone longa* contributed together 7% to the taxon frequency.

Figure 3. Sampling stations 1-9 in Tálknafjörður. *Sýnatökustöðvar 1-9 í Tálknafirði.*

Of crustacean, 12 species and specimens within 3 higher level taxa (ostracoda, isopoda and copepod) were recorded of which ostracoda was the most abundant (contribution 26.4% of all taxon frequency and 92% of the total number of crustacean specimens). Of mollusca, 19 species were identified, 9 were identified to genus level and six were recorded to higher level or as juvenile. The most abundant were *Ennucula tenuis* and *Nuculana minuta* (contributing almost 11% and 3% of all taxon frequency respectively and 59% and 14% of the total number of mollusca specimens). Few specimens belonged to other groups and among them echinodermata was represented by three species of Ophiuroidea.

Diversity

Diversity of the bottom fauna in Tálknafjörður ranged from 2.4–4.4 (H'log$_2$) with highest value at stations 4 and 3 (table 6) and lowest value at station 7. Stations 3 and 4 had the lowest number of individuals. There were 33 singletons (species represented by a single individual) and 54 species were unique to a one station.

Cluster analysis

Cluster analysis showed that all stations but 3 and 4 share a common community structure, as evidenced by their high degree of similarity (fig. 5). At these stations, the polychaete *Galathowenia oculata* (leirglyrna) was most abundant, but other common species were the molluscs *Ennucula tenuis* (gljáhnytla) and *Nuculana minuta* (trönusystir) and the polychaete *Cossura longocirrata* (langþráður).

Stations 3 and 4 cluster together but were less than 50% similar. It is therefore not entirely clear if these two stations represent the same community (fig. 5 & 6), although these are tentatively marked and analysed as community B. The SIMPER analysis compares the communities in clusters A and B (table 7) and shows which taxa contribute most to the differences of these communities. ANOSIM analysis showed a clear difference between community A and B (R = 1, $p > 0.5$, significance level 2.8%) and difference between sand and mud bottom (R=0,691, $p>0.5$, significance level 2.4%).

PATREKSFJÖRÐUR

A total of 29.640 benthic individuals were counted from 14 stations (fig. 8) and sorted into 176 taxa (see Appendix II). The fauna represented 13 invertebrate phyla (table 8). Most animals were found at station 2, calculated to 27.483 animals pr. m^2. Fewest animals were at station six or 4.825 pr. m^2.

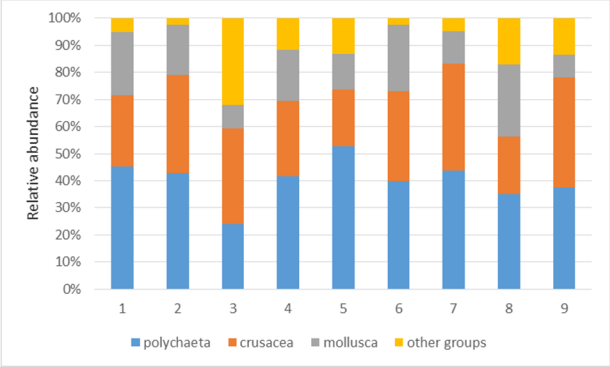

Figure 4. Most abundant phyla organized by station 1-9 from Tálknafjörður. *Þéttleiki helstu dýrahópa sem finnast á stöðvum 1-9 í Tálknafirði.*

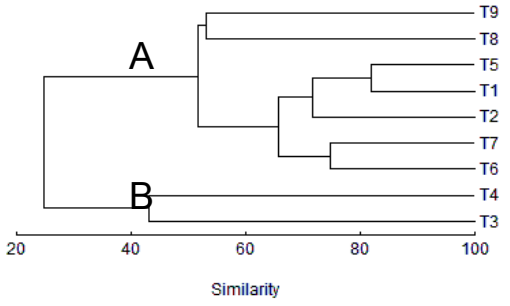

Figure 5. Cluster diagram of stations in Tálknafjörður based on Bray -Curtis coefficient of similarity. Groups A and B indicate communities by similarity. *Líkingagreining (Bray-Curtis) milli stöðva í Tálknafirði. A og B tákna tvö ólík samfélög.*

Table 5. The most common taxa (=species/groups), represent 80% of the faunal abundance in Tálknafjörður. Number of specimens, the proportion of each taxa of the total number of individuals, average specimen number in sample, and standard deviation (SD) of each taxa from all stations. (p) indicates species belonging to polychaete, (m) to mollusca and (c) to crustacea. *Algengustu tegundir/hópar í Tálknafirði sem leggja til 80% af heildar þéttleika. Fjöldi eintaka og hlutfall þeirra af heild, meðalfjöldi og staðalfrávik. (þ) táknar tegundir sem tilheyra burstaormum, (m) tilheyra samlokum og (c) krabbadýrum.*

Taxon *Tegund/hópur*	Number of specimens *Fjöldi eintaka*	Taxon % of all individuals *Hlutfall % af heild*	Average specimen number pr. sample *Meðalfjöldi eintaka í sýni*	SD *Staðal-frávik*
*Galathowenia oculata (p)/*leirglyrna*	5113	32.9	568	753
Ostracoda sp. (c) /skelkrabbar	4101	26,4	455,7	239
Ennucula tenuis (m) /gljáhnytla	1668	10,7	185,3	161,2
*Cossura longocirrata (p)/*langþráður*	802	5,2	89,1	117,5
Nuculana minuta (m) /trönusystir	408	2,6	45,3	45,3
Eteone longa (p) /leirlaufi	296	1,9	32,9	26,2

*Langþráður og leirglyrna eru tillögur að íslenskum nöfnum á þessum tegundum sem eru algengir burstaorma í sjó við Ísland. Nöfnin vísa til þess annars vegar að um er að ræða tegund með langan þráð sem vex út úr baki dýrsins og hins vegar að tegundin, sem er einn algengasti ormur á leirbotni við landið, hefur áberandi augu (e. oculus = auga).

