C-survey at Fossfjörður, 2022

Arnarlax ehf

Akvaplan-niva AS Report: 2022 64107.01

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Arnarlax ehf. C-Survey at Fossfjörður, 2022.

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Arnarlax ehf

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Summary

The results from the monitoring at the farming site Fossfjörður in June 2022 showed that the sediment was somewhat loaded with organic carbon and the copper concentrations were within reported natural levels for bottom sediment around Iceland (Egilsson *et al.*, 1999). The fauna might be somewhat disturbed at C2alt and C4 (nEQR between 0.5 and 0.6) and undisturbed at the other stations (nEQR above 0.6). The diversity index H' was lowest at C2alt and C4 (2.47 and 1.49, respectively) and above 4 at the other stations. NS 9410:2016-assessment of the community in the local impact zone (C1) showed environmental condition 1 (Very good). No pollution indicators were recorded among the top-10 species on any of the stations. The redox measurements (pH/Eh) gave point 0 acc. Appendix D in NS 9410:2016 for all the sampling stations. The oxygen saturation in June was good in the whole water column with 74 % in the bottom water.

Approval

Project leader

Kamila Sztybor

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Quality control

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Preface

Akvaplan-niva carried out an environmental survey of type C (NS 9410:2016) at the Fossfjörður site. It includes pH/redox measurements (Eh), hydrography, geochemical analyses, and analyses of the bottom fauna from five stations at the fish farming site. The following personnel have contributed:

Snorri Gunnarsson	Akvaplan-niva	Field work, report, project leader.
Hans-Petter Mannvik	Akvaplan-niva	Identification of bottom fauna (Echinodermata). Report, professional assessments, and interpretations.
Kamila Sztybor	Akvaplan-niva	QA report, professional assessments, and interpretations.
Roger Velvin	Akvaplan-niva	Identification of bottom fauna (Various taxa).
Rune Palerud	Akvaplan-niva	Identification of bottom fauna (Crustaceans). Statistics.
Charlotte P. Ugelstad	Akvaplan-niva	Identification of bottom fauna (Polychaeta).
Jesper Hansen	Akvaplan-niva	Identification of bottom fauna (Mollusca).
Vegard Holen	Akvaplan-niva	Hydrographical vertical profiles
Kristine H Sperre	Akvaplan-niva	Coordination of sorting of bottom fauna.
Ingar H. Wasbotten	Akvaplan-niva	Coordination of geo-chemical analyses.

Akvaplan-niva would like to thank Arnarlax ehf. and Silja Baldvinsdóttir for good cooperation

Accreditation information:

The survey was done by Akvaplan-niva AS with ALS Laboratory Group (Czech Republic) as a sub-contractor.

NORSK AKKREDITERING TEST 079

Akvaplan-niva AS is accredited under NS-EN ISO/IEC 17025 by Norwegian Accreditation for field sampling of sediments and fauna, analyses of TOC, TOM, TN, particle size and macrofauna, and for professional evaluations and interpretations. Our Accreditation number is TEST 079.

Czech Accreditation Institute (Lab nr 1163)

ALS Laboratory Group is accredited by the Czech Accreditation Institute (Lab nr 1163) for copper analyses.

Non-accredited services: Hydrographical measurements and mapping of bottom topography (Olex).

Reykjavik, 20.09 2022

Snorri Gunnarsson (Project Manager)

1 Data Summary

Client information			
Report title:	C-Survey at Fossfjörður, 2022.		
Report nr.	2022 64107.01	Site:	Fossfjörður
Municipality:	Vesturbyggð	Map Coordinates (construction):	65°37,850 N 23°32,793 V
MTB permitted:	2.182 ton	Operations manager:	Silja Baldvinsdóttir
Client:	Arnarlax ehf		

Biomass/production status at time of survey (22.06.2022)			
Fish group:	Salmon	Biomass on examination:	2.182 t
Feed input:	2.209 t	Produced amount of fish:	2.712 t
Type/time of survey			
Maximum biomass:	X	Follow up study:	
Fallow (resting period):		New location:	

Results from the C study /NS 9410 (2016) – Main results from soft bottom fauna			
Faunal index nEQR (Veileder 02:2018)		**Diversity index H' (Shannon-Wiener)**	
Fauna C1 (impact zone)	0.687	Fauna C1 (impact zone)	4.26
Fauna C2	0.761	Fauna C2	4.86
Fauna C2alt	0.561	Fauna C2alt	2.47
Fauna C3	0.734	Fauna C3	4.66
Fauna C4 (deep area)	0.523	Fauna C4 (deep area)	1.49
Date fieldwork:	(22.06.2022)	**Date of report:**	20.09.2022
Notes to other results (sediment, pH/Eh, oxygen)			nTOC from 21.6 to 40.8 mg/g. Copper 43.2 mg/kg at C1 Eh positive at all stations O_2-conditions were good throughout the water column.
Responsible for field work:	Signature: SGU	Project manager Snorri Gunnarsson	Sign: SGU

2 Introduction

2.1 Background and aim of the study

On behalf of Arnarlax ehf, Akvaplan-niva completed an environmental survey (type C) for a fish farming site at Fossfjörður (Figure 1). The survey fulfils the requirements from the Icelandic authorities for bottom surveys according to ISO 12878 and the requirements for environmental bottom surveys (according to Vöktunaráætlun). An environmental study was simultaneously undertaken, with reference to chapter 5.0 in NS 9410:2016 which follows the methodology for C-study. A survey (type C) is aimed at studying the environmental conditions of the bottom sediments along a transect sector from the fish farm that extends from the local, to the intermediate and to the regional impact zones. The main emphasis is on the study of the soft bottom fauna which is conducted according to standards ISO 5567-19:2004 and ISO 16665:2014. The obligatory parameters that are included in the survey are described in NS 9410:2016.

A classification or threshold values for this type of survey have not been developed Icelandic officials so it is not possible to apply the classification based on Norwegian threshold values to Icelandic conditions. We do however report the results with these same indexes with reference to Norwegian threshold values but it should be emphasized that some of these (such as NSI) are developed according to Norwegian conditions. For further descriptions of these indexes see details in Appendix 1 and Miljødirektoratets Veileder 02:2018.

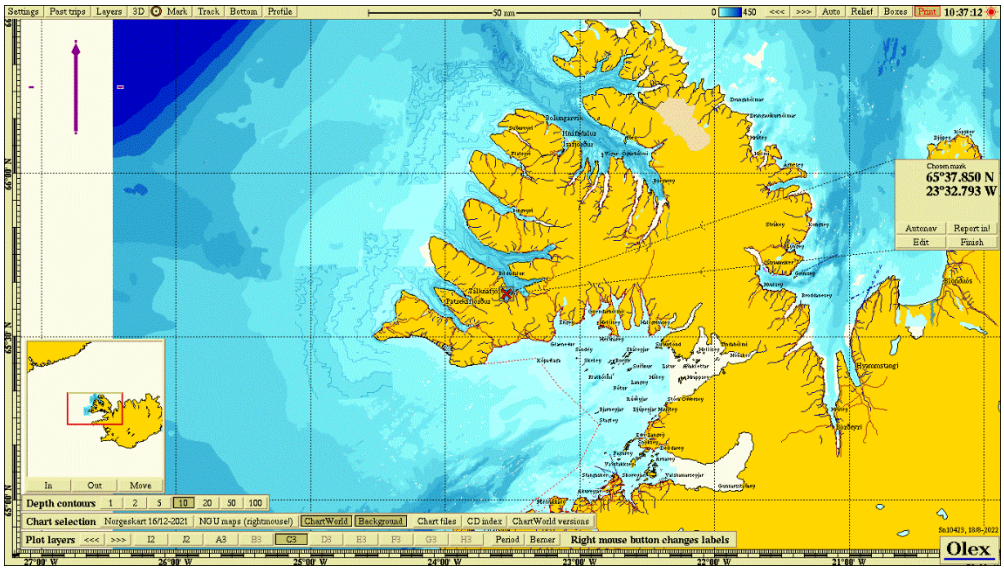

Figure 1 Overview of Arnarfjörður with the farming site Fossfjörður (red cross). The map coordinates for the midpoint of the farming site are given to the right.

2.2 Site operation and feed use

Fossfjörður fish farming site is located in the southern part of Arnarfjörður, approximately 6,5 km south of the town of Bíldudalur. The installed frame is suited for up to 6 net-pens with a circumference of 120 m. The frame is positioned in southeast direction from land (118°) with depth below the cages ranging from 52 to 74 m. This is the first generation of fish farmed at the current location at Fossfjörður. Previously a fish farm was placed further south in the fjord about 1 km from

the current location. Two generations of fish had been produced at the old site that is now at fallow state.

In Iceland, the MTB (maximum allowed biomass) limit is not given a site level as in Norway. The MTB limit determines how much live fish the holder of the permit can have standing in the sea at any time. In Iceland the allowed production is regulated at two levels, site level and company level.

At the time of the survey, the standing stock was approximately 2.182 tons of salmon (used at MTB here) from 2020 generation (Baldvinsdóttir, pers reference).

2.3 Previous surveys

Akvaplan-niva AS has done one previous environmental surveys of the type C (NS 9410) at the site prior to putting out the first generation fish at the new site Fossfjörður.

There are other investigations that were conducted in Fossfjörður related to fish farming activities at the old Fossfjörður site. In 2011-2013 and 2014-2016 there were done benthic surveys prior to putting fish into sea (Þórisson et al. 2010), at max biomass (Þórisson et al. 2015 and Gallo 2016) and at fallow period after the first generation. The placement of the cages for these two generations was about 700-1000 m south of the planned fish farming site for the next generation at Fossfjörður. The previous benthic surveys described substantial and long-lasting effects from the fish farming activity at Fossfjörður site mainly near the cages. Main reason for these negative impacts is suggested to be the overfeeding of the fish (Þórisson et al. 2015).

An overview of previous surveys carried out at present site in Fossfjörður is shown in Table 1.

Table 1: Previous surveys at Fossfjörður.

Survey date	Report reference (author, year)	Production (tonn)	Type of survey
12.06 2020	APN-62252.01 (Mannvik and Gunnarsson, 2020)	0	C-survey at fallow period

3 Materials and methods

3.1 Survey program

The choice of study parameters, placement of sampling stations and other criteria for the study is based on descriptions in NS 9410 (C-surveys). An overview of the planned professional program is given in Table 2.

