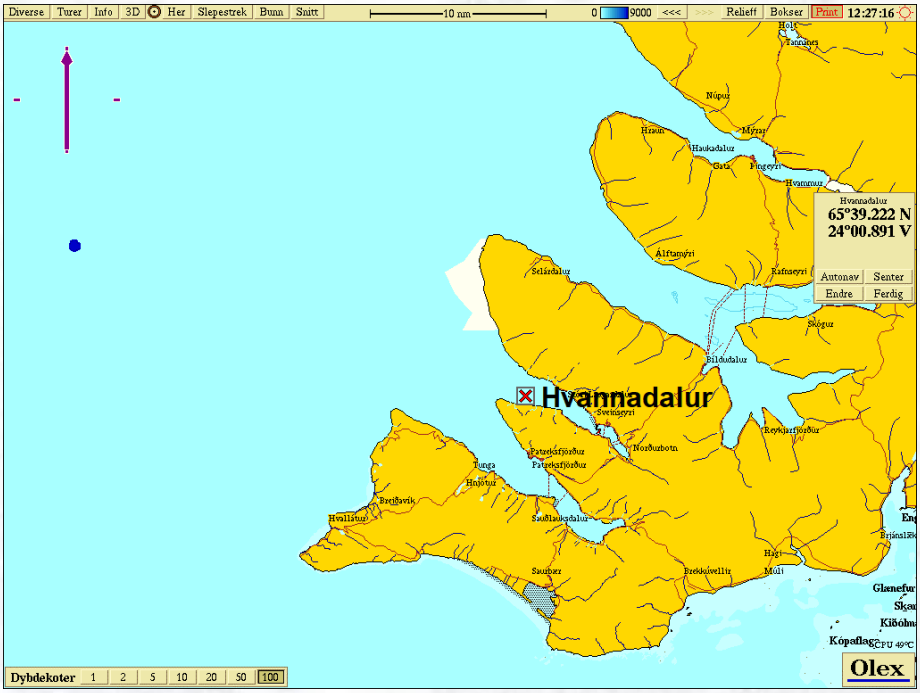
Akvaplan niva

Rapport Report

Hvannadalur, Arctic Sea Farm
B-bottom pre-survey,
July 2019



NORSK AKKREDITERING TEST 079

Akvaplan-niva AS: APN 61376.B01

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Information client			
Titel	Hvannadalur, Arctic Sea Farm. B-bottom pre-survey, July 2019		
Report number	APN-61376.B01		
Site name	Hvannadalur	Coordinates site	65°39.222 N 024°00.891 V
County	Vesturbyggð	Municipality	Tálknafjörður
MTB-or estimated max biomass	3400 tonn	Site manager/contact	Stein Ove Tveiten
Client name	Arctic Sea Farm hf.		

Biomass/production/status at date of survey			
Biomass at date of survey	0 ton	Feed use	0 ton
Fish type	Salmon	Amount produced	0 ton
Type/time of survey	**Mark with X**	Comments	
At maximal biomass see kap 7.9	☐		
A follow up survey	☐		
Half maximal biomass	☐		
Survey prior to putting out smolt	☐		
A pre-survey new site	☒		
Other	☐		
Last fallowing period:			

Results from B-survey iht. NS 9410:2016 (main results)			
Parameters and indexes		**Parameters and site status**	
Gr. II. pH/Eh	0,00	Gr. II. pH/Eh	1
Gr. III. Sensory	0,53	Gr. III. Sensory	1
GR. II + III	0,31	GR. II+ III	1
Date field work	15.07 2019	**Date report**	10.10.19
Site status (NS 9410:2016):			**1**

Report writing and project leader	Arnþór Gústavsson	Signature	Arnþór Gústavsson
Quality control	Snorri Gunnarsson	Signature	Snorri Gunnarsson

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Preface

The survey is carried out according to guidelines in NS 9410:2016 which includes evaluation of sediment, faunal investigation and bottom topography. The environmental survey is regulated by § 35 in the Norwegian «akvakulturdriftsforskriften. The survey also fulfills the requirements regarding bottom surveys in the standard ISO 12878.