Table 6. Number of taxa (S), specimens (N), evenness (J'), and diversity (H') for the stations in Tálknafjörður. Foraminiferans, Porifera, Hydrozoa, Bryozoa, Nematoda, larvae, and unidentified specimens were omitted. *Fjöldi tegunda (S), fjöldi einstaklinga (N), jafnvægis-stuðull (J') og fjölbreytileikastuðull Shannon (H') fyrir stöðvarnar í Tálknafirði. Götungar, svampar, hveldýr, mosadýr þráðormar, ungviði og ógreindir einstaklingar eru ekki tekin með.*

Station *Stöð*	S	N	J'	H'(log *e*)	H'($\log_2$)
T1	41	2270	0,6	2,19	3,16
T2	40	1658	0,5	1,74	2,50
T3	33	212	0,8	2,93	4,23
T4	54	296	0,8	3,02	4,36
T5	35	1750	0,6	2,10	3,04
T6	43	2470	0,5	1,83	2,63
T7	38	1840	0,5	1,69	2,44
T8	69	4822	0,5	1,96	2,82
T9	59	1588	0,5	1,97	2,84

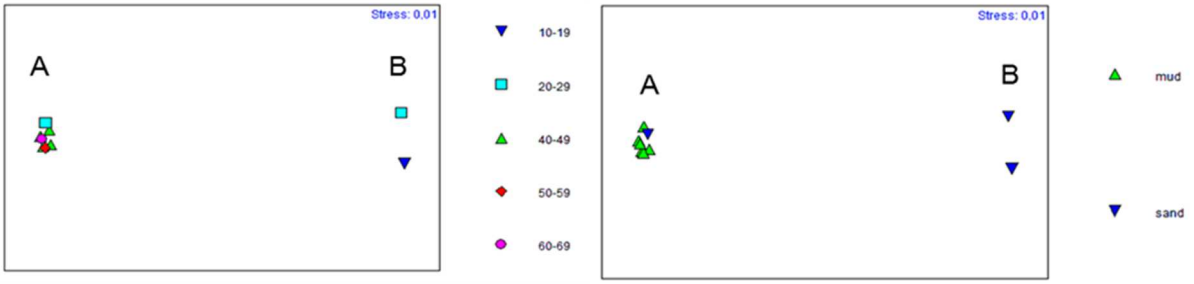

Figure 6. MDS showing grouping of stations by depth (left) and bottom type (right). A represents community found on mud bottom and B community found on sand bottom. *MDS greining sýnir hvernig stöðvarnar flokkast eftir dýpi (vinstri myndin) og botngerð (hægri myndin). A táknar samfélag á leirbotni og B táknar samfélag á sandbotni.*

Figure 7. Community distribution in Tálknafjörður. *Botndýrasamfélög í Tálknafirði.*

Table 7. Results of SIMPER comparison between communities A and B in Tálknafjörður. *Niðurstöur SIMPER greiningar til samanburðar á samfélögum A og B í Tálknafirði.*

	Communities/samfélög					
Taxon *Tegund/hópur*	A Average abundance *Meðal fjöldi*	B Average abundance *Meðal fjöldi*	Average dissimilarity *Meðal munur milli samfélaga*	Diss/SD *Staðalfrávik á mun*	Contribution (%) *Framlag (%)*	Cumulative (%) *Uppsöfnun (%)*
Ostracoda sp.	764,14	50,5	30,36	2,29	33,5	33,5
Galathowenia oculata	725,43	17,5	23,45	1,83	25,88	59,38
Ennucula tenuis	237,71	2	8,84	2,11	9,76	69,14
Cossura longocirrata	113,71	3	4,94	0,93	5,45	74,59
Nuculana minuta	58	1	2,25	1,39	2,48	77,07
Sternaspis scutata	37,43	0,5	1,54	1,58	1,69	78,77
Eteone longa	41,57	2,5	1,5	1,9	1,65	80,42
Maldane sarsi	37,57	0	1,32	0,58	1,46	81,88
Pholoe sp.	2	23	0,92	1,99	1,02	82,89
Prionospio steenstrupi	20,71	0	0,86	1,26	0,95	83,85

Species composition
Over 7000 foraminiferans were counted (limited counting to 200 pr. sample) and the total number of ostracoda counted was little less than 6000 (also limited to 200 pr. sample), which is a high proportion of all counted individuals. When foraminiferans were omitted, the polychaetes, with in the phylum Annelida, were dominant (fig. 9).

Ten taxa accounted for about 80% of the total abundance (table 9). Polychaetes and molluscs were dominant on this list (table 5). The polychaete *Galathowenia oculata* was most abundant (almost 36% of all taxon frequency and 52% of the total number of polychaete specimens).

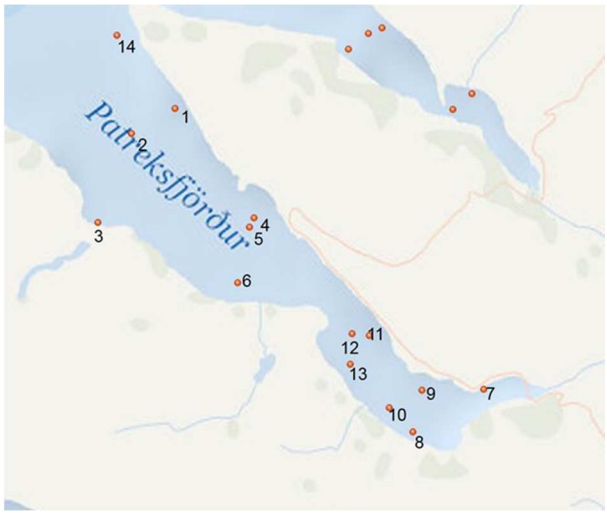

Figure 8. Sampling stations 1-14 in Patreksfjörður.
Sýnatökustöðvar 1-14 í Patreksfirði.

Table 8. Phylum found pr. station in Patreksfjörður (number of individuals or colonies per phylum). *Fylkingar á hverri stöð í Patreksfirði (fjöldi eintaka eða sambýla af hverri fylkingu).*

Phylum *Fylking*	Stations P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14
Foraminifera	600	600	420	513	500	600	300	600	208	400	600	600	400	600
Porifera			1				2	4				1		
Cnidaria	13	880	10		13	48	4	41	1	2	36	27	7	373
Nemertinea	19	23	3	8	7	14	1	7	2	2	2	4	1	1
Nematoda	57	184	7	158	71	13	10	18	87		48	80	5	28
Kinorhynca		9			2				1		1	1		
Turbellaria				1										
Sipuculida	2	2	1	6	2	4			1			1		
Mollusca	112	166	259	191	355	154	401	356	423	428	430	533	298	182
Annelida	509	1931	524	419	731	233	337	904	485	251	613	1092	412	910
Crustacea	164	656	425	301	436	98	603	613	501	607	613	561	611	101
Echinodermata	2	1	7	1		14	3	18	11	2	4	1	10	
Bryozoa	18	46	55	36	6	68	5	14	14	4	5	18	22	66

Table 9. Most common species/groups in Patreksfjörður. Abundance, percentage of total abundance, average abundance and standard deviation of each species/group from all stations. (p) indicates species belonging to polychaete and (m) to mollusca. *Algengustu tegundir/hópar í Patreksfirði. Fjöldi dýra og hlutfall þeirra af heild, meðalfjöldi og staðalfrávik. (p) táknar tegundir sem tilheyra burstaormum og (m) tilheyra samlokum.*