Akvaplan-niva is accredited for field work, analyses of samples and professional evaluation of results in accordance with applicable standards and guidelines ("Veiledere"). For implementation and follow through, the following standards and quality assurance systems were used:

- ISO 5667-19:2004: *Guidance on sampling of marine sediments.*
- ISO 16665:2014. *Water quality – Guidelines for quantitative sampling and sample processing of marine soft-bottom macro fauna.*
- NS 9410:2016. *Miljøovervåking av bunnpåvirkning fra marine oppdrettsanlegg.*
- Internal procedures. *Quality Manual for Akvaplan-niva.*
- Veileder 02:2018. *Klassifisering av miljøtilstand i vann*. Norsk klassifiseringssystem for vann i henhold til Vannforskriften. Veileder fra Direktoratgruppen.

Table 2: Survey program for the C-survey at Fossfjörður, 2022. TOC = total organic carbon. Korn = grain size in sediment. TOM = total organic material. TN = total nitrogen. Cu = Copper. pH/Eh = acidity and redox potential.

Station	Type analyses/parameters
C1 (local impact zone)	Quantitative analyses of bottom fauna. TOC. Korn. TOM. TN. Cu. pH/Eh.
C2 (transect zone outer)	Quantitative analyses of bottom fauna. TOC. Korn. TOM. TN. pH/Eh.
C2alt (transect zone outer)	Quantitative analyses of bottom fauna. TOC. Korn. TOM. TN. pH/Eh.
C3 (transect zone)	Quantitative analyses of bottom fauna. TOC. Korn. TOM. TN. pH/Eh.
C4 (transect zone, deep area)	Quantitative analyses of bottom fauna. TOC. Korn. TOM. TN. Hydrography/O_2. pH/Eh.

Field work was completed on 22.06.2022.

Placement of stations and local conditions

The number of stations was calculated with reference to the sites estimated maximal standing biomass for the first generation which is 2.182 tons (used as MTB here). According to the standard four sampling stations should be examined. The fifth station C2alt was however added to the survey as an alternative reference station as the C2 station (reference station) was placed towards land in line with main oceanic current at the site where depth limited the distance from the farm. Depth and position of the stations are given in Table 3 and shown in Figure 2. Stations C1-C3 were placed in the direction of the main oceanic current direction at 15 m depth (Hermansen, 2020). Station C4

was placed in the deepest area northeast from the site and comprise the hydrographical measurements.

Table 3: Depth, distance between the nearest frame of the fish farm and sampling stations and coordinates for C-stations at Fossfjörður, 2022.

Station	Depth, m	Distance from frame, m	Position	
			N	W
C1	50	25	65°37.900	23°32.920
C2	28	267	65°37.906	23°33.265
C2alt	65	400	65°37.607	23°32.998
C3	46	100	65°37.920	23°33.007
C4	80	150	65°37.884	23°32.444

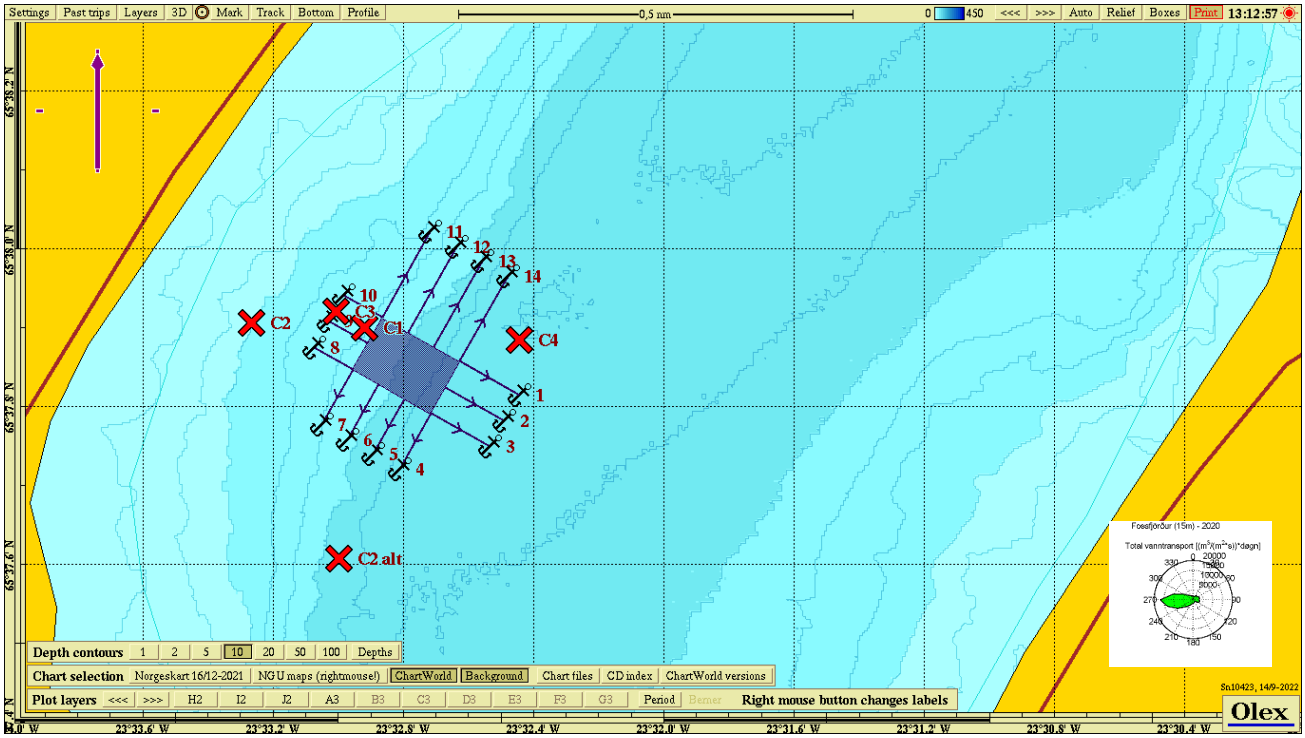

Figure 2. Map showing the sampling stations for the C-survey at Fossfjörður, 2022. Current measurements used were from 15 m depth (Hermansen, 2020).

3.2 Hydrography and oxygen

At station C4, hydrographic measurements, salinity, temperature, density, and oxygen saturation were carried out for vertical surface to bottom profiles using a Sensordata CTDO 204 probe.

3.3 Soft bottom sampling and analyses

3.3.1 Fieldwork

Sediment samples were collected with a 0.1 m^2 bottom grab (van Veen). The sample material was collected through inspection openings. Samples for TOC, TN and Cu were taken from the top 1 cm layer of the sediment and for TOM and grain size analyses from the top 5 cm using a hollow pipe. Only samples with an undisturbed surface were used. The samples were frozen for further processing in the laboratory.

3.3.2 Total organic material (TOM)

The amount of TOM in sediment was determined by weight loss after combustion at 495 °C. The percent weight loss was calculated. The reproducibility of the TOM analyses is checked during the analyses by using a standard household sediment that contains TOM with a known level. Standard calcium carbonate was burned together with the samples as a control of the amount of carbonate that was not burned in the analyses process.

3.3.3 Total nitrogen (TN)

After drying the samples at 40°C, the amount of total nitrogen (TN) was quantified by electrochemical determination using an internal method that is based on NS-EN 12260:2003 (Vannundersøkelse – Bestemmelse av bundet nitrogen (TNb) etter oksidasjon til nitrogenoksider).

3.3.4 Total organic carbon (TOC) and grain size

The proportion of fine material, the fraction less than 63 µm, was determined gravimetrically after wet sieving of the samples. The results are presented as proportion of fine material on a dry weight basis.

After drying the samples at 40 °C, the content of total organic carbon (TOC) was determined by NDIR-detection in accordance with DIN19539:2016 (Investigation of solids – Temperature-dependent differentiation of total carbon (TOC_{400}, ROC, TIC_{900})). To classify the environmental conditions based on the content of TOC, the measured concentrations are normalized for proportion of fine substance (nTOC) using the equation: nTOC = TOC + 18 (1 – F), where TOC and F represent a measured TOC value and the proportion of fine substance (%) in the sample (Aure *et al.,* 1993).

3.3.5 Metal analysis - copper (Cu)

The samples for metal analysis were freeze-dried before being placed in a microwave oven in a sealed Teflon container with concentrated ultrapure nitric acid and hydrogen peroxide. The concentration of copper (Cu) was determined by means of ICP-SFMS.

3.3.6 Redox- and pH measurements

At all the stations, a quantitative chemical examination of the sediment was carried out. Acidity (pH) and redox potential (Eh) were measured using electrodes and the YSI Professional Plus instrument. In accordance to the manual of the instrument, 200 mV was added to the measured ORP (the Oxidation Reduction Potential) value.

3.4 Soft bottom fauna investigation

3.4.1 About effect of organic material on bottom fauna

The emission of organic material from fish farms can contribute to the deterioration of conditions for many of the organisms living in the bottom sediment. Negative effects in the bottom fauna can best be assessed through quantitative bottom fauna analyses. Many soft bottom species have low mobility, the fauna composition will largely reflect the local environmental conditions. Changes in the bottom fauna communities are a good indication of unwanted organic loads. Under natural conditions, the communities typically consist of many species. High number of species (diversity) is, amongst other things, dependent on favorable conditions for the fauna. However, moderate increases in organic load can stimulate the fauna and result in an increased number of species found. Larger organic loads can result in less favorable conditions where opportunistic species increase their individual numbers, while the species not suited are knocked out resulting in a reduced diversity of species. Changes in species diversity near emission points of feed and fecal matter can, to a large degree, be attributed to changes in organic content (from the feed and fecal matter) in the sediment.

3.4.2 Sampling and fixation

All the bottom fauna samples were taken with a 0.1 m^2 van Veen grab. Only grab samples where the grab was completely closed and the surface undisturbed were approved. After approval, the contents were washed through a 1 mm sieve and the remaining material fixed with 4 % formalin with Bengal Rose dye added and neutralized with borax. In the laboratory, the animals were sorted from the remaining sediment.