The primary objective of a B-survey is to fulfil the requirements regarding pre-surveys (forundersøkelse) as they are defined in NS9410:2016. There is a requirement of at least 10 sampling stations within the mooring lines of the fish farm. The estimated max biomass for first generation farmed salmon at the site Hvannadalur is 3.400 MTB ton. The methods applied in this pre-survey follow guidelines in chapter 5 (NS6410:216) and fulfil the requirements described in ISO 12878. The survey deviates though from chapter 7.6 in NS9410:2016 regarding sampling. Requirements that samplings stations should be placed just beside the cages or under cages that have been used is not fulfilled. The reason is that this is a new site that has not been used before and cages are not installed at the time of this survey.

The following have participated in the survey:

Arnþór Gústavsson	Akvaplan-niva AS	Prosjektleder.
Arnþór Gústavsson / Snorri Gunnarsson	Akvaplan-niva AS	Feltarbeid. Kart (Olex). Rapport.

The date for sampling at the Hvannadalur was done 15.07 2019.

Accredited survey:

The following parts of the survey are done in accordance to accreditation methods:

Sampling and treatment of sediment samples, analysis of samples and evaluations of the results. It should be pointed out that as Icelandic officials have not set standards regarding different parameters based on samplings at Icelandic conditions so the site characters in this report should be interpreted with that disclaimer in mind.

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Akvaplan-niva AS thanks Arctic Sea Farm their personnel for the cooperation during the conductance of this site survey.

Kópavogi 10. oktober 2019

Arnþór Gústavsson

Arnþór Gústavsson
Project manager

1 Introduction

The sampling date for the present site survey was the 15.07 2019 and done by Akvaplan-niva AS contracted by Arctic Sea Farm in relation to the company's fish farming activity at the site Hvannadalur in Tálknafjörður, Tálknafjörður municipality.

The objective of the B-survey is to document the environmental condition of the local impact zone of the fish farm according to NS 9410:2016 (and ISO 12878) which includes condition of the seabed, faunal evaluation and bottom topography registration.

The survey gives an estimate and evaluation of the site condition regarding organic load and feasibility assessment of the site for fish farming activity.

Figure 1 shows map of the fjord system Vestfirðir where the site Hvannadalur is placed.

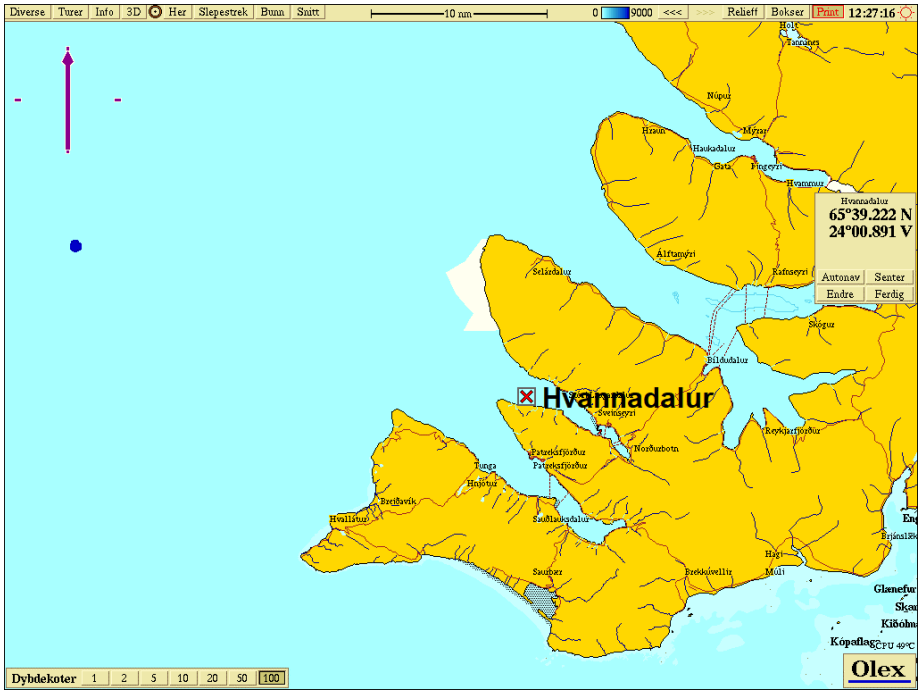

Figure 1. An overview map with the Hvannadalur site market by its name.

