B-survey at Haukadalsbót, September 2025 (fallow period), Arctic Sea Farm ehf

Akvaplan-niva AS Report:
APN 2025 66881.B01

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Customer	Arctic Sea Farm ehf
Contact person	Guðmundur Ólafsson

Summary

Sediment was recovered at 15 of the total stations (100% soft bottom). The sediments were in general homogenous at the site and consisted primarily of clay in the whole near zone of the fish farm. Fauna was recorded to be present at all stations mainly in the form of polychaetes. There were no signs of out-gassing. Light smell of H_2S was recorded at eight sampling stations and no smell at seven stations. The substrate was light/grey colour at eleven stations and brown/black at four stations. Consistency of the sediment was solid at all the fifteen stations.

Based on the classification of sediment chemistry (pH/Eh) and the sensory assessment all fifteen stations received status 1 – "very good". Overall, the index score for parameter III (sensory parameters) was somewhat higher (0.75) compared with the index score for the parameter II (pH/Eh) (0.00). Status of stations within parameter II (pH/Eh) was all fifteen stations with status 1 – "very good" while within parameter III (sensory) twelve stations had status 1 – "Very good and three stations had status 2 – " good.

In summary, the site receives the environmental status 1 - "Very good" (average group II-III index =0.37).

Approval

Snorri Gunnarsson
Project Manager

Quality Control

Key information

Site details and license holder information			
Site name	Haukadalsbót	Site coordinates	65°53.342' N 23°35.871' V
County	Ísafjarðarbær	Municipality	Ísafjarðarbær
MTB (estimated max biomass next generation)	4.500 tonnes	Operations Manager / Contact	Guðmundur Ólafsson
License holder / customer	Arctic Sea Farm		

Production status on date of survey			
Biomass at site	0 tonnes	Total feed use	0 tonnes
Farmed species	Salmon	Total biomass produced	0 tonnes
Type/time of survey	Indicated with X	Comments	
Maximum organic load cf. chapter 7.9	☐		
Follow-up survey	☐		
Half maximum load	☐		
Pre-stock	☒		
Required by the state administrator - baseline survey	☐		
Other	☐		
Last fallowing period:	13.06 2025-sampling date		

Results from B-survey in accordance with NS 9410:2016 (main results)			
Parameter group and index		Parameter group and status	
Gr. II. pH/Eh	0.00	Gr. II. pH/Eh	1
Gr. III. Sensory	0.75	Gr. III. Sensory	1
GR. II + III	0.37	GR. II+ III	1
Date of fieldwork	02.09 2025	Date of report	03.09 2025
Environmental status (NS 9410:2016):			**1**

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1 Introduction

The present survey was conducted by Akvaplan-niva AS on behalf of Arctic Sea Farm in connection with the company's fish farming activities at the site Haukadalsbót in Dýrafjörður in Ísafjarðabær county.

The purpose of a B-survey is to document the environmental status in the near zone of a fish farm by evaluating sediment condition (chemistry, sensory and presence/absence of fauna) in accordance with NS 9410:2016.

The B-survey is a tool for trend monitoring and allows to assess the status of organic enrichment beneath the net pens at different stages of the production cycle.

Figure 1 shows a map of the fjord Dýrafjörður where Haukadalsbót farm is located (marked with red X).