3.4.3 Quantitative bottom fauna analysis

At all stations, two samples (replicates) were collected in accordance with guidelines in NS 9410 (2016). After sorting the sample material was processed quantitatively. The bottom fauna was identified to the lowest level possible and quantified by specialists (taxonomists). The quantitative lists of species were analyzed statistically. See Appendix 1 for description of analysis methods. The following statistical methods were used to describe community structure and to assess the similarity between different communities:

- Shannon-Wiener diversity index (H')
- Hurlberts diversity index (ES_{100}) – expected number of species pr. 100 individuals
- Pielou's evenness index (J)
- Sensitivities index (Ømfintlighet) (ISI_{2012}), unsuitable at low individual/species number
- Sensitivity index (NSI)
- Composite index for diversity of species and sensitivity (NQI1)
- Sensitivities index which is included in NQI1 (AMBI)
- Normalized EQR (nEQR)
- Number of species plotted against the number of individuals in geometric arts classes
- Cluster analyses
- The ten most dominant taxa per station (top-ten)

4 Results

4.1 Hydrography and oxygen

The hydrographical profile for the deep station C4 in June 2022 is presented in Figure 3.

Temperature was around 8 ^{0}C at the surface and 2 ^{0}C in the bottom water, and oxygen saturation was 113 % in the upper layer and 74 % in the bottom layer.

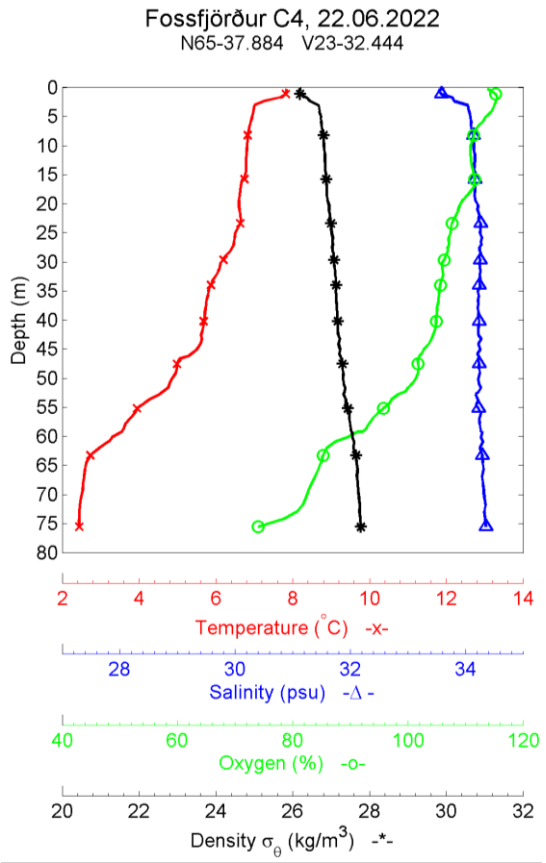

Figure 3. Vertical profiles. Temperature, salinity, density, and oxygen at C4 at Fossfjörður, 2022.

4.2 Sediment

4.2.1 TOC, TOM, TN, C/N, grain size and pH/Eh

Levels of total organic material (TOM), total organic carbon (TOC), total nitrogen (TN), C/N-relationship, grain size distribution in sediment (pelite) and pH/Eh in the sediment are presented in Table 4.

TOM-levels varied from 5.3 to 12.8 %. TN-levels were low (2.8 – 4.8 mg/g) as were the C/N-ratios. TOC was rather high at the stations and nTOC varied from 21.6 to 40.8 mg/g TS. The bottom sediments were moderately fine to fine with a pelite ratio ranging from 43 to 85 %.

Redox measurements (pH/Eh) gave a point of 0 for all the sampling stations according to Appendix D in NS 9410:2016.

Table 4. Sediment description, TOM (%), TOC (mg/g), TN (mg/g), C/N, grain size distribution (pelite ratio % <0,063 mm) and pH/Eh. Fossfjörður, 2022.

St.	Sediment description	TOM	TOC	nTOC	TN	C/N	Pelite	pH/Eh
C1	Olive green clay. Lots of broken dead shells. Little washed sample as there was stones/shell in mouth of grab.	5.3	13	21.6	2.8	4.7	52.8	7.6/252
C2	Olive green clay. Some dead broken shells and some alga (lithothamnion) mostly dead.	10.7	23	26.0	4.8	4.7	81.2	7.7/269
C2alt	Olive green clay, pebbles, and some dead broken shells. Washed sample as there were stones in mouth of grab.	11.7	31	40.8	4.2	7.3	43.2	7.7/277
C3	Olive green clay. Lots of broken dead shells. Little washed sample as there were shells in mouth of grab.	6.1	15	23.1	3.2	4.6	53.1	7.5/284
C4	Olive green clay.	12.8	28	30.9	3.6	7.7	85.1	7.9/294

4.2.2 Copper

Level of copper in bottom sediment at C1 is shown in Table 5. The level of copper was 43.2 mg/kg.

Table 5. Copper (Cu), mg/kg DS. Fossfjörður, 2022.

St.	Cu
C1	43,2

4.3 Soft-bottom fauna

4.3.1 Faunal indices

Results from the quantitative soft bottom faunal analyses at the C-stations are presented in Table 6.

The number of individuals varied from 228 (C4) to 1065 (C1) and number of species from 17 (C4) to 61 (C2). The diversity H' varied from 2.47 to 4.66. At most of the stations, the overall index of nEQR was higher than 0.6. The nEQR values indicate good conditions and no disturbance of the communities. At C2alt and C4, the nEQR was between 0.5 and 0.6 which might indicate some disturbance.

J (Pielous evenness index) is a measure of how equally individuals are divided between species and will vary between 0 and 1. A station with low value has a "crooked" individual distribution between the species, indicating a disturbed bottom fauna community. The index varied from 0.79 to 0.84 at C1, C2 and C3 which indicates an even distribution. At C2alt and C4 it was 0.56 and 0.42, respectively, indicated an uneven distribution.

Table 6. Number of species and individuals pr. 0,2 m^2. H´ = Shannon-Wiener's diversity index. ES100 = Hurlberts diversity index. NQI1 = overall index (diversity and sensitivity). ISI2012 = sensitivity index. NSI = sensitivity index. J = Pielous evenness index. AMBI = AZTI marine biotic index (part of NQI1). nEQR = normalized EQR (excl. DI). C-stations at Fossfjörður, 2022.

St.	Numb. ind.	Numb. species	H´	ES_{100}	NQI1	ISI_{2012}	NSI	nEQR	AMBI	J
C1	1065	53	4.26	24.3	0.724	8.44	20.57	0.687	2.129	0.79
C2	511	61	4.66	33.1	0.804	9.31	21.96	0.761	1.511	0.83
C2alt	471	31	2.47	15.1	0.612	8.31	17.73	0.561	3.050	0.56
C3	602	59	4.66	31.0	0.741	8.87	21.90	0.734	2.240	0.84
C4	228	17	1.49	11.3	0.496	9.01	22.73	0.523	4.004	0.42

4.3.2 NS 9410 Evaluation of the bottom fauna at station C1 (local impact zone).

According to NS 9410 the classification of the environmental status in the local impact zone can also be evaluated based on the number of species and their dominance in the bottom faunal community (see chapter 8.6.2 in NS 9410:2016).

The soft bottom communities were classified to environmental condition 1 "Very good". The criteria for condition 1 are that there are at least 20 species/0.2 m^2 and that none of these are in numbers exceeding 65 % of the individuals (Table 7).

Table 7. Classification of the environmental status of the soft bottom fauna at station C1 at the Fossfjörður site 2022.

Station	Site name	Num. species	Dominating taxa	Environmental condition-NS 9410
C1	Fossfjörður	53	Ennucula tenuis – 17 %	1 – Very good

Geometric classes

Figure 4 shows the number of species plotted against the number of individuals, where the number of individuals is divided into geometric classes. For an explanation of the concept of geometric classes is given in Appendix 1.

At C4, the curve started very low (6 species) and stretched out towards higher classes, which might indicate disturbed fauna at that station. At the other stations, the curves started somewhat higher (13 to 19 species and stretched out in varying degrees towards higher classes). These did not give any clear indications of the faunal conditions.

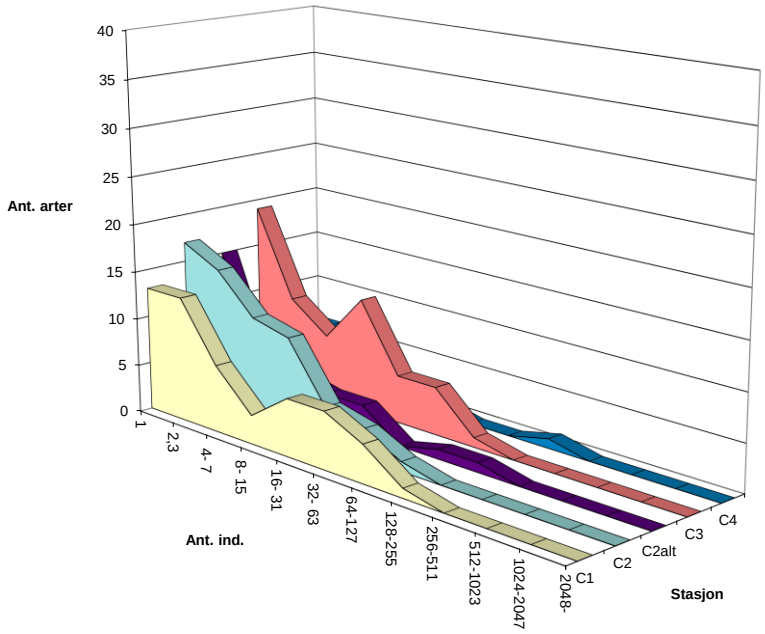

Figure 4. The soft bottom fauna shown as number of species against number of individuals pr. species in geometric classes. Fossfjörður, 2022.

4.3.3 Cluster analyses

To investigate the similarity of the faunal composition between the sampling stations, the multivariate technique cluster analysis was used. The results of this are presented in dendrogram in Figure 5.

The stations were divided into two main groups. In one of the groups, the faunal composition at station C1, C2 and C3 was more than 58 % similar. In the other group, station C2alt and C4 was 62 % similar. The similarity between the two main groups was 37 %. C2alt and C4 had the lowest nEQR values (see Table 6).