2 Professional program and methods

Environmental monitoring of the impact from the fish farming activities on the seabed is a standardised system. All fish farming sites in the sea are to be regularly assessed. The methods for monitoring in Iceland, are based on description in the ISO 12878 standard and methodology described in the NS 9410:2016 is followed. The Icelandic Environmental agency (Umhverfisstofnun) can also set forward specific requirements regarding frequency of samplings for different fish farming sites that can overrule the requirements in the above mentioned standards.

The B-survey is a trend study of the benthic conditions at, or in close proximity, to the fish farming site (local impact zone). Sediment is collected by use of grab (min 250 cm^2). Each grab sample is investigated with regard to three observation types of benthic characters; faunal parameters, chemical parameters (pH and redox potential) and a sensory evaluation (gas bobbles, smell, texture, colour and the thickness of the precipitated slam layer in the sediment. The different benthic parameters are given a character on the scale from 1 to 4, according to the scale of the impact on the benthic conditions from organic load, see criteria in table 1. The number of sampling stations are decided based on the estimated max standing biomass for the given year class for farmed fish at the site and it is the weighted average for all the sampling stations that gives the sites condition.

Table 1. Frequency of category B-research for the location of the farm based on state of the defined farming area.

Site condition at the time of sampling	Sampling frequency for B-surveys (NS 9410:2016)
1-very good	At next max biomass
2-good	Prior to putting next generation into sea and again at next max biomass.
3-bad	Prior to putting next generation into sea. Based on the site condition prior to putting next generation into sea: - Condition 1 – next site survey at next max biomass - Condition 2 – next site survey at next 50% max biomass and at max biomass - Condition 3 – next site survey at next 50% max biomass and at max biomass. Some conditions should apply for farming of next generation at the site If any of the samples result in character 4 it is a sign of overload.
4-very bad	Overload

2.1 Field equipment

The following field equipment was used during the site survey:
Grabb: Van Veen grabb (0,025 m^2)
Sieve 1 mm: Akvaplan-niva
pH meter: Electrode, YSI Professional Plus
Redox-meter: Electrode, YSI Professional Plus
Position determination– Garmin GPS mapping tool.
Digital camera

3 Site description and bottom topography

3.1 Info site operation

Hvannadalur site is a new site with no previous fish farming activity. The planned fish farm at the site will be a dual frame mooring system, each frame having 6 cages, a total of 12 cages, each with 160 m circumference. The planned timing for first smolts seawater transfer is August 2019.

Table 2 shows the production and feed usage for the present and past generations.

Table 2. Production and feed usage at the site Hvannadalur, data is based on info given from the fish farmer.

Generation of fish (G)	Production (ton)	Feed usage (ton)
Present generation	0 ton (new site)	0 ton (new site)

3.2 Present and past site surveys

Data from previous sampling not available as this is the first time with fish put into fish cages on the site.

3.3 Dispersing current

Measurement of dispersing current has not been done at the site so we use data from current measurements at 15 m depth (Heggem, 2018). Dominating current (15 m) is in direction south-east (120 degrees) with very little counter current. Average current speed is measured to be 4.9 cm/s. Highest current speed is measured to be 21.3 cm/s and 4.7 % of the measurements are < 1 cm/s.

3.4 Position of sampling stations

Description of the stations in the survey is given in figure 2 and table 3. Positioning of the stations was chosen based guidance and perimeters described in NS 9410:2016 and the bottom topography and planned configuration of the farm. The farming company has informed that there has not been any previous farming activity at the site. The planned fish farming site is to be placed in the fjord were the bottom depth under the cages is the range from 53 – 58 m, with the shallowest parts in the south-east part (closest to land) and more depth in direction into the middle of the fjord. The placement of sampling stations were chosen to give a good picture of the whole local impact zone. It is important to evaluate the status in both the deeper and shallower parts of the local impact zone of the fish farm. The sampling stations had a depth varying from 54 m (st. 1) to 58 m. The placement of the sampling stations is regarded to be in accordance with the descriptions for survey of local impact zone given in NS 9410:2016.