Taxon *Tegund/hópur*	Number of specimens *Fjöldi eintaka*	Taxon % of all individuals *Hlutfall % af heild*	Average specimen number pr. sample *Meðalfjöldi eintaka í sýni*	SD *Staðalfrávik*
Galathowenia oculata (p)/leirglyrna	9091	35.6	395.3	499.5
Ennucula tenuis (m) /gljáhytla	3551	13.9	154.4	123.1
Cossura longocirrata (p)/langþráður	3177	12.4	138.1	250.7
Nuculana minuta (m) /trönusystir	1185	4.6	51.5	44.6
Abra nitida (m) /lýsuskel	718	2.8	31.2	37.8
Eteone longa (p) /leirlaufi	680	2.7	29.6	21.9
Sternaspis scutata (p)	538	2.1	23.4	21.5
Thyasiroidea sp(p). (m)	422	1.7	18.3	24.9
Maldane sarsi (p)	376	1.5	16.3	37.6
Scoloplos armiger (p) /roðamaðkur	362	1.4	15.7	19.7

Cossura longocirrata, Eteone longa, Sternaspis scutata, Maldane sarsi and *Scoloplos armiger* contributed together 8% to the taxon frequency. Eight species and speciemens within 5 higher level taxa (ostracoda, tanaidacea, copepod, anomura and mydidacea) were recorded. A total of 33 taxa of molluscs were recorded. The most common of these were: *Ennucula tenuis* and *Nuculana minuta* (almost 14% and 5% of all taxon frequency respectively, or 50% and 22% of the total number of mollusca specimens). *Abra nitida* and Thyasiroidea sp(p). contributed together 4,5% to the taxon frequency. Few specimens belonged to other groups and among them echinodermata was represented by three species of Ophiuroidea.

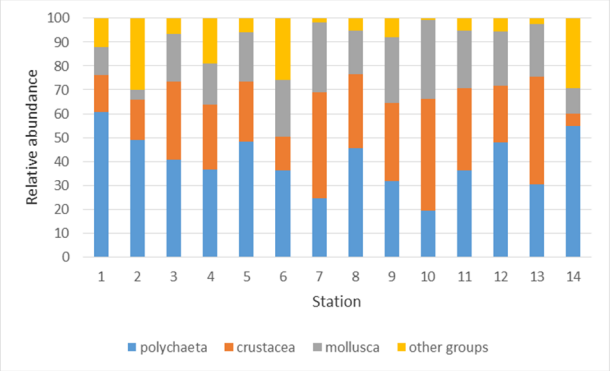

Figure 9. Most abundant phyla organized by station 1-14 from Patreksfjörður. *Þéttleiki helstu dýrahópa á stöðvum 1-14 í Patreksfirði.*

Diversity

Diversity of bottom fauna in Patreksfjörður is high. It ranged from 2.54-5.18 (Shannon H'log$_2$) and was highest at stations 6 and 1, but lowest at station 2 (table 10). There were 36 singletons (species represented by a single individual) and 51 were unique to a one station.

Cluster analysis

Cluster analysis showed that most stations grouped together in cluster A with >50% similarity, and can be considered as a specific community type. In group A, the polychaete *Galathowenia oculata* (leirglyrna) was the most common species but other less common species were the *Ennucula tenuis* (gljáhnytla) and the polychaete *Cossura longocirrata* (langþráður). Stations 1, 4 and 6 form cluster B. These stations share only about 50% or less similarity and cannot be considered as a specific community type (fig. 10).

As indicated in figures 10 and 11, benthic community type A is found on mud bottom. Two subgroups (A1 and A2) could be detected and as shown in the MDS plot, these are split by depth. The bottom type in subgroup A1 is slightly more mixed with sand, while proportion of mud at stations in A2 is between 83-88%.

Table 10. Number of taxa (S), specimens (N), evenness (J'), and diversity (H') for the stations in Patreksfjörður. Foraminiferans, Porifera, Hydrozoa, Bryozoa, Nematoda, larvae, and unidentified specimens were omitted. *Fjöldi tegunda/hópa S, fjöldi einstaklinga (N), jafnvægisstuðull (J') og fjölbreytileikastuðull Shannon (H') fyrir stöðvarnar í Patreksfirði. Götungar, svampar, hveldýr, mosadýr, þráðormar, ungviði og ógreindir einstaklingar eru ekki tekin með.*

Station *Stöð*	S	N	J'	H'(log*e*)	H'($\log_2$)
P1	75	643	0.8	3.56	5.14
P2	37	2084	0.5	1.76	2.54
P3	53	795	0.6	2.24	3.24
P4	82	609	0.8	3.40	4.90
P5	31	1090	0.7	2.28	3.28
P6	73	406	0.8	3.59	5.18
P7	32	742	0.5	1.88	2.72
P8	38	1269	0.5	1.86	2.69
P9	57	931	0.7	2.77	4.00
P10	31	683	0.6	2.02	2.91
P11	40	1057	0.6	2.15	3.10
P12	32	1631	0.6	2.05	2.95
P13	54	724	0.7	2.70	3.89
P14	30	1097	0.6	1.94	2.80

BENTHIC COMMUNITIES IN TÁLKNAFJÖRÐUR AND PATREKSFJÖRÐUR

To test the similarity of benthic communities in the two fjords, a cluster analysis was conducted on the combined data set (figs. 13 & 14). Those stations where the bottom is made of fine grains (mud and muddy sand) share a distinct community type, therefore most stations in Tálknafjörður and in Patreksfjörður are clustered together. Stations with coarser sediments (sand or mixt grain sizes) show lesser similarity. The two stations on sand bottom in Tálknafjörður are here marked as B1 (fig.13). They do not cluster with stations on sand or mixed bottom in Patreksfjörður, marked as B2.

ANOSIM analysis of the three groups showed high significant difference between these (R=0.966, p=0.1). SIMPER analysis showed that average similarity for stations on mud bottom (community A) was 54%. Average similarity in group B1 was 32%, and for mixed bottom sediments in group B2 the similarity was 42%. In community A, eight species were responsible for 90% of the similarity, with *Galathowenia oculata*, *Ennucula tenuis* and *Cossura longocirrata* comprising 75% of it. On sand bottom in group B1, 11 species were responsible for 90% of the similarity with *Pholoe* sp., *Spio* sp., and *Scoloplos armiger* comprising most of the similarity. On mixed bottom in B2, no particular species contribute to most of the similarity, as there are 27 species that jointly explain 90% of the similarity. Average dissimilarity between these groups (A and B1, A and B2 and B1 and B2) was 76-78%.