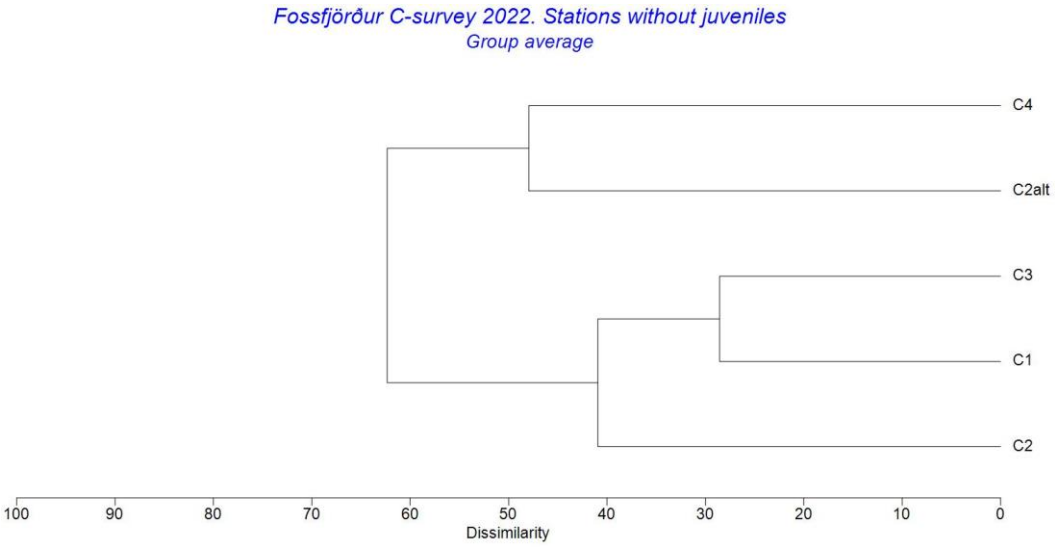

Figure 5. Cluster diagram for the soft bottom fauna at the C- sampling stations at Fossfjörður, 2022.

4.3.4 Species composition

The main features of the species composition are shown in the form of a top ten species list from each station in Table 8.

In Rygg and Norling (2013) the species are divided into five ecological groups (EG) based on the value of the sensitivity index. These groups run from sensitive species (group I) to pollution indicators (group V).

At C1, the fauna was dominated by the neutral bivalve *Ennucula tenuis* with 17 % of the individuals. The other most dominant species at the station were a mixture of neutral, tolerant, and opportunistic species.

At C2, the fauna was dominated by the opportunistic bivalve *Thyasira gouldi* with 14 % of the individuals. The other most dominant species at the station were a mixture of sensitive, neutral, tolerant, and opportunistic species.

At C2alt, the fauna was dominated by the opportunistic bivalve *Thyasira sarsi* with 51 % of the individuals. The other most dominant species at the station were a mixture of tolerant and opportunistic species.

At C3, the fauna was dominated by the tolerant bivalve *Abra nitida* with 11 % of the individuals. The other most dominant species at the station were a mixture of neutral and opportunistic species.

At C4, the fauna was dominated by the neutral polychaeta *Prionospio steenstrupi* with 76 % of the individuals. The other most dominant species at the station were a mixture of neutral, tolerant, and opportunistic species, but most of these species were recorded with few individuals.

No pollution indicators were recorded among the top-10 at any of the stations.

Table 8. Number of individuals, cumulative percentage, and ecological group for the ten most dominant species on the C stations. Fossfjörður, 2022.*

C1	EG	Numb.	Cum.	C2	EG	Numb.	Cum.
Ennucula tenuis	II	178	17 %	Thyasira gouldii	IV	70	14 %
Abra nitida	III	107	26 %	Maldane sarsi	IV	57	25 %
Macoma calcarea	IV	102	36 %	Levinsenia gracilis	II	49	34 %
Thyasira gouldii	IV	95	45 %	Macoma calcarea	IV	34	41 %
Prionospio steenstrupi	II	81	52 %	Rhodine gracilior	I	28	46 %
Eteone flava/longa		50	57 %	Arctica islandica	III	24	51 %
Lagis koreni	IV	44	61 %	Nuculana pernula	II	17	54 %
Thyasira sarsii	IV	43	65 %	Scoloplos armiger	III	16	57 %
Scoloplos armiger	III	42	69 %	Sternaspis scutata		14	60 %
Axinopsida orbiculata		40	73 %	Eteone flava/longa		13	63 %
C2alt	**EG**	**Numb.**	**Cum.**	**C3**	**EG**	**Numb.**	**Cum.**
Thyasira sarsii	IV	238	51 %	Abra nitida	III	67	11 %
Prionospio steenstrupi	II	99	72 %	Thyasira gouldii	IV	61	21 %
Galathowenia oculata	III	23	76 %	Leitoscoloplos mammosus		56	30 %
Echiurus echiurus		18	80 %	Prionospio steenstrupi	II	39	36 %
Ennucula tenuis	II	17	84 %	Ennucula tenuis	II	34	42 %
Chaetozone sp.	III	12	86 %	Nuculana pernula	II	32	47 %
Spio limicola		10	89 %	Lagis koreni	IV	24	51 %
Lumbrineris mixochaeta	IV	8	90 %	Thyasira sarsii	IV	23	54 %
Scoloplos armiger	III	7	92 %	Levinsenia gracilis	II	22	58 %
Eteone flava/longa		6	93 %	Macoma calcarea	IV	21	61 %

C4	EG	Numb.	Cum.
Prionospio steenstrupi	II	174	76 %
Thyasira sarsii	IV	16	83 %
Chaetozone sp.	III	7	86 %
Leucon sp.		7	89 %
Yoldia hyperborea		4	91 %
Ennucula tenuis	II	3	93 %
Parougia nigridentata		3	94 %
Lumbrineris mixochaeta	IV	2	95 %
Ophelina acuminata	II	2	96 %
Pholoe assimilis	III	2	96 %

*Ecological groups: EG I = sensitive species. EG II = neutral species. EG III = tolerant species. EG IV = opportunistic species. EG V = pollution indicator species. From Rygg and Norling, 2013. Ik = unidentified group.

5 Summary and Conclusions

5.1 Summary

The results from the environmental monitoring (type C) at Fossfjörður, 2022, can be summarized as follows:

- The hydrography measurements showed good oxygen conditions throughout the water column with 74 % saturation in the bottom layer in June 2022.
- TOC was rather high at station C2alt and C4 (40.8 and 30.9 mg/g) and lower at the other stations (21.6 – 26.0 mg/g). TOM-levels varied from 5.3 to 12.8 %. TN-levels were low (2.8 – 4.8 mg/g) as was the C/N-ratio. The copper level in the sediment at C1 was elevated (43.2 mg/kg) according to Norwegian standards, but within reported natural levels of 55 mg/kg in Icelandic coastal areas (Egilsson *et al.* 1999). The bottom sediments were moderately fine to fine with a pelite ratio ranging from 43 to 85 %. The redox measurements (pH/Eh) gave point 0 acc. Appendix D in NS 9410:2016 for all the stations.
- The number of individuals varied from 228 to 1065 and number of species from 17 to 61. The diversity H' varied from 1.49 (C4) to 4.66 (C2 and C3). At C2alt and C4, the overall index of nEQR was between 0.5 and 0.6, which might indicate some faunal disturbance. At the other stations the nEQR values were above 0.6, which might indicate no disturbance of the communities.

5.2 Conclusions

The results from the monitoring at the farming site Fossfjörður in June 2022 showed that the sediment was somewhat loaded with organic carbon and the copper concentrations were within reported natural levels for bottom sediment around Iceland (Egilsson *et al.*, 1999). The fauna might be somewhat disturbed at C2alt and C4 (nEQR between 0.5 and 0.6) and undisturbed at the other stations (nEQR above 0.6). The diversity index H' was lowest at C2alt and C4 (2.47 and 1.49, respectively) and above 4 at the other stations. NS 9410:2016-assessment of the community in the local impact zone (C1) showed environmental condition 1 (Very good). No pollution indicators were recorded among the top-10 species on any of the stations. The redox measurements (pH/Eh) gave point 0 acc. Appendix D in NS 9410:2016 for all the sampling stations. The oxygen saturation in June was good in the whole water column with 74 % in the bottom water.

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7 Appendix (in Norwegian)

7.1 Statistiske metoder

Diversitet

Diversitet er et begrep som uttrykker mangfoldet i dyre- og plantesamfunnet på en lokalitet. Det finnes en rekke ulike mål for diversitet. Noen tar mest hensyn til artsrikheten (mål for artsrikheten), andre legger mer vekt på individfordelingen mellom artene (mål for jevnhet og dominans). Ulike mål uttrykker derved forskjellige sider ved dyresamfunnet. Diversitetsmål er "klassiske" i forurensningsundersøkelser fordi miljøforstyrrelser typisk påvirker samfunnets sammensetning. Svakheten ved diversitetsmålene er at de ikke alltid fanger opp endringer i samfunnsstrukturen. Dersom en art blir erstattet med like mange individer av en ny art, vil ikke det gjøre noe utslag på diversitetsindeksene.

Shannon-Wieners indeks (Shannon & Weaver, 1949) er gitt ved formelen:

$$H' = -\sum_{i=1}^{s} \frac{n_i}{N} \log_2 \left(\frac{n_i}{N} \right)$$

der n_i = antall individer av art i i prøven
N = total antall individer
s = antall arter

Indeksen tar hensyn både til antall arter og mengdefordelingen mellom artene, men det synes som indeksen er mest følsom for individfordelingen. En lav verdi indikerer et artsfattig samfunn og/eller et samfunn som er dominert av en eller få arter. En høy verdi indikerer et artsrikt samfunn.

Pielous mål for jevnhet (Pielou, 1966)

har følgende formel, der symbolene er som i Shannon-Wieners indeks

$$J = \frac{H'}{\log_2 s}$$

Hurlberts diversitetskurver

Grafisk kan diversiteten uttrykkes i form av antall arter som funksjon av antall individer. Med utgangspunkt i total antall arter og individer i en prøve søker man å beregne hvor mange arter man ville vente å finne i delprøver med færre individer. Diversitetsmålet blir derved uavhengig av prøvestørrelsen og gjør at lokaliteter med ulik individtetthet kan sammenlignes direkte. Hurlbert (1971) har gitt en metode for å beregne slike diversitetskurver basert på sannsynlighetsberegning.

ES_n er forventet antall arter i en delprøve på n tilfeldig valgte individer fra en prøve som inneholder total N individer og s arter og har følgende formel:

$$ES_n = \sum_{i=1}^{s} \left[1 - \frac{\binom{N-N_i}{n}}{\binom{N}{n}} \right]$$

der N = total antall individ i prøven
N_i = antall individ av art i

n = antall individ i en gitt delprøve (av de N)
s = total antall arter i prøven

Plott av antall arter i forhold til antall individer

Artene deles inn i grupper/klasser etter hvor mange individer som er registrert i en prøve. Det vanlige er å sette klasse I = 1 individ pr. art, klasse II = 2-3 individer, klasse III = 4-7 individer, klasse IV = 8-15 individer, osv., slik at de nedre klassegrensene danner en følge av ledd på formen 2^x, x=0,1,2, ... En slik følge kalles en geometrisk følge, derfor kalles klassene for geometriske klasser. Hvis antall arter innenfor hver klasse plottes mot klasseverdien på en lineær skala, vil det fremkomme en kurve som uttrykker individfordelingen mellom artene i samfunnet. Det har vist seg at i prøver fra upåvirkede samfunn vil det være mange arter med lavt individantall og få arter med høyt individantall, slik at vi får en entoppet, asymmetrisk kurve med lang "hale" mot høye klasseverdier. Denne kurven vil være godt tilpasset en log-normal fordelingskurve.