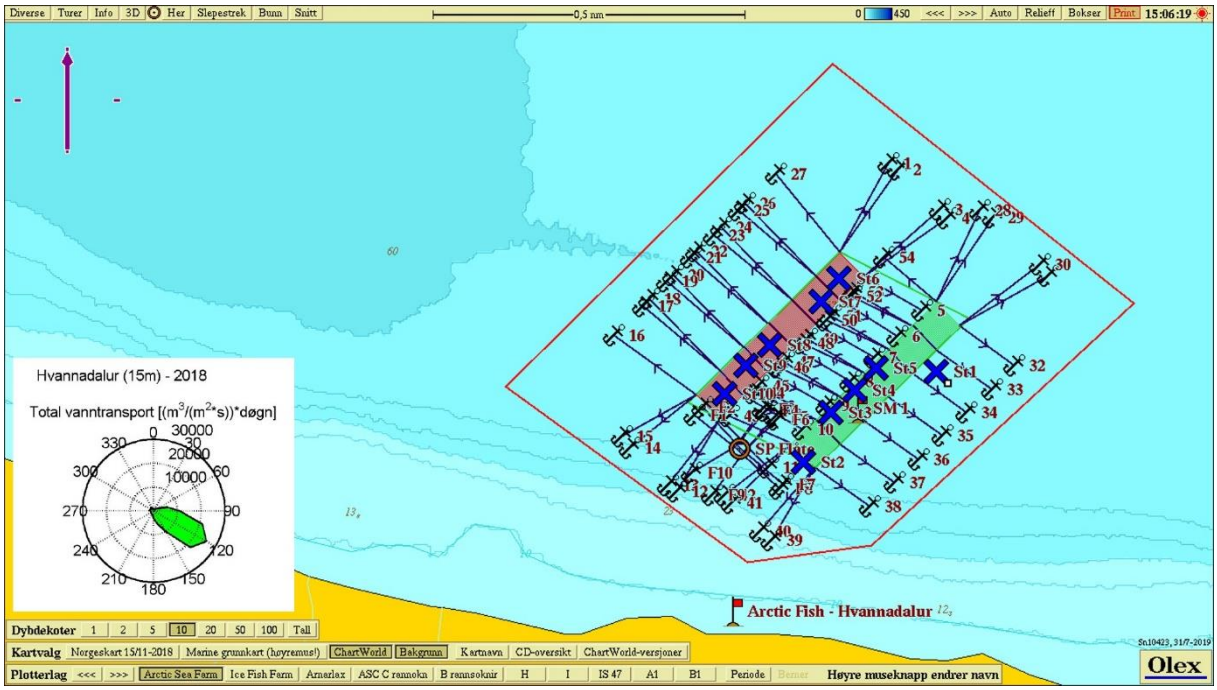

Figure 2. Chart showing depths at the site Hvannadalur. Sampling stations st. 1 – 10 are marked with color codes that describe the condition according to NS 9410:2016, chapter 7.11. Color codes: Blue =very good condition, green = good condition, yellow = bad condition, red = very bad condition. (Current rose from Heggem, 2018)

Table 3. Placement and depth of the sampling stations in the B-survey.

Station number	North	Vest	Depth (m)
St 1	65°39.203	24°00.469	55,3
St 2	65°39.059	24°00.984	56,5
St 3	65°39.138	24°00.880	56,8
St 4	65°39.174	24°00.787	57,0
St 5	65°39.210	24°00.704	56,3
St 6	65°39.353	24°00.847	56,6
St 7	65°39.316	24°00.917	56,2
St 8	65°39.246	24°01.116	56,9
St 9	65°39.214	24°01.208	57,1
St 10	65°39.168	24°01.290	57,5

4 Results

Results for the different parameters are given in Table 4. A complete filled sampling sheet with calculations for each parameter is attached in appendix.

Table 4. Results from the classifications of the local impact zone of the fish farm.

Parameter	Condition
Group II - parameters (pH/Eh)	1
Group III – parameters, (sensory)	1
Group II + III – parameters (mean value)	1
Site condition	1

There were collected valid sediment samples at all stations in the first grab taken. This indicates that in general there is soft bottom in the whole local impact zone. The sediment type consisted mainly of clay and very little silt. For the group I and II parameters, all ten station had conditions 1 «very good». For sensory parameters (group III) all stations had condition 1 «very good». For combined parameters I, II and III (animals, pH/redox and sensory) all stations had condition 1 «very good». Animals where present in all samples.