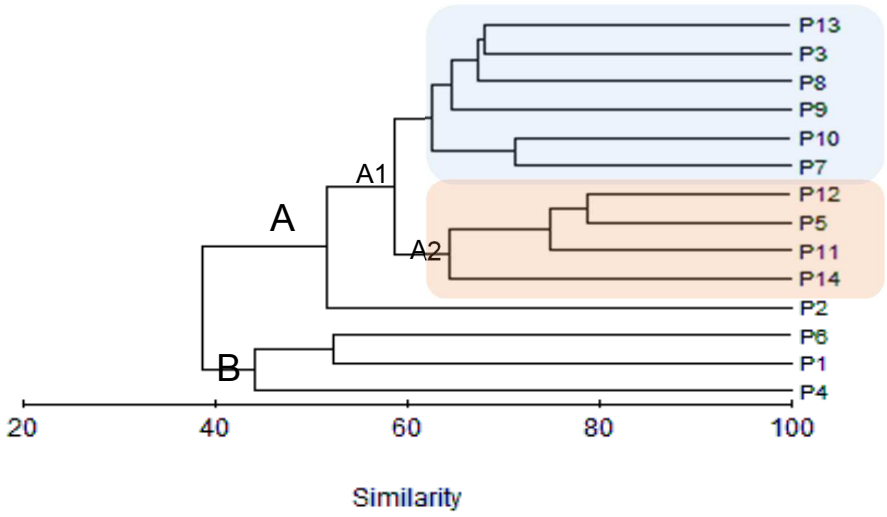

Figure 10. Cluster diagram of stations in Patreksfjörður based on Bray-Curtis coefficient of similarity. Two main groups are resolved: A and B. Group A is further divided in subgroup A1, Including stations at depths between 18-36 m, and subgroup A2, including stations at depths 36-66 m. *Líkingagreining stöðva í Patreksfirði leiðir í ljós hópana A og B, auk undirhópinn A1, sem inniheldur stövar á 18-36 m dýpi og undirhópinn A2, sem inniheldur stöðvar á 36-66 m dýpi.*

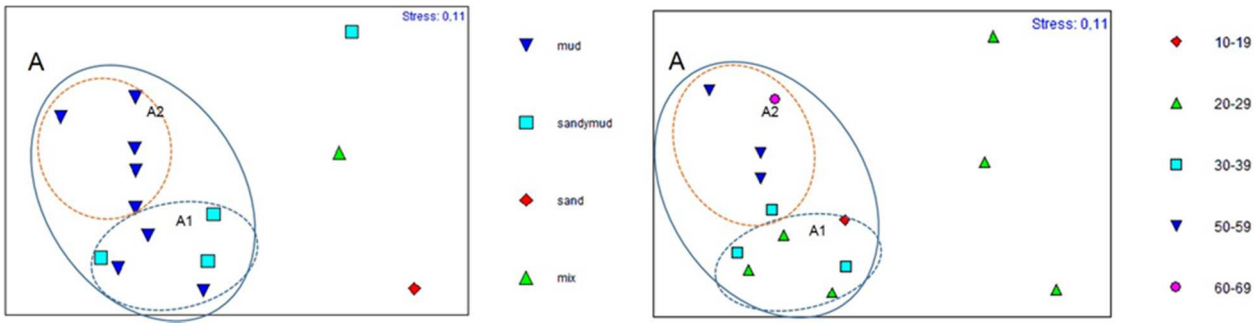

Figure 11. MDS grouping of stations by bottom type (left) and depth (right). The circles show community A and the subcommunities A1 and A2. Stations of group B of the cluster analysis are dispersed in the MDS graph, reflecting their low similarity. *MDS greining stöðva eftir botngerð (vinstri mynd) og dýpi (hægri mynd). Hringirnir sýna samfélag A og undirsamfélögin A1 og A2. Stöðvar í hóp B dreifast um MDS grafið, enda ólíkar innbyrðis.*

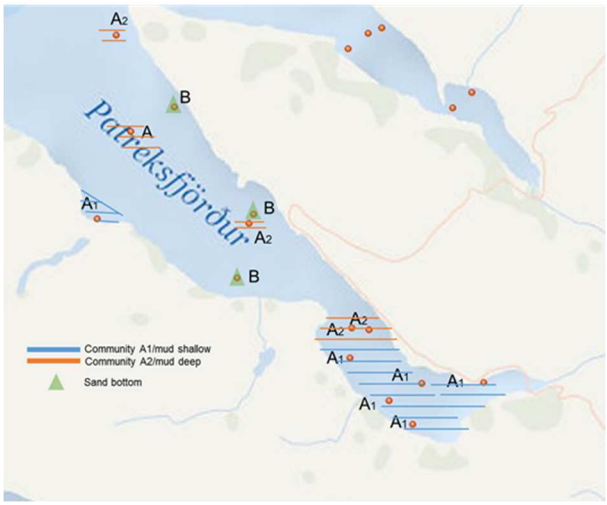

Figure 12. Benthic communities in Patreksfjörður. *Botndýrasamfélög í Patreksfirði.*

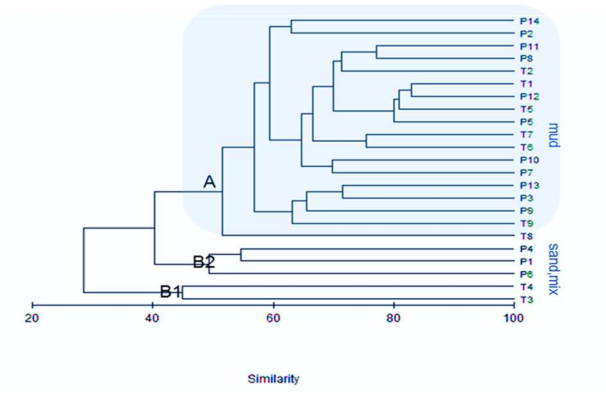

Figure 13. Cluster diagram of stations in Tálknafjörður & Patreksfjörður based on Bray-Curtis coefficient of similarity. Cluster A includes stations found on mud bottom. *Líkingagreining stöðva í Tálknafirði og Patreksfirði. Hópur A inniheldur stöðvar á leirbotni.*