Ved moderat forurensing forsvinner en del av de individfattige artene, mens noen som blir begunstiget, øker i antall. Slik flater kurven ut, og strekker seg mot høyere klasser eller den får ekstra topper. Under slike forhold mister kurven enhver likhet med den statistiske log-normalfordelingen. Derfor kan avvik fra log-normalfordelingen tolkes som et resultat av en påvirkning/forurensing. Det har vist seg at denne metoden tidlig gir utslag ved miljøforstyrrelse. Ved sterk forurensning blir det bare noen få, men ofte svært tallrike arter tilbake. Log-normalfordelingskurven vil da ofte gjenoppstå, men med en lavere topp og spredt over flere klasser enn for uforstyrrede samfunn.

Faunaens fordelingsmønster

Variasjoner i faunaens fordelingsmønster over området beskrives ved å sammenligne tettheten av artene på hver stasjon. Til dette brukes multivariate klassifikasjons- og ordinasjons-analyser (Cluster og MDS).

Analysene i denne undersøkelsen ble utført ved hjelp av programpakken PRIMER v5. Inngangsdata er individantall pr. art, pr. prøve. Prøvene kan være replikater eller stasjoner. Det tas ikke hensyn til hvilke arter som opptrer. Forut for klassifikasjons- og ordinasjonsanalysene ble artslistene dobbelt kvadratrot-transformert. Dette ble gjort for å redusere avviket mellom høye og lave tetthetsverdier og dermed redusere eventuelle effekter av tallmessig dominans hos noen få arter i datasettet.

Clusteranalyse

Analysen undersøker faunalikheten mellom prøver. For å sammenligne to prøver ble Bray-Curtis ulikhetsindeks benyttet (Bray & Curtis, 1957):

$$d_{ij} = \frac{\sum_{k=1}^{n} \left| X_{ki} - X_{kj} \right|}{\sum_{k=1}^{n} (X_{ki} + X_{kj})}$$

der n = antall arter sammenlignet
X_{ki} = antall individ av art k i prøve nr. i
X_{kj} = antall individ av art k i prøve nr. j

Indeksen avtar med økende likhet. Vi får verdien 1 hvis prøvene er helt ulike, dvs. ikke har noen felles arter. Identiske arts- og individtall vil gi verdien 0. Prøver blir gruppert sammen etter graden av likhet ved å bruke "group-average linkage". Forholdsvis like prøver danner en gruppe (cluster). Resultatet presenteres i et trediagram (dendrogram).

Ømfintlighet (AMBI, ISI og NSI)

Ømfintligheten bestemmes ved indeksene ISI og AMBI. Beregning av ISI er beskrevet av Rygg (2002). Sensitivitetsindeksen AMBI (Azti Marin Biotic Index) tilordner en ømfintlighetsklasse (økologisk gruppe, EG): EG-1: sensitive arter, EG-II: indifferente arter, EG-III: tolerante arter, EG-IV: opportunistiske arter, EG-V: forurensningsindikerende arter. Sammensetningen av makroevertebratsamfunnet i form av andelen av økologiske grupper indikerer omfanget av en forurensningspåvirkning.

NSI er en sensitivitetsindeks som ligner AMBI, men er utviklet med basis i norske faunadata og ved bruk av en objektiv statistisk metode. En prøves NSI verdi beregnes ved gjennomsnittet av sensitivitetsverdiene av alle individene i prøven.

Sammensatte indekser (NQI1 og NQI2)

Sammensatte indekser NQI1 og NQI2 bestemmes både ut fra artsmangfold og ømfintlighet. NQI1 er brukt i NEAGIG (den nordøst-atlantiske interkalibreringen). De fleste land bruker nå sammensatte indekser av samme type som NQI1 og NQI2.

NQI1 indeksen er beskrevet ved hjelp av formelen:

NQI1 (Norwegian quality status, version 1) = [0.5* (1-AMBI/7) + 0.5*(SN/2.7)* (N/(N+5)]

Diversitetsindeksen SN = lnS/ln(lnN), hvor S er antall arter og N er antall individer i prøven

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7.2 Statistical results Fossfjörður, 2022

Number of species and individuals per station

St.	C1	C2	C2alt	C3	C4
Ant. ind.	1065	511	471	602	228
Ant. arter	53	61	31	59	17

Benthos indices per replicate

st.nr.		C1_01	C1_02	C2_01	C2_02	C2alt_01	C2alt_02	C3_01	C3_02	C4_01	C4_02
no. ind.		474	591	245	266	237	234	238	364	105	123
no. spe.		46	40	46	51	20	24	44	48	10	14
Shannon-Wiener:		4,3	4,2	4,7	4,6	2,8	2,2	4,8	4,6	1,3	1,7
Pielou		0,79	0,79	0,85	0,81	0,64	0,47	0,87	0,82	0,40	0,43
ES100		26	23	33	33	15	15	33	29	10	13
SN		2,11	1,99	2,25	2,29	1,76	1,87	2,23	2,18	1,50	1,68
ISI-2012		8,68	8,20	9,18	9,44	7,79	8,83	9,26	8,47	9,35	8,68
AMBI		2,039	2,218	1,428	1,594	3,179	2,921	2,136	2,343	4,057	3,95
NQI1		0,74	0,71	0,81	0,80	0,59	0,63	0,75	0,73	0,47	0,52
NSI		20,5	20,6	22,5	21,4	19,1	16,3	22,3	21,5	22,6	22,8

Benthos indices, averages per station

st.nr.		C1	C2	C2alt	C3	C4
Shannon-Wiener:		4,26	4,66	2,47	4,66	1,49
Pielou		0,79	0,83	0,56	0,84	0,42
ES100		24,3	33,1	15,1	31,0	11,3
SN		2,05	2,27	1,82	2,20	1,59
ISI-2012		8,44	9,31	8,31	8,87	9,01
AMBI		2,129	1,511	3,050	2,240	4,004
NQI1		0,72	0,80	0,61	0,74	0,50
NSI		20,57	21,96	17,73	21,90	22,73
Tilstandsklasse nEQR		0,687	0,761	0,561	0,734	0,523

Geometrical classes

int.	C1	C2	C2alt	C3	C4
1	13	17	15	19	6
2,3	13	15	4	10	6
4- 7	7	11	4	7	3
8- 15	3	10	3	12	0
16- 31	6	4	3	5	1
32- 63	6	3	0	5	0
64-127	4	1	1	1	0
128-255	1	0	1	0	1
256-511	0	0	0	0	0
512-1023	0	0	0	0	0
1024-2047	0	0	0	0	0
2048-	0	0	0	0	0

7.3 Species lists

Artsliste pr stasjon

Fossfjörður ASC-C-survey 2022

Rekke	Klasse	Orden	Art/Taxa	Replikat:	01	02	-	Sum
Stasjonsnr.:	**ASC1**							
ANNELIDA								
	Polychaeta							
		Spionida						
			Chaetozone sp.		11	2	-	13
			Prionospio steenstrupi		143	107	-	250
		Capitellida						
			Mediomastus fragilis			2	-	2
			Praxillella gracilis		1	1	-	2
		Opheliida						
			Ophelina acuminata			2	-	2
		Phyllodocida						
			Gattyana cirrhosa			1	-	1
			Nephtys ciliata		1	2	-	3
		Eunicida						
			Lumbrineris mixochaeta		2	5	-	7
			Ophryotrocha lobifera		3		-	3
			Parougia nigridentata			2	-	2
		Oweniida						
			Galathowenia oculata		1	1	-	2
		Terebellida						
			Ampharete borealis		1		-	1
			Melinna cristata		4		-	4
		Sabellida						
			Euchone sp.			2	-	2
CRUSTACEA								
	Malacostraca							
		Cumacea						
			Leucon sp.		2	1	-	3
		Amphipoda						
			Metopa boeckii			1	-	1
MOLLUSCA								
	Bivalvia							
		Nuculoida						
			Ennucula tenuis			2	-	2
			Yoldia hyperborea			1	-	1
		Veneroida						
			Astarte montagui		1		-	1
			Macoma calcarea		1		-	1
			Thyasira sarsii		14	6	-	20
				Maksverdi:	143	107		250
				Antall arter/taxa:	13	16		21
				Sum antall individ:				323
Stasjonsnr.:	**ASC2**							
NEMERTINI								
			Nemertea indet.		1		-	1
ANNELIDA								
	Polychaeta							
		Orbiniida						
			Scoloplos armiger		1		-	1
		Spionida						
			Chaetozone sp.		3	1	-	4
			Prionospio steenstrupi		19	25	-	44
			Spio limicola		3	2	-	5
		Capitellida						
			Capitella capitata			355	-	355
			Mediomastus fragilis		8	8	-	16
		Opheliida						
			Ophelina acuminata		1	3	-	4
			Scalibregma inflatum			3	-	3
		Phyllodocida						

Rekke	Klasse	Orden	Art/Taxa	Replikat:	01	02	-	Sum
			Eteone flava/longa		2	2	-	4
			Goniada maculata			2	-	2
			Nephtys ciliata			2	-	2
			Nephtys paradoxa		1		-	1
			Pholoe assimilis		1	3	-	4
		Eunicida						
			Ophryotrocha lobifera			3	-	3
			Parougia nigridentata		5	3	-	8
		Oweniida						
			Galathowenia oculata		5	1	-	6
CRUSTACEA								
	Malacostraca							
		Cumacea						
			Leucon sp.		1	1	-	2
MOLLUSCA								
	Prosobranchia							
		Neogastropoda						
			Curtitoma trevelliana		2		-	2
	Opistobranchia							
		Cephalaspidea						
			Philine denticulata			1	-	1
	Bivalvia							
		Nuculoida						
			Ennucula tenuis		41	15	-	56
			Nuculana pernula		3	1	-	4
			Nuculana sp. juv.		3		-	3
			Yoldia hyperborea		2		-	2
		Veneroida						
			Axinopsida orbiculata		7	1	-	8
			Macoma calcarea		21	19	-	40
			Thyasira gouldii		20	8	-	28
			Thyasira sarsii		93	53	-	146
				Maksverdi:	93	355		355
				Antall arter/taxa:	22	22		28
				Sum antall individ:				755