5 Conclusion

Based on the criteria given in NS 9410:2016 the fish farming site has been assigned a site condition 1 «Very Good» at the date of sampling. A total of 10 samples were taken with Van Veen grab (0,025 m^2), divided on 10 stations placed around the ten cages that are planned to be use at the site. All ten stations were assigned condition 1 «very good».

Measurement of dispersing current has not been done at the site, so we use data from current measurements at 15 m depth (Heggem, 2018). Dominating current (15 m) is in direction south-east (120 degrees). Average current speed is measured to be 4.9 cm/s. Highest current speed is measured to be 21.3 cm/s and 4.7 % of the measurements are < 1 cm/s.

The planned timing for putting the first smolts into sea at Hvannadalur is August 2019. The results from the study indicate that in general there is soft bottom in the whole local impact zone.

The site is assigned a condition factor 1 "Very good" according to calculations based on methodology described in NS 9410:2016 and sample sheet Table B.1 and B.2 (se chapter 7 Appendix).

6 References

Forskrift om drift av akvakulturanlegg (akvakulturdriftsforskriften) §§ 35 og 36.

Heggem, T. 2018. Arctic Sea Farm hf, lokalitetsrapport Hvannadalur. Akvaplan-niva AS rapport nr. 60201.05. 20 s.

ISO 5667-19:2004. Guidance on sampling of marine sediments.

ISO 12878:2012. Environmental monitoring of the impacts from marine finfish farms on soft bottom..

Norsk Standard NS 9410:2016. Miljøovervåking av bunnpåvirkning fra marine akvakultur-anlegg.

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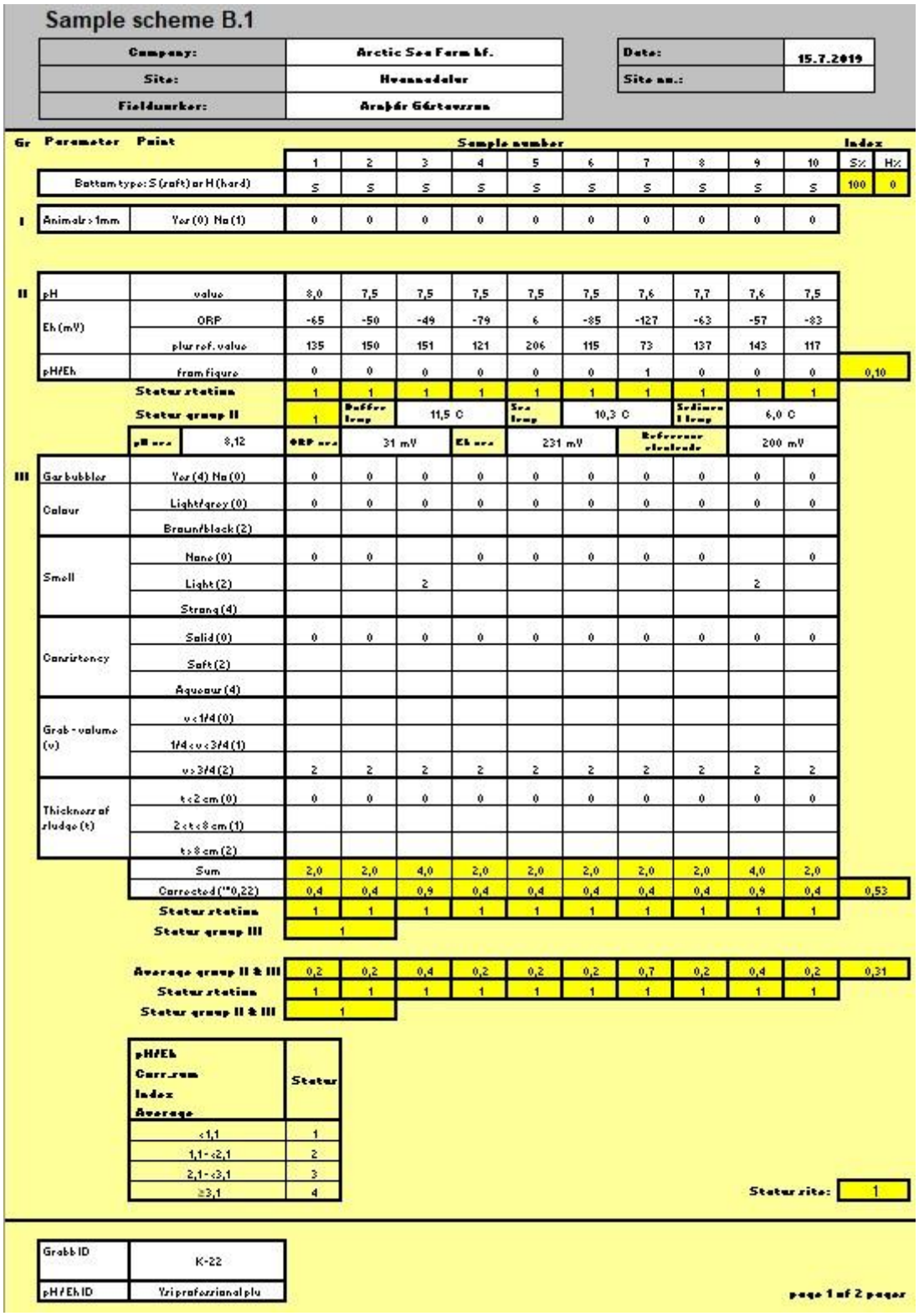
7 Appendix:

7.1 Sheet (B.1 og B.2) NS 9410:2016



Sample scheme B.1

Company:	Arctic Sea Farm hf.	Date:	15.7.2019
Site:	Hvannadalur	Site nr.:	
Fieldmarker:	Arnþór Gústavsson		

Gr	Parameter	Point	Sample number 1	2	3	4	5	6	7	8	9	10	Index S%	H%
	Bottom type: S (soft) or H (hard)		S	S	S	S	S	S	S	S	S	S	100	0
I	Animals > 1mm	Yes (0) No (1)	0	0	0	0	0	0	0	0	0	0		
II	pH	value	8,0	7,5	7,5	7,5	7,5	7,5	7,6	7,7	7,6	7,5		
	Eh (mV)	ORP	-65	-50	-49	-79	6	-85	-127	-63	-57	-83		
		plus ref. value	135	150	151	121	206	115	73	137	143	117		
	pH/Eh	from figure	0	0	0	0	0	0	1	0	0	0	0,10	
	Status station		1	1	1	1	1	1	1	1	1	1		
	Status group II		1	Buffer loop	11,5 C		Sea loop	10,3 C		Sediment loop	6,0 C			
	pH ave.	8,12	ORP ave.	31 mV		Eh ave.	231 mV		Reference electrode		200 mV			
III	Gas bubbles	Yes (4) No (0)	0	0	0	0	0	0	0	0	0	0		
	Colour	Light/grey (0)	0	0	0	0	0	0	0	0	0	0		
		Brown/black (2)												
	Smell	None (0)	0	0		0	0	0	0	0		0		
		Light (2)			2						2			
		Strong (4)												
	Consistency	Solid (0)	0	0	0	0	0	0	0	0	0	0		
		Soft (2)												
		Aqueous (4)												
	Grab - volume (v)	v < 1/4 (0)												
		1/4 < v < 3/4 (1)												
		v > 3/4 (2)	2	2	2	2	2	2	2	2	2	2		
	Thickness of sludge (t)	t < 2 cm (0)	0	0	0	0	0	0	0	0	0	0		
		2 < t < 8 cm (1)												
		t > 8 cm (2)												
		Sum	2,0	2,0	4,0	2,0	2,0	2,0	2,0	2,0	4,0	2,0		
		Corrected (*0,22)	0,4	0,4	0,9	0,4	0,4	0,4	0,4	0,4	0,9	0,4	0,53	
		Status station	1	1	1	1	1	1	1	1	1	1		
		Status group III	1											
		Average group II & III	0,2	0,2	0,4	0,2	0,2	0,2	0,7	0,2	0,4	0,2	0,31	
		Status station	1	1	1	1	1	1	1	1	1	1		
		Status group II & III	1											

pH/Eh Corr.sum Index Average	Status
<1,1	1
1,1 - <2,1	2
2,1 - <3,1	3
≥3,1	4

Status site: 1

Grabb ID	K-22
pH/Eh ID	Yri profesional plu

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Sample Scheme B.2

Company:	Arctic Sea Farm hf.	Date:	15.7.2019
Site:	Hvannadalur	Site no.:	0
Fieldworker:	Arnþór Gústavsson		