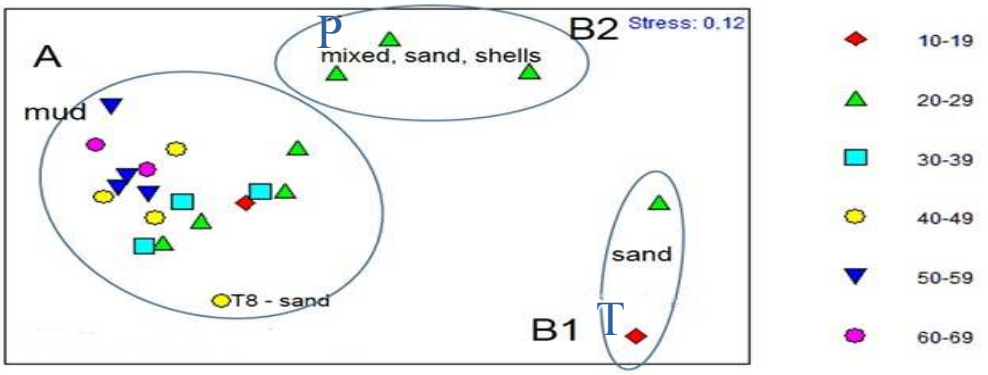

Figure 14. MDS grouping of Tálknafjörður (T) and Patreksfjörður (P). Community A is the same in both fjords, while groups B1 (in T) and B2 (in P) are different in the fjords. MDS greining fyrir Tálknafjörð (T) og Patreksfjörð (P). *Samfélag A er það sama í báðum fjörðum, en hópar B1 (finnst í T) og B2 (finnst í P) eru innbyrðis ólíkir.*

DISCUSSION

The benthic fauna of Tálknafjörður and Patreksfjörður is rather similar. As common in Icelandic fjords, the polychaete macrofauna is often dominating. Bivalves are also in high numbers, but other group less so. Most species found in the current study are well known locally. The most common species, the polychaete *Galathowenia oculata* (also known as *Myriochele oculata)*, occurs widely in Icelandic coastal waters (Parapar 2003, Sigmar A. Steingrímsson 2009, Steinunn H. Ólafsdóttir & Sigmar A. Steingrímsson 2007, Hafsteinn Guðfinnsson *et al*. 2001, Jörundur Svavarsson & Arnþór Garðarsson 1985, Kristín Aðalsteinsdóttir & Arnþór Garðarsson 1980). It is also commonly encountered in fjords in northern Norway (Holte 1998, Oug 2000). The most common bivalves are *Ennucula tenuis* and *Nuculana minuta.* These species are known from all around Iceland, and are common in Ísafjarðadjúp (Þorleifur Eiríksson *et al*. 2012). High densities of foraminiferans and ostracods are observed at most stations. Both groups are common on the seafloor both in deep and shallow coastal waters. The study of Böðvar Þórisson *et al*. (2012a) in Patreksfjörður, shows similar results, where the most common species were *Galathowenia oclulata, Cossura longocirrata, Ennucula tenuis* and *Nuculana pernula* (or *N. minuta* – discerning between these species is very difficult).

Diversity was high in both fjords, with H'_{log2} up to 4 and 5. Grain size, organic material, nutrition, and depth are among the most important variables in determining benthic faunal communities (Ellingsen 2002). Variability in bottom type and depth in a given area may increase the likelihood of varied community types. Benthic fauna community characteristic for mud bottom was found in both Tálknafjörður and Patreksfjörður. More than one community in a single fjord is not uncommon where often a specific community has been related to mud bottom (Jörundur Svavarsson & Arnþór Garðarsson 1985, Steinunn H. Ólafsdóttir & Sigmar A. Steingrímsson 2007, Sigmar A. Steingrímsson 2009). The central channels of both fjords, where depth was greatest, had mud bottoms but the sediments in shallower waters were coarser. The proportion of mud in the sediment often increases with depth, making it difficult to discern which has more influence on the community, the depth or the sediment composition. It is possible to say that mud covers a much larger area of the bottom than sand or mixed sediment. Thus, community on mud bottom is expected to be dominant in these two fjords. However, this study shows that caution is needed when comparing two or more sites within fjords, as species composition can vary, especially at shallower sites with coarse sediment.

G. oculata, *C. longocirrata* and *E. tenuis* are deposit-feeders, eating organic sediment particles (Fauchal & Jumars 1979, Weslawski *et al*. 2003). Carnivores and filter feeders are uncommon. Species that burrow into the sediment or feed on the surface are sensitive to grain size. Coarseness of sediment grains and physical aspects, such as adhesion are important in shaping benthic communities. In many cases, animals have evolved specific ways of digging within a specific range of grain sizes (Drogan *et al*. 2006). For this reason, changes in grain size can have strong effects on the species composition of the community. Sediment type can be an indication of currents and usually where mud is present there is little current. Furthermore, it's often the case that where the sediment is coarse the current or wave

action is stronger. It was observed in this study that communities at on sandy bottom were dissimilar, and differed also from those on muddy bottom. This could be due to changes in the species composition caused by changes in the environmental conditions at sandy bottom. On the other hand, environmental conditions on mud bottom are relatively stable; therefore it is possible that benthic communities have developed a recognizable type.

In Tálknafjörður, studies have been conducted on the effects of aquaculture in the vicinity of farming cages, located close to station nr. 2 in the present study (Böðvar Þórisson *et al*. 2012b). Their study showed that the aquaculture had dramatic effect on the fauna. Nearly all of the polychaete species were almost absent directly underneath the cases. The long-term effect of the aquaculture on the benthic community has not yet been studied, and the recovery rate is unknown. Based on the present study, the effect of stress can be estimated on a larger scale and this can be an important part of possible risk assessment for different types of stress.

CONCLUSION

General knowledge of the fauna within fjords is useful and provides a basis for studies of possible future changes in the ecosystem.

Studies in Norway have shown that the effects of aquaculture on the benthos are most often local and only detected in close vicinity of the cages (Kutti *et al*. 2007). It is important to study the benthic communities close to the aquaculture cages and outside their area of impact, considering also local effects of natural environmental variations. It could mean, in this case, that where the sediment is more coarse at shallower sites, the stronger the currents and wave action may be and thus it seems more likely the waste from the aquaculture is dispersed faster and further away over the bottom beneath the cages. However, the variation of the fauna on shallow sand bottom is greater than in the deeper parts of the fjords. Effects of pollution at species compositions on sandy bottom could be more dramatic and thus diminish local species diversity. In the central channels of the fjords, the depth is greater and the bottom consists of mud, where a specific community has evolved. This community is presumably very important part of the whole ecosystem of the fjords, as mud covers high portion of the seafloor in these fjords. The polychaetes *Galathowenia oculata, Cossura longocirrata* and the molluscs *Ennucula tenuis* and *Nuculana minuta* were found in most abundance and all of these species were sensitive to the effects of the aquaculture (Böðvar Þórisson *et al*. 2012b). Ranking species as vulnerable or opportunistic in relation to effects or pollution has not been performed for benthic species in Icelandic waters. According to the AMBI (*Azti* Marine Biotic Index, http://ambi.azti.es/) assessment of the quality of benthic macro invertebrates assemblages by calculating the homonymous index, these species are ranked as very sensitive (*N. minuta* in group I) to higher tolerance (*C. longocirrata* in group IV). The results of Böðvar Þórisson *et al.* (2012b) indicate the need to review the AMBI indices for Icelandic waters.