Stasjonsnr.: C1

NEMERTINI								
			Nemertea indet.		2	1	-	3
ECHIURIDA								
			Echiurus echiurus		1	6	-	7
ANNELIDA								
	Polychaeta							
		Orbiniida						
			Leitoscoloplos mammosus		4	2	-	6
			Levinsenia gracilis			9	-	9
			Scoloplos armiger		22	20	-	42
		Spionida						
			Chaetozone sp.		13	20	-	33
			Laonice cirrata			1	-	1
			Prionospio steenstrupi		25	56	-	81
			Spio limicola			1	-	1
		Capitellida						
			Capitella capitata		1	2	-	3
			Maldane sarsi		5		-	5
			Mediomastus fragilis		2	3	-	5
			Praxillella gracilis		4	7	-	11
		Opheliida						
			Scalibregma inflatum			2	-	2
		Phyllodocida						
			Eteone flava/longa		25	25	-	50
			Goniada maculata		1	1	-	2
			Nephtys ciliata		1	1	-	2
			Nereimyra punctata			1	-	1
			Pholoe assimilis		12	12	-	24
			Polynoidae indet.		1		-	1
			Syllis sp.		1		-	1
		Eunicida						
			Lumbrineris mixochaeta		7	13	-	20

Rekke	Klasse	Orden	Art/Taxa	Replikat:	01	02	-	Sum
			Nothria conchylega		1		-	1
			Ophryotrocha lobifera		2		-	2
			Parougia nigridentata		7	3	-	10
			Scoletoma fragilis		4		-	4
		Sternaspida						
			Sternaspis scutata			1	-	1
		Oweniida						
			Galathowenia oculata		11	12	-	23
		Flabelligerida						
			Diplocirrus longisetosus		2	1	-	3
		Terebellida						
			Cistenides hyperborea		1	1	-	2
			Lagis koreni		22	22	-	44
CRUSTACEA								
	Malacostraca							
		Cumacea						
			Leucon sp.		2		-	2
		Amphipoda						
			Oedicerotidae indet.		1	1	-	2
MOLLUSCA								
	Caudofoveata							
			Caudofoveata indet.		2	2	-	4
	Prosobranchia							
		Neogastropoda						
			Curtitoma trevelliana		1		-	1
	Opistobranchia							
		Cephalaspidea						
			Diaphana minuta		1		-	1
			Philine denticulata			1	-	1
			Retusa obtusa		1		-	1
		Nudibranchia						
			Gulenia sp.		1		-	1
	Bivalvia							
		Nuculoida						
			Ennucula tenuis		72	106	-	178
			Nuculana pernula		20	9	-	29
			Nuculana sp. juv.		3	4	-	7
			Yoldia hyperborea		2	16	-	18
		Mytiloida						
			Crenella decussata		3	1	-	4
		Veneroida						
			Abra nitida		51	56	-	107
			Arctica islandica		1	1	-	2
			Astarte montagui		1	1	-	2
			Astarte sulcata		3		-	3
			Axinopsida orbiculata		19	21	-	40
			Macoma calcarea		49	53	-	102
			Thyasira gouldii		46	49	-	95
			Thyasira sarsii		16	27	-	43
			Thyasiridae indet.		4	24	-	28
		Myoida						
			Mya sp. juv.			2	-	2
ECHINODERMATA								
	Asteroidea							
			Asteroidea indet. juv.		1		-	1
	Ophiuroidea							
		Ophiurida						
			Ophiocten affinis		1		-	1
			Ophiuroidea indet. juv.		1		-	1
				Maksverdi:	72	106		178
				Antall arter/taxa:	49	42		57
				Sum antall individ:				107

Stasjonsnr.: C2

NEMERTINI								
			Nemertea indet.			2	-	2
ECHIURIDA								

Rekke	Klasse	Orden	Art/Taxa	Replikat:	01	02	-	Sum
			Echiurus echiurus		4	6	-	10
SIPUNCULIDA								
			Phascolion strombus		2	1	-	3
ANNELIDA								
	Polychaeta							
		Orbiniida						
			Aricidea sp.			1	-	1
			Leitoscoloplos mammosus		1	4	-	5
			Levinsenia gracilis		23	26	-	49
			Scoloplos armiger		7	9	-	16
		Spionida						
			Chaetozone sp.		3	9	-	12
			Cirratulus cirratus		3		-	3
			Laonice cirrata			1	-	1
			Prionospio steenstrupi		4	1	-	5
			Tharyx killariensis			1	-	1
		Capitellida						
			Maldane sarsi		22	35	-	57
			Maldanidae indet.		4	6	-	10
			Mediomastus fragilis		2	2	-	4
			Notomastus latericeus			1	-	1
			Praxillella gracilis		5	3	-	8
			Rhodine gracilior		24	4	-	28
		Opheliida						
			Pseudoscalibregma parvum		1		-	1
		Phyllodocida						
			Eteone flava/longa		6	7	-	13
			Nephtys ciliata			1	-	1
			Nephtys paradoxa		2		-	2
			Pholoe assimilis		2	5	-	7
			Pholoe baltica		2	1	-	3
			Polynoidae indet.			1	-	1
			Syllis cornuta		5	3	-	8
		Eunicida						
			Nothria conchylega		2		-	2
			Parougia nigridentata		4	1	-	5
		Sternaspida						
			Sternaspis scutata		3	11	-	14
		Oweniida						
			Galathowenia oculata			1	-	1
		Flabelligerida						
			Bradabyssa villosa		1	2	-	3
			Diplocirrus longisetosus		2		-	2
		Terebellida						
			Ampharete octocirrata			1	-	1
			Cistenides hyperborea		2	3	-	5
			Lagis koreni			1	-	1
			Melinna cristata		2		-	2
		Sabellida						
			Euchone sp.		4	1	-	5
CRUSTACEA								
	Ostracoda							
			Ostracoda indet.		1	2	-	3
	Malacostraca							
		Amphipoda						
			Deflexilodes sp.		1	2	-	3
			Gammaridea indet.			1	-	1
			Oedicerotidae indet.		1		-	1
			Crustacea indet.		1		-	1
MOLLUSCA								
	Caudofoveata							
			Caudofoveata indet.		3	1	-	4
	Polyplacophora							
		Ischnochitonidae						
			Stenosemus albus		4	1	-	5
	Prosobranchia							
		Archaeogastropoda						
			Lepeta caeca		5	5	-	10
			Moelleria costulata		1	1	-	2

Rekke	Klasse	Orden	Art/Taxa	Replikat:	01	02	-	Sum
	Bivalvia							
		Nuculoida						
			Ennucula tenuis		1	8	-	9
			Nuculana pernula		10	7	-	17
			Nuculana sp. juv.		2	1	-	3
		Mytiloida						
			Crenella decussata			1	-	1
		Ostreoidea						
			Palliolinae indet.			1	-	1
		Veneroida						
			Arctica islandica		17	7	-	24
			Astarte elliptica		1	4	-	5
			Astarte montagui		6	6	-	12
			Macoma calcarea		11	23	-	34
			Parvicardium pinnulatum		2		-	2
			Thyasira gouldii		30	40	-	70
			Thyasira sarsii			2	-	2
		Pholadomyoida						
			Thracia devexa		6	1	-	7
ECHINODERMATA								
	Ophiuroidea							
		Ophiurida						
			Amphipholis squamata		1		-	1
			Ophiopholis aculeata			1	-	1
			Ophiura albida		1	1	-	2
				Maksverdi:	30	40		70
				Antall arter/taxa:	47	52		62
				Sum antall individ:				514

Stasjonsnr.: C2alt

NEMERTINI								
			Nemertea indet.		3	1	-	4
ECHIURIDA								
			Echiurus echiurus		6	12	-	18
SIPUNCULIDA								
			Phascolion strombus			1	-	1
ANNELIDA								
	Polychaeta							
		Orbiniida						
			Scoloplos armiger		4	3	-	7
		Spionida						
			Chaetozone sp.		9	3	-	12
			Prionospio steenstrupi		73	26	-	99
			Spio armata			1	-	1
			Spio limicola		7	3	-	10
		Capitellida						
			Mediomastus fragilis			1	-	1
		Phyllodocida						
			Eteone flava/longa		4	2	-	6
			Nephtys ciliata			2	-	2
			Pholoe assimilis		1		-	1
			Pholoe baltica		1		-	1
			Syllis cornuta		1		-	1
		Eunicida						
			Lumbrineris mixochaeta		7	1	-	8
			Parougia nigridentata		2	3	-	5
		Oweniida						
			Galathowenia oculata		13	10	-	23
		Terebellida						
			Ampharete borealis		1		-	1
			Cistenides hyperborea			1	-	1
			Melinna cristata			1	-	1
CRUSTACEA								
	Malacostraca							
		Cumacea						
			Cumacea indet.			1	-	1
			Leucon sp.			2	-	2

Rekke	Klasse	Orden	Art/Taxa	Replikat:	01	02	-	Sum
		Amphipoda						
			Dyopedos porrectus		1		-	1
			Gammaridea indet.		1		-	1
			Metopa boeckii			2	-	2
MOLLUSCA								
	Prosobranchia							
		Archaeogastropoda						
			Lepeta caeca			1	-	1
	Bivalvia							
		Nuculoida						
			Ennucula tenuis		15	2	-	17
			Nuculana pernula			1	-	1
		Veneroida						
			Macoma calcarea		1		-	1
			Thyasira gouldii		2	1	-	3
			Thyasira sarsii		85	153	-	238
				Maksverdi:	85	153		238
				Antall arter/taxa:	20	24		31
				Sum antall individ:				471