Sample number		1	2	3	4	5	6	7	8	9	10
Depth (m)											
Number of trials		1	1	1	1	1	1	1	1	1	1
Gas bubbles (in sample)											
Sediment type	Clay	x	x	x	x	x	x	x	x	x	x
	Silt										
	Sand										
	Gravel										
	Shellsand										
Reef											
Rocky bottom (cobbles, boulders)											
Echinodermata, count					1				3	4	2
Crustaceans, count											
Molluscs, count		3	4	>5	1	2	3	4	3	5	5
Polychaetes, count		3	2	1		>5	3	3	3	5	>5
Other animals, count											
Beggiatoa											
Feed											
Faeces											
Comments											

Grab	Area [m²]		Grab ID	K-22
Signature fieldworker:	Arnþór Gústavsson			page 2 of 2 pages

7.2 Pictures of samples at Hvannadalur

St 1		
St 2		
St 3		N/A
St 4		
St 5		

St 6		
St 7		
St 8		
St 9	N/A	
St 10		

7.3 Bottom topography and 3D view

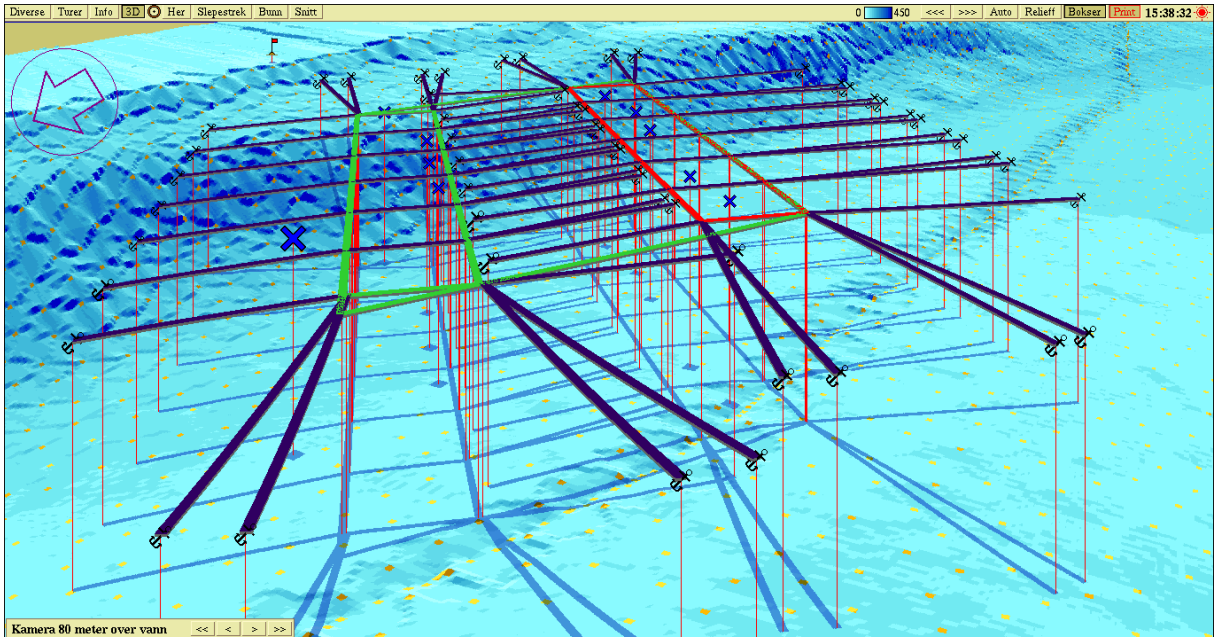

Figure 3. Showing bottom topography 3D at Hvannadalur with each sampling station according to info in figure 2 and Table 4.