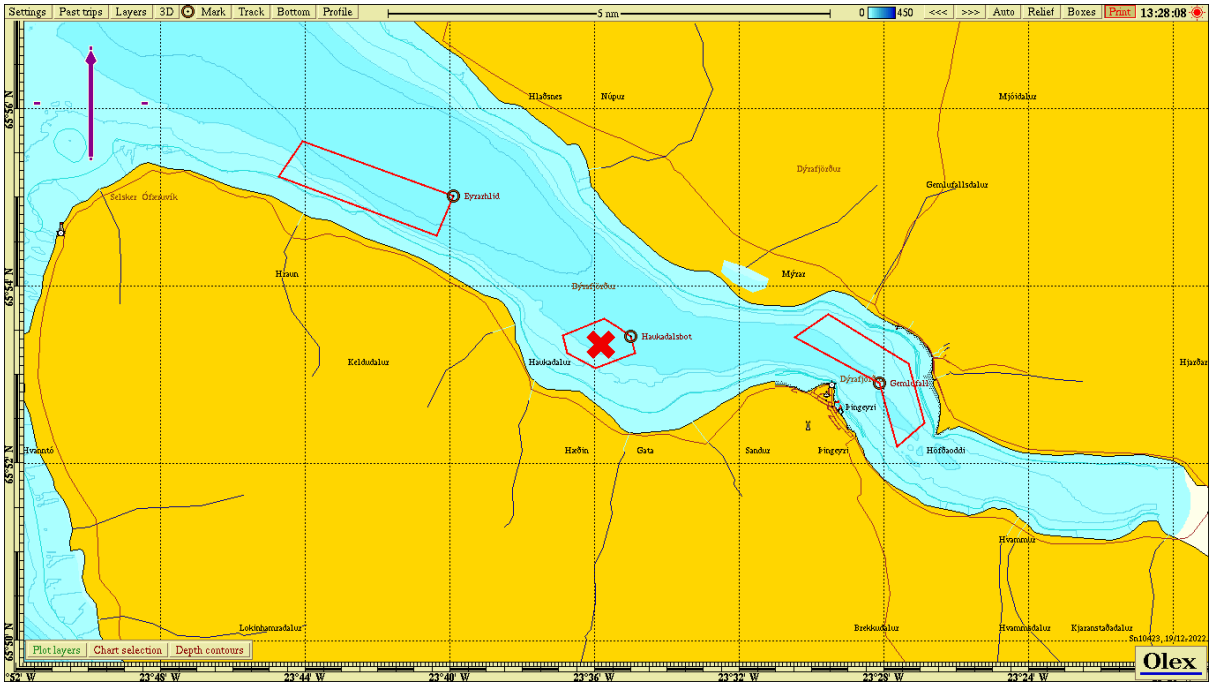

Figure 1. Overview map where Haukadalsbót farm is marked with a red cross. Other fish farming areas in the nearest vicinity (Dýrafjörður) are also shown.

2 Methods

Monitoring of the environmental impact of fish farming activities on the seabed is standardised and regulated. All fish farming sites that are in use must be regularly assessed. This B-survey follows guidelines and methods outlined in NS 9410:2016 and ISO 12878. The Icelandic Environment and Energy Agency (Umhverfis og orkustofnun) can also set specific requirements regarding frequency of surveys for different fish farming sites, which can overrule the above-mentioned standards.

The B survey is a trend monitoring tool with the focus on sediment condition (benthic impact) under and in the immediate vicinity of an aquaculture site. Sediment samples are taken using a grab (min. 250 cm^2). Sediment condition for each sample is assessed applying three indicators: sediment chemistry (pH and redox potential), sensory evaluation (gas bubbles; smell, texture, colour of substrate and thickness of deposited sludge) and the presence or absence of fauna. The performance of these indicators against predefined thresholds allows to categorise the site into four different environmental statuses (Table 1), which are used to determine subsequent sampling frequency. The number of sampling stations is based on the site's allocated MTB, here the estimated max biomass for next generation i.e. 4.500 ton (Personal reference, Guðmundur Ólafsson, 2025).

Table 1. Frequency of B-survey based on environmental status at site.

Environmental status at maximum organic load (near zone)	Monitoring frequency for B survey
1-very good	At the next maximum load
2-good	Pre-stock and again at maximum load
3-poor	Pre-stock If the survey prior to restocking / end of fallowing provides: Status 1 – survey should be carried out at next maximum load. Status 2 – survey should be carried out at half the maximum load and at the next maximum load. Status 3 – survey should be carried out at half the maximum load and at maximum load. Implementation of measures to reduce impact should be planned for the next production cycle. If any surveys show the environmental status to be 4 – "very poor", the site's environmental capacity has been exceeded.
4- very poor	Environmental capacity at site is exceeded. The authorities decide further measures.

The following equipment was used in this survey:
Grab: Van Veen grab (0.1 m^2)
Sieve 1 mm: Akvaplan-niva
pH meter: Electrode, YSI Professional Plus
Redox meter: Electrode, YSI Professional Plus
Position determination – GPS map 62s
Digital camera

3 Site, production and survey design

3.1 Site characteristics and production

The Haukadalsbót site is in Dýrafjörður about 5,5 km west from Þingeyri town. The cages are lined in a north-eastern direction from land. The typical depth under cages ranges from about 25-35 m. The fish farm at the site is a two-frame mooring system, each frame having 6 cages total 12 cages each with 160 m circumference. During the last production cycle all 12 cages of were used.

There have been farmed three generations salmon at the site in addition to one generation rainbow trout 2015-2017. The last generation started with smolt output in April 2023 and finished slaughter on the 13th of June 2025.

Table 2 shows production and feed use for present and previous generations.

Table 2. Production and feed use for farm site Haukadalsbót. Data provided by customer.

Generation of fish (G)	Production (tonnes)	Feed use (tonnes)
Last generation (2023-2025) salmon	6.218	7.679
Generation 2020-2022 salmon	6.434	8.342
Generation 2015-2017 rainbow trout	1.900 (approx.)	-
Generation 2012-2014 salmon	1.000 (approx.)	1.000 (approx.)