Stasjonsnr.: C3

NEMERTINI								
			Nemertea indet.		5	2	-	7
ECHIURIDA								
			Echiurus echiurus			5	-	5
SIPUNCULIDA								
			Phascolion strombus		1		-	1
ANNELIDA								
	Polychaeta							
		Orbiniida						
			Leitoscoloplos mammosus		22	34	-	56
			Levinsenia gracilis		10	12	-	22
			Scoloplos armiger		6	7	-	13
		Spionida						
			Chaetozone sp.		6	10	-	16
			Laonice cirrata			1	-	1
			Prionospio steenstrupi		25	14	-	39
			Spio limicola		2	2	-	4
		Capitellida						
			Capitella capitata			1	-	1
			Maldane sarsi		6	2	-	8
			Maldanidae indet.		2	1	-	3
			Mediomastus fragilis		1	1	-	2
			Petaloproctus tenuis			1	-	1
			Praxillella gracilis		9	3	-	12
			Rhodine gracilior		10	2	-	12
		Opheliida						
			Scalibregma inflatum			2	-	2
		Phyllodocida						
			Eteone flava/longa		5	3	-	8
			Goniada maculata			2	-	2
			Nephtys ciliata		1	2	-	3
			Nephtys paradoxa		1	1	-	2
			Pholoe assimilis		3	2	-	5
			Syllis cornuta		1		-	1
			Syllis sp.		1		-	1
		Eunicida						
			Lumbrineris mixochaeta		4	4	-	8
			Nothria conchylega		4	1	-	5
			Parougia nigridentata			2	-	2
			Scoletoma fragilis			1	-	1
		Sternaspida						
			Sternaspis scutata		1	9	-	10
		Oweniida						
			Galathowenia oculata		4	5	-	9
		Flabelligerida						
			Bradabyssa villosa			1	-	1

Rekke	Klasse	Orden	Art/Taxa	Replikat:	01	02	-	Sum
			Diplocirrus longisetosus		1		-	1
		Terebellida						
			Ampharete petersenae		1		-	1
			Cistenides hyperborea		3		-	3
			Lagis koreni		4	20	-	24
			Laphania boecki		1		-	1
			Leaena ebranchiata		1		-	1
		Sabellida						
			Euchone sp.		1	1	-	2
CRUSTACEA								
	Ostracoda							
			Ostracoda indet.		1		-	1
	Malacostraca							
		Amphipoda						
			Deflexilodes sp.		1		-	1
			Gammaridea indet.		1		-	1
			Megamoera dentata			1	-	1
			Oedicerotidae indet.			1	-	1
		Isopoda						
			Pleurogonium spinosissimum			1	-	1
MOLLUSCA								
	Caudofoveata							
			Caudofoveata indet.		4	4	-	8
	Bivalvia							
		Nuculoida						
			Ennucula tenuis		8	26	-	34
			Nuculana pernula		8	24	-	32
			Nuculana sp. juv.		7	5	-	12
		Mytiloida						
			Crenella decussata		9	2	-	11
		Veneroida						
			Abra nitida		9	58	-	67
			Arctica islandica		1	2	-	3
			Astarte elliptica		4	3	-	7
			Astarte montagui		4	11	-	15
			Axinopsida orbiculata			5	-	5
			Macoma calcarea		7	14	-	21
			Thyasira gouldii		29	32	-	61
			Thyasira sarsii		10	13	-	23
			Thyasiridae indet.			12	-	12
		Myoida						
			Mya sp. juv.		1	1	-	2
ECHINODERMATA								
	Asteroidea							
		Forcipulatida						
			Asterias rubens			1	-	1
	Ophiuroidea							
			Ophiuroidea indet. juv.		1		-	1
				Maksverdi:	29	58		67
				Antall arter/taxa:	47	50		62
				Sum antall individ:				617

Stasjonsnr.: C4

Rekke	Klasse	Orden	Art/Taxa	01	02	-	Sum
ANNELIDA							
	Polychaeta						
		Spionida					
			Chaetozone sp.	4	3	-	7
			Prionospio steenstrupi	82	92	-	174
		Capitellida					
			Praxillella gracilis	1	1	-	2
		Opheliida					
			Ophelina acuminata		2	-	2
		Phyllodocida					
			Eteone flava/longa	1		-	1
			Pholoe assimilis	1	1	-	2
		Eunicida					
			Lumbrineris mixochaeta		2	-	2
			Parougia nigridentata		3	-	3
		Terebellida					
			Melinna cristata		1	-	1

Rekke	Klasse	Orden	Art/Taxa	Replikat:	01	02	-	Sum
		Sabellida						
			Euchone sp.			1	-	1
CRUSTACEA								
	Malacostraca							
		Cumacea						
			Leucon sp.		1	6	-	7
MOLLUSCA								
	Bivalvia							
		Nuculoida						
			Ennucula tenuis		3		-	3
			Nuculana pernula			1	-	1
			Yoldia hyperborea		2	2	-	4
		Veneroida						
			Macoma calcarea			1	-	1
			Thyasira gouldii		1		-	1
			Thyasira sarsii		9	7	-	16
				Maksverdi:	82	92		174
				Antall arter/taxa:	10	14		17
				Sum antall individ:				228

7.4 Analytical report

ANALYSERAPPORT

Kunde:	Arnarlax	Rapport nr.:	P2200115
Kundemerking:	Fossfjordur		
Kontaktperson kunde:		Rapportdato	2022-08-01
Prosjektnr.:	64107	Ankomst dato	2022-06-17

Lab-id. P2200115-01

Objekt	Kundens ID	Beskrivelse	Notering	Mottatt lab
Sediment	C1	64107 - Fossfjordur ASC/C og B undersøkelse 2022		2022-06-17

Analyseresultat

Parameter	Resultat	Enhet	Analysedato start	Analysedato slutt	Standard	Måleusikkerhet
TOC	13	mg/g TS	2022-07-11	2022-07-13	DIN 19539:2016	±1.3
TNb	2.8	mg/g TS	2022-07-11	2022-07-13	NS-EN 16168:2012	±0.8
N TOC	21.6	mg/g TS	2022-07-20	2022-07-20	Veileder 02:2018	
C/N - forhold	4.7		2022-07-20	2022-07-20		
TOM	5.3	% TS	2022-07-18	2022-07-21	Intern metode	±0.0
Vekt % 2 mm	3.9	wt% TS	2022-07-11	2022-07-14	Intern metode	±0.2
Vekt % 1 mm	2.2	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.1
Vekt % 0.500 mm	2.6	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.1
Vekt % 0.250 mm	4.8	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.2
Vekt % 0.125 mm	10.3	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.5
Vekt % 0.063 mm	23.4	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±1.2
Vekt % < 0.063 mm	52.8	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±2.6
Pelitt	52.8	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±2.6
Sand	43.3	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±2.2
Grus	3.9	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.2
Cu (kobber) [a]	43.2	mg/kg TS	2022-07-14	2022-07-14	Intern metode	
P (Fosfor) [a]	810	mg/kg TS	2022-07-14	2022-07-14	Intern metode	

[a] Prøvingen er utført av eksternt laboratorium, ALS Laboratory Group

* = Ikke akkreditert resultat

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ANALYSERAPPORT

Kunde:	Arnarlax	**Rapport nr.:**	P2200115
Kundemerking:	Fossfjordur		
Kontaktperson kunde:		**Rapportdato**	**2022-08-01**
Prosjektnr.:	**64107**	**Ankomst dato**	2022-06-17

Lab-id. P2200115-02

Objekt	Kundens ID	Beskrivelse	Notering	Mottatt lab
Sediment	C2/ ASC ref/Cu ref1	64107 - Fossfjordur ASC/C og B undersøkelse 2022		2022-06-17

Analyseresultat

Parameter	Resultat	Enhet	Analysedato start	Analysedato slutt	Standard	Måleusikkerhet
TOC	23	mg/g TS	2022-07-11	2022-07-13	DIN 19539:2016	±2.3
TNb	4.8	mg/g TS	2022-07-11	2022-07-13	NS-EN 16168:2012	±1.4
N TOC	26.0	mg/g TS	2022-07-20	2022-07-20	Veileder 02:2018	
C/N - forhold	4.7		2022-07-20	2022-07-20		
TOM	10.7	% TS	2022-07-18	2022-07-21	Intern metode	±0.0
Vekt % 2 mm	5.4	wt% TS	2022-07-11	2022-07-14	Intern metode	±0.3
Vekt % 1 mm	3.9	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.2
Vekt % 0.500 mm	2.0	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.1
Vekt % 0.250 mm	1.6	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.1
Vekt % 0.125 mm	1.6	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.1
Vekt % 0.063 mm	4.2	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.2
Vekt % < 0.063 mm	81.2	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±4.1
Pelitt	81.2	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±4.1
Sand	13.3	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.7
Grus	5.4	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.3
Cu (kobber) [a]	44.7 43.6	mg/kg TS	2022-07-14	2022-07-14	Intern metode	
P (Fosfor) [a]	1160	mg/kg TS	2022-07-14	2022-07-14	Intern metode	

[a] Prøvingen er utført av eksternt laboratorium, ALS Laboratory Group

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ANALYSERAPPORT

Kunde:	Arnarlax	**Rapport nr.:**	P2200115
Kundemerking:	Fossfjordur		
Kontaktperson kunde:		**Rapportdato**	**2022-08-01**
Prosjektnr.:	**64107**	**Ankomst dato**	2022-06-17

Lab-id. P2200115-03

Objekt	Kundens ID	Beskrivelse	Notering	Mottatt lab
Sediment	C3/ASC3	64107 - Fossfjordur ASC/C og B undersøkelse 2022	Analyse av EMB sendes ut i en egen analyserapport	2022-06-17

Analyseresultat

Parameter	Resultat	Enhet	Analysedato start	Analysedato slutt	Standard	Måleusikkerhet
TOC	15	mg/g TS	2022-07-11	2022-07-13	DIN 19539:2016	±1.5
TNb	3.2	mg/g TS	2022-07-11	2022-07-13	NS-EN 16168:2012	±0.9
N TOC	23.1	mg/g TS	2022-07-20	2022-07-20	Veileder 02:2018	
C/N - forhold	4.6		2022-07-20	2022-07-20		
TOM	6.1	% TS	2022-07-18	2022-07-21	Intern metode	±0.0
Vekt % 2 mm	2.0	wt% TS	2022-07-11	2022-07-14	Intern metode	±0.1
Vekt % 1 mm	2.1	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.1
Vekt % 0.500 mm	2.3	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.1
Vekt % 0.250 mm	4.2	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.2
Vekt % 0.125 mm	11.0	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.5
Vekt % 0.063 mm	25.2	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±1.3
Vekt % < 0.063 mm	53.1	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±2.7
Pelitt	53.1	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±2.7
Sand	44.9	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±2.2
Grus	2.0	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.1
Cu (kobber) [a]	44.4 44.7	mg/kg TS	2022-07-14	2022-07-14	Intern metode	
P (Fosfor) [a]	510	mg/kg TS	2022-07-14	2022-07-14	Intern metode	