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Appendix I. Taxa and species identified from stations 1-9 in Tálknafjörður. *=taxa only counted to 200 pr. sample (3 sample pr. station)

			Station/stöð									
Taxa	**hópur**	**Species/tegund**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total nr.**
Foraminifera*	**Götungar**		600	200	580	570	600	600	600	600	537	4887
Porifera	**Svampar**		1		1						41	43
Hydrozoa	**Hveldýr**		26	15	10		193		50		6	300
Nemertea	**Ranaormar**		21	1	12	6	9	23	5			77
Nematoda	**Þráðormar**		58	14	41	17	54	15	10	466	142	817
Kinorhyncha	**Hnykkhöfðar**		4				3		1		1	9
Annelida	**Liðdýr**											
	Oligochaeta			5	5							10
	Polychaeta unidentified							1				1
		Phyllodocidae sp.		2						2		4
		Hesionidae sp.								1		1
		Aphroditidae sp.				2	1					3
		Polynoidae sp(p).				1		5	1	11	27	45
		Eunoe nodosa					1					1
		Bylgides sarsi			1							1
		Phyllodoce mucosa/groenlandica								3		3
		Pholoe sp.	1	3	15	31	1			9		60
		Eteone longa	53	4	2	3	46	44	54	71	19	296
		Syllidae sp(p).						1		12	18	31
		Sphaerosyllis sp.			1							1
		Syllis cornuta	2	1						1		4
		cf. Syllis armillaris	1	1								2
		Microphthalmus sp.	19	2			32	1	8	6	5	73
		Apistobranchus tullbergi									1	1
		Nephtyidae sp(p).						9	4	4	5	22
		Nephtys sp.	8	4			11		7	5	1	36
		Nereis zonata				1						1
		Glyceridae sp.						2			3	5

		Station/stöð									
Taxa/hópur	Species/tegund	1	2	3	4	5	6	7	8	9	
	Glycera alba				1						1
	Goniada maculata								2		2
	Dorvilleidae sp(p)	12	2	0	1	13	25	10		5	68
	Sphaerodoridium sp.						4				4
	Onuphidae sp.									9	9
	Nothria conchylega				14				1	1	16
	Eunicidae sp.									2	2
	Lumbrineridae sp.					1			1	1	3
	Scoletoma fragilis									7	7
	Scoloplos armiger	3	3	26	8	3	10	1	15	49	118
	Spionidae sp.						20	4	8	20	52
	Spio sp.	6	7	10	26	18		6	4		77
	Prionospio steenstrupi	25	3	0	0	24	41	39	11	2	145
	Polydora sp.				1					3	4
	Levinsenia gracilis					1		1		3	5
	Aricidea suecica	8	2			13	9	15	1	4	52
	Paraonidae sp.						4			1	5
	Cirratulidae sp(p).								5	6	11
	Chaetozone setosa	7	1			12	14	8	1	4	47
	Chaetozone sp.				1						1
	Cossura longocirrata	309	49	3	3	278	40	44	26	50	802
	Scalibregmatidae sp.								2		2
	Scalibregma inflatum						1		2		3
	Sternaspis scutata	72	41	1		27	66	33	20	3	263
	Capitellidae sp.			1			1				2
	Notomastus sp.	1						1			2
	Capitella capitata									1	1
	Heteromastus filiformis									4	4
	Maldanidae sp.	4	4			1		5			14
	Maldane sarsi		2				1	3	144	113	263
	Praxillella gracilis	1	2			1					4

			Station/stöð									
Taxa/hópur		Species/tegund	1	2	3	4	5	6	7	8	9	
		Praxillella praetermissa								4		4
		Praxillella sp.	2				1	13	2	2		20
		Rhodine gracilior				1						1
		Oweniidae sp.				1				249		250
		Galathowenia oculata	482	589	5	30	547	390	408	2493	169	5113
		Owenia fusiformis								1		1
		Terebellomorpha sp(p).						5				5
		Terebellidae sp(p).						6	1	1	1	9
		Terebellides stroemii	1						1		1	3
		Diplocirrus glaucus						1				1
		Brada villosa						1			2	3
		Laphania boecki					1					1
		Polycirrus medusa					1					1
		Lagis koreni			2	4		2		83	14	105
		Pectinariidae sp.			1	1						2
		Melinna cristata	2						1	1		4
		Melinna sp.		1								1
		Ampharete borealis	2	1								3
		Ampharetidae sp.				1						1
		Euchone analis	46	1	0		22		21	9	2	101
		Euchone papillosa								3		3
		Euchone sp.	1					27	2	9		39
		Sabellidae spp.					1			8	3	12
Sipuncula	**Sæbelgir**			1	1		1	1		7	2	13
Priapulida	**Maðkamóðir**					1						1
Crustacea	**Krabbadýr**											
	Ostracoda*		600	600	33	68	400	600	600	600	600	4101
	Amphipoda			1				2	1	2	3	9
		Protomedeia fasciata			13					1		14
		Dulichia falcata	1									1
		Orchomenella minuta	1									1

			Station/stöð									
Taxa/hópur		Species/tegund	1	2	3	4	5	6	7	8	9	
	Isopoda									2		2
	Tanaidacea				14							14
		Akanthophoreus gracilis			4							4
	Cumacea			1	9			21	7	32	6	76
		Leucon sp.	1									1
		Leucon nasicoides				4						4
		Leucon cf. *nasica*	1			1						2
		Leucon nathorsti	1		1					8		10
		Eudorellopsis deformis			21							21
		Eudorella emarginata	13	8			16			5		42
		Brachydiastylis resima				4				1		5
		like Brachydiastylis resima				2						2
	Cirripedia	*Semibalanus balanoides*				1						1
		Balanus balanus				1						1
	Copepoda		10	2	5	7	6	1	1	11		43
Mollusca	**Lindýr**											
	Aplacophora							6			5	11
		Chaetoderma nitidulum		1		4						5
		Caudofoveata sp.				1						1
	Polyplachophora					1						1
	Bivalvia	Bivalvia juvenile			2							2
		Ennucula tenuis	358	174	3	1	162	395	144	395	36	1668
		Nuculanidae unidentified			2	1				1		4
		Nuculana minuta	117	66		2	75	9	29	101	9	408
		Nucula sp.	1									1
		Yoldia hyperborea		1		0				2		3
		Crenella decussata			1	15				9	12	37
		Musculus sp.						3	2		2	7
		Musculus discors								12		12
		Modiolus modiolus	1	1	1	2						5

			Station/stöð									
Taxa/hópur		Species/tegund	1	2	3	4	5	6	7	8	9	
		Modiolaria sp.	2							6		8
		Mytilidae juvenile		3								3
		Astarte elliptica				1						1
		Astarte sp.								2	13	15
		Arctica islandica		2	8			1		5	1	17
		Thyasiroidea sp(p).	52	16	4	1	17			24	5	119
		Thyasira flexuosa		37				22	6	82		147
		Parvicardium sp.								3	5	8
		Parvicardium pinnulatum				13				7		20
		Abra nitida	19	10		2	4	14	3	128	21	201
		Macoma calcarea				1				46	4	51
		Mya arenaria			1	2				11	1	15
		Thracia sp.			2	3				3	1	9
		Portlandia sp						6	2	4		12
	Gastropoda	Prosobranchia sp.					2					2
		Lepeta caeca				2					4	6
		Margarites cinereus				1					1	2
		Margarites sp.				2						2
		Moelleria costulata				1						1
		Lacuna vincta				1						1
		Rissoidae juvenile				2						2
		Euspira pallida									1	1
		Lora sp.									1	1
		Ophistobranchia sp.	3				1	3	2		1	10
Echinodermat	**Skrápdýr**											
	Ophiuridea	*Ophiura* sp.				2				1	2	5
		Ophiuroidea juvenile				2			2			4
		Ophiura albida			2	6			0		1	9
		Amphipholis squamata				1						1
Bryozoa	**Mosadýr**		8	4	20	2	6	4	5	60	7	116

Total number of speciemens* pr. 0.12 m^2	2367	1688	284	315	2006	1870	1550	5268	1493	16841
Calculated number pr. m^2	19725	14066,7	2366,7	2625	16716,7	15583,3	12916,7	43900	12441,7	
Total number of taxa	47	44	41	59	40	46	44	70	65	
*foraminifera excluded										

Appendix II. Taxa and species identified from stations 1-14 in Patreksfjörður. *=taxa only counted to 200 pr. sample (3 sample pr. station)

			Station/stöð														
Taxa	**hópur**	**Species/tegund**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**Total**
Foraminifera*	**Götungar**		600	600	420	513	500	600	300	600	208	400	600	600	400	600	6941
Porifera	**Svampar**				1				2	4				1			8
Hydrozoa	**Hveldýr**		13	880	10		13	48	4	41	1	2	36	27	7	373	1455
Nemertea	**Ranaormar**		19	23	3	8	7	14	1	7	2	2	2	4	1	1	94
Nematoda	**Þráðormar**		57	184	7	158	71	13	10	18	87		48	80	5	28	766
Turbellaria	**Flatormar**					1											1
Kinorhyncha	**Hnykkhöfðar**			9			2				1		1	1			14
Annelida	**Liðdýr**																
	Oligochaeta		4	24		2	1							2		1	34
	Hirudinea							1									1
	Polychaeta unidentified			2				2		15		1			2	2	24
		Phyllodocidae sp(p).	2			1					3						6
		Polynoidae sp(p).	4		5	1		15		4	1	1			16		47
		Gattyana cirrhosa	2			2					1				1		6
		Lepidonotus squamatus				1											1
		Harmothoe imbricata	2					1									3
		Pholoe sp(p).	14	2	5	12	1	6			8		2	3			53
		Phyllodocidae sp(p).	2	7													9
		Eteone longa	30	61	6	42	38	10	3	21	22	13	19	66	16	37	384
		Syllidae sp(p).	7			1		2		5		1	1	2	4	1	24
		Sphaerosyllis sp.						1									1
		cf. *Syllis cornuta*		2		3					4			3			12
		Syllis gracilis				1											1
		cf. *Syllides longocirratus*				2											2
		Procerastea sp.				1											1
		Microphthalmus sp.		29		1	4		6	2		5	12	9	1	23	92
		Apistobranchus tullbergi				3		1			1				1		6
		Nephtys sp.	7	14	6		8	2	6	14	39	9	7	11	10	2	135
		Nephtys cf. *paradoxa*							6								6

			Station/stöð														
Taxa	hópur	Species/tegund	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
		Nereidinae sp.	9			1										1	11
		Nereis zonata	0			3											3
		Nereis sp.	21			2		8									31
		Glyceridae sp.													3		3
		Goniada maculata	1		1			4			1	1					8
		Eunicidae sp.	5	2	1												8
		Dorvilleidae sp.	8	50	1	2	7	4	1		5	3	3	6	2	23	115
		Sphaerodoridium sp.		2	1			1		1							5
		Onuphidae sp.			2		1	3		1					2		9
		Nothria conchylega				20											20
		Lumbrineridae sp.	1														1
		Scoletoma fragilis	2			1							1			1	5
		Lumbrineris cf. *tetraura*	1			1		1									3
		Scoloplos armiger	29	2	18	87	3	13	0	15	24	3	7	24	19		244
		Spionidae sp.	42	12	11	17	11	47	1	9	9	2	5	1	10	16	193
		Spio sp.				4					2						6
		Prionospio steenstrupi	12	80	2	1	27			5		9	8	15		34	193
		Polydora sp.	2		2	1		1	1		1						8
		Levinsenia gracilis	43	2	1	29		11									86
		Aricidea suecica	1	34	1	6	24	3	3	5	5	1	3	13	6	13	118
		Paraonidae sp.			1	11					3						15
		cf. *Paradoneis lyra*				1											1
		Paraonidae sp A.			1	11					3						15
		Cirratulidae sp(p).	3	10	1		1	3							1	1	20
		Chaetozone setosa	11	9	2	6	8	2		2	1		3	4	3	10	61
		Chaetozone christiei						1									1
		Chaetozone sp.				1		1			1						3
		Cirratulus sp.	8														8
		Cirratulus cirratus				9		1			1						11
		Cossura longocirrata	64	1183	22	56	199	7	20	86	61	8	113	173	11	372	2375
		Scalibregma inflatum									1						1
		Sternaspis scutata	6	47	1	1	45	0	2	26	31	18	39	34	5	20	275