[a] Prøvingen er utført av eksternt laboratorium, ALS Laboratory Group

* = Ikke akkreditert resultat

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ANALYSERAPPORT

Kunde:	Arnarlax	**Rapport nr.:**	P2200115
Kundemerking:	Fossfjordur		
Kontaktperson kunde:		**Rapportdato**	**2022-08-01**
Prosjektnr.:	**64107**	**Ankomst dato**	2022-06-17

Lab-id. P2200115-04

Objekt	Kundens ID	Beskrivelse	Notering	Mottatt lab
Sediment	C4/ASC4	64107 - Fossfjordur ASC/C og B undersøkelse 2022		2022-06-17

Analyseresultat

Parameter	Resultat	Enhet	Analysedato start	Analysedato slutt	Standard	Måleusikkerhet
TOC	28	mg/g TS	2022-07-11	2022-07-13	DIN 19539:2016	±2.8
TNb	3.6	mg/g TS	2022-07-11	2022-07-13	NS-EN 16168:2012	±1.1
N TOC	30.9	mg/g TS	2022-07-20	2022-07-20	Veileder 02:2018	
C/N - forhold	7.7		2022-07-20	2022-07-20		
TOM	12.8	% TS	2022-07-18	2022-07-21	Intern metode	±0.0
Vekt % 2 mm	0.1	wt% TS	2022-07-11	2022-07-14	Intern metode	±0.0
Vekt % 1 mm	1.0	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.1
Vekt % 0.500 mm	3.9	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.2
Vekt % 0.250 mm	4.5	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.2
Vekt % 0.125 mm	2.7	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.1
Vekt % 0.063 mm	2.8	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.1
Vekt % < 0.063 mm	85.1	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±4.3
Pelitt	85.1	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±4.3
Sand	14.8	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.7
Grus	0.1	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.0
Cu (kobber) [a]	51.0 52.4	mg/kg TS	2022-07-14	2022-07-14	Intern metode	
P (Fosfor) [a]	1030	mg/kg TS	2022-07-14	2022-07-14	Intern metode	

[a] Prøvingen er utført av eksternt laboratorium, ALS Laboratory Group

* = Ikke akkreditert resultat

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Analyserapporten er digitalt undertegnet av:
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ANALYSERAPPORT

Kunde:	Arnarlax	**Rapport nr.:**	P2200115
Kundemerking:	Fossfjordur		
Kontaktperson kunde:		**Rapportdato**	**2022-08-01**
Prosjektnr.:	**64107**	**Ankomst dato**	2022-06-17

Lab-id. P2200115-05

Objekt	Kundens ID	Beskrivelse	Notering	Mottatt lab
Sediment	ASC1	64107 - Fossfjordur ASC/C og B undersøkelse 2022		2022-06-17

Analyseresultat

Parameter	Resultat	Enhet	Analysedato start	Analysedato slutt	Standard	Måleusikkerhet
TOC	28	mg/g TS	2022-07-11	2022-07-13	DIN 19539:2016	±2.8
TNb	*5.0	mg/g TS	2022-07-11	2022-07-13	NS-EN 16168:2012	±1.5
N TOC	30.7	mg/g TS	2022-07-20	2022-07-20	Veileder 02:2018	
C/N - forhold	5.6		2022-07-20	2022-07-20		
TOM	11.6	% TS	2022-07-18	2022-07-21	Intern metode	±0.0
Vekt % 2 mm	2.3	wt% TS	2022-07-11	2022-07-14	Intern metode	±0.1
Vekt % 1 mm	3.0	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.1
Vekt % 0.500 mm	3.2	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.2
Vekt % 0.250 mm	2.0	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.1
Vekt % 0.125 mm	1.2	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.1
Vekt % 0.063 mm	2.5	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.1
Vekt % < 0.063 mm	85.9	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±4.3
Pelitt	85.9	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±4.3
Sand	11.8	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.6
Grus	2.3	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.1

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ANALYSERAPPORT

Kunde:	Arnarlax	**Rapport nr.:**	P2200115
Kundemerking:	Fossfjordur		
Kontaktperson kunde:		**Rapportdato**	**2022-08-01**
Prosjektnr.:	**64107**	**Ankomst dato**	2022-06-17

Lab-id. P2200115-06

Objekt	Kundens ID	Beskrivelse	Notering	Mottatt lab
Sediment	ASC2	64107 - Fossfjordur ASC/C og B undersøkelse 2022		2022-06-17

Analyseresultat

Parameter	Resultat	Enhet	Analysedato start	Analysedato slutt	Standard	Måleusikkerhet
TOC	**18**	mg/g TS	2022-07-11	2022-07-13	DIN 19539:2016	±1.8
TNb	**3.9**	mg/g TS	2022-07-11	2022-07-13	NS-EN 16168:2012	±1.2
N TOC	**24.2**	mg/g TS	2022-07-20	2022-07-20	Veileder 02:2018	
C/N - forhold	**4.5**		2022-07-20	2022-07-20		
TOM	**8.4**	% TS	2022-07-18	2022-07-21	Intern metode	±0.0
Vekt % 2 mm	**0.7**	wt% TS	2022-07-11	2022-07-14	Intern metode	±0.0
Vekt % 1 mm	**2.9**	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.1
Vekt % 0.500 mm	**0.7**	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.0
Vekt % 0.250 mm	**2.5**	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.1
Vekt % 0.125 mm	**6.5**	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.3
Vekt % 0.063 mm	**23.6**	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±1.2
Vekt % < 0.063 mm	**63.1**	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±3.2
Pelitt	**63.1**	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±3.2
Sand	**36.2**	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±1.8
Grus	**0.7**	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.0

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ANALYSERAPPORT

Kunde:	Arnarlax	**Rapport nr.:**	P2200115
Kundemerking:	Fossfjordur		
Kontaktperson kunde:		**Rapportdato**	**2022-08-01**
Prosjektnr.:	**64107**	**Ankomst dato**	2022-06-17

Lab-id. P2200115-07

Objekt	Kundens ID	Beskrivelse	Notering	Mottatt lab
Sediment	Cu ref2	64107 - Fossfjordur ASC/C og B undersøkelse 2022		2022-06-17

Analyseresultat						
Parameter	Resultat	Enhet	Analysedato start	Analysedato slutt	Standard	Måleusikkerhet
Cu (kobber) [a]	52.6 48.3	mg/kg TS	2022-07-14	2022-07-14	Intern metode	

[a] Prøvingen er utført av eksternt laboratorium, ALS Laboratory Group

Lab-id. P2200115-08

Objekt	Kundens ID	Beskrivelse	Notering	Mottatt lab
Sediment	Cu ref3	64107 - Fossfjordur ASC/C og B undersøkelse 2022		2022-06-17

Analyseresultat						
Parameter	Resultat	Enhet	Analysedato start	Analysedato slutt	Standard	Måleusikkerhet
Cu (kobber) [a]	56.8 52.1	mg/kg TS	2022-07-14	2022-07-14	Intern metode	

[a] Prøvingen er utført av eksternt laboratorium, ALS Laboratory Group

Lab-id. P2200115-09

Objekt	Kundens ID	Beskrivelse	Notering	Mottatt lab
Sediment	C2alt / ASC ref alt	64107 - Fossfjordur ASC/C og B undersøkelse 2022		2022-06-17

Analyseresultat						
Parameter	Resultat	Enhet	Analysedato start	Analysedato slutt	Standard	Måleusikkerhet
TOC	31	mg/g TS	2022-07-11	2022-07-13	DIN 19539:2016	±3.1
TNb	4.2	mg/g TS	2022-07-11	2022-07-13	NS-EN 16168:2012	±1.3
N TOC	40.8	mg/g TS	2022-07-20	2022-07-20	Veileder 02:2018	
C/N - forhold	7.3		2022-07-20	2022-07-20		

Tabellen fortsetter på neste side...

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ANALYSERAPPORT

Kunde:	Arnarlax	**Rapport nr.:**	P2200115
Kundemerking:	Fossfjordur		
Kontaktperson kunde:		**Rapportdato**	**2022-08-01**
Prosjektnr.:	**64107**	**Ankomst dato**	2022-06-17

Fortsettelse av tabell fra forrige side.

Parameter	Resultat	Enhet	Analysedato start	Analysedato slutt	Standard	Måleusikkerhet
TOM	**11.7**	% TS	2022-07-18	2022-07-21	Intern metode	±0.0
Vekt % 2 mm	**3.9**	wt% TS	2022-07-11	2022-07-14	Intern metode	±0.2
Vekt % 1 mm	**0.8**	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.0
Vekt % 0.500 mm	**0.8**	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.0
Vekt % 0.250 mm	**9.5**	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.5
Vekt % 0.125 mm	**16.4**	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.8
Vekt % 0.063 mm	**25.3**	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±1.3
Vekt % < 0.063 mm	**43.2**	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±2.2
Pelitt	**43.2**	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±2.2
Sand	**52.9**	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±2.6
Grus	**3.9**	wt% TS	2022-07-11	2022-07-14	Intern metode (Bale/Kenny 2005)	±0.2
Cu (kobber) [a]	**53.8 53.0**	mg/kg TS	2022-07-14	2022-07-14	Intern metode	
P (Fosfor) [a]	**7880**	mg/kg TS	2022-07-14	2022-07-14	Intern metode	

[a] Prøvingen er utført av eksternt laboratorium, ALS Laboratory Group

Analyse av EMB i sedimenter sendes ut i egen analyserapport.

Analyseansvarlig:

Ingar H. Wasbotten

Signatur:

Ingar H. Wasbotten

Underskriftsberettiget:

Signatur:

* = Ikke akkreditert resultat

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ANALYSERAPPORT

Kunde:	Arnarlax	**Rapport nr.:**	P2200115
Kundemerking:	Fossfjordur		
Kontaktperson kunde:		**Rapportdato**	**2022-08-01**
Prosjektnr.:	**64107**	**Ankomst dato**	2022-06-17

Analysene gjelder bare for de prøver som er testet. De oppgitte analyseresultat omfatter ikke feil som måtte følge av prøvetagningen, inhomogenitet eller andre forhold som kan ha påvirket prøven før den ble mottatt av laboratoriet. Rapporten får kun kopieres i sin helhet og uten noen form for endringer. En eventuell klage skal leveres laboratoriet senest en måned etter mottak av analyseresultat.
Nærmere informasjon om analysemetodene (måleusikkerhet, metodeprinsipp etc.) fås ved henvendelse til Akvaplan-Niva AS

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