			Station/stöð														
Taxa	hópur	Species/tegund	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
		Capitellidae sp.	7	3		1		3									14
		Heteromastus filiformis	3		1	3		2									9
		Mediomastus sp.				5											5
		Notomastus sp.				1										2	3
		Maldanidae sp.	7	17	9	2	6	4	1		1			2	1	5	55
		Maldane sarsi	10		19	4		7	1		18				54		113
		Praxillella gracilis														2	2
		Praxillella sp.	1	3		1									1		6
		Petaloproctus sp.				1											1
		Rhodine sp.	2														2
		Rhodine gracilior	3			3											6
		Nicomache sp.	1			2											3
		Oweniidae sp.				1	1						1		2		5
		Galathowenia oculata	90	208	377	31	269	45	282	687	227	164	378	661	224	335	3978
		Owenia fusiformis		2	7										1		10
		Euchone analis	9		10	2	66		2	1	5		3	56		2	156
		Euchone papillosa	4	118	6			1		1		6			2	4	142
		Euchone sp.			1							4					5
		Sabellidae sp.		1			7	8			1				2	1	20
		Terebellomorpha sp(p).	4	2	1			3		2							12
		Terebellidae sp(p).	2									2			3	1	8
		Terebellides stroemii	10	1		1	1	5	2				1	1	1	1	24
		Terebellides sp.													1		1
		Terebellinae sp.				1	1										2
		Laphania boecki				3							1				4
		Polycirrus medusa					1							1			2
		Lagis koreni	2		1	9		2		2	5		5	2	6		34
		Cistenides granulata				1											1
		Pectinariidae sp.				1											1
		Ampharete borealis					1										1
		Ampharete sp.		1													1
		Melinna cristata												3			3

			Station/stöð														
Taxa	hópur	Species/tegund	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
		Flabelligerida sp.	3	1	1								1				6
		Brada villosa	5			1									1		7
		Diplocirrus glaucus	1														1
		Serpulidae sp.	1					1									2
		Ctenodrilus sp.				1											1
Sipuncula	**Sæbelgir**		2	2	1	11	2	4			1			1			24
Crustacea	**Krabbadýr**																
	Ostracoda*		104	600	413	267	401	67	600	600	477	600	600	537	600	85	5951
	Amphipoda		7	2	2	1		4			1				4		21
		Gammarus sp.						1									1
		Protomedeia fasciata									1						1
		Ampithoe rubricata						1									1
	Tanaidacea				1	1		2			2						6
	Cumacea		12	12	4	1		7		7	0	4			6	8	61
		Leucon sp.					3			1	6		8				18
		Leucon cf. *nasica*							2					1			3
		Eudorella emarginata				2	2				9		2	6			21
	Isopoda				1												1
		Pleurogonium spinosissimum									1						1
		Pleurogonium sp.									1						1
	Cirripedia		14					1									15
		Balanus cf. *crenatus*				1											1
	Copepoda		14	35		27	30	3	1		3		3	16			132
	Brachyura		1											1			2
		Hyas coarctatus						1									1
	Anomura							2							1		3
	Mysidacea			7													7
Mollusca	**Lindýr**																
	Aplacophora		2	2	3			3	1	2	1			1	4		19
		Chaetoderma nitidulum				3				1	1		1				6
	Polyplacophora		1					6									7
	Bivalvia	Bivalvia juvenile				5		2			2						9

			Station/stöð														
Taxa	hópur	Species/tegund	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
		Ennucula tenuis	8	155	79	1	185	5	189	124	154	264	228	278	76	137	1883
		Nuculanidae unid.	2					4	4	4			4				18
		Nuculana minuta	9	1	35	11	133		84	111	72	77	78	113	20	33	777
		Portlandia sp.	3		1				3				2				9
		Yoldia hyperborea		1							1				1	1	4
		Crenella decussata			3	39		26		1	35	1	1		17		123
		Musculus sp.								1					1		2
		Musculus discors	2					4			1		2				9
		Modiolus modiolus	1					1					2	1	3		8
		Mytilidae sp.				1		1			1	3			1		7
		Dacrydium vitreum											2		5		7
		Astarte crenata				2					3						5
		Astarte sulcata				3											3
		Astarte elliptica				4		1									5
		Astarte sp.	6		1	4		4			3				1		19
		Arctica islandica	3		3				2	9	8	1	2		5		33
		Heteranomia squamula				1											1
		Thyasiroidea sp(p).	4		3	6	29		72	10	17	23	39	95	1	4	303
		Thyasira flexuosa		6	23			1		11	17	23	5		29		115
		Parvicardium pinnulatum	23		2	54		1	1		12	2					95
		Parvicardium sp.			8			25		2			2		9		46
		Abra prismatica				27						1			2	2	32
		Abra nitida	10		84	1	5		35	67	82	31	60	39	103		517
		Abra juvenile			0	2											2
		Macoma calcarea			6			3	2	3	7	1			4		26
		Mya arenaria	6		2			1		2		1			6		18
		Thracia sp.				4		7									11
		Hiatella arctica						5									5
		Pecten juvenile						1									1
	Gastropoda	Prosobranchia unidentified		1	3			3	1	6			1		4		19
		Puncturella noachina	1														1
		Lepeta caeca	6			15											21

			Station/stöð														
Taxa	hópur	Species/tegund	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
		Gibbula tumida						2									2
		Margarites cinereus				1		1									2
		Margarites sp.				1		4									5
		Moelleria costulata	1								2						3
		Moelleria juvenile	2					2									4
		Lacuna vincta	1														1
		Rissoidae juvenile						3	1								4
		Onoba semicostata	4			1		6	2					1	1		15
		Ariadnaria borealis	1														1
		Euspira pallida						1							1		2
		Euspira sp.									1						1
		Boreotrophon clathratus	3														3
		Boreotrophon sp.	1														1
		Lora sp.	3				1	1			1						6
		Limacina sp.								2							2
		Ophistobranchia sp.	9		3	5	2	30	4		2		1	5	4	5	70
Echinodermata	**Skrápdýr**																
	Ophiuroidea	*Ophiura* sp.		1	5			2			1	1					10
		Ophiuroidea juvenile	1		1			2	1	2	6	1					14
		Ophiura albida	1		1	1		3	2	16	4		4	1	10		43
		Ophiopholis aculeata						3									3
		Amphipholis squamata						4									4
Bryozoa	**Mosadýr**		18	46	55	36	6	68	5	14	14	4	5	18	22	66	377

Total number of speciemens* pr. 0.12 m^2	883	3898	1288	1125	1623	637	1366	1970	1526	1293	1752	2319	1366	1653	22699
Calculated number pr. m^2	7358	32483	10733	9375	13525	5308	11383	16417	12717	10775	14600	19325	11383	13775	
Total number of taxa	88	50	64	93	41	89	41	47	70	38	48	44	63	38	

*foraminifera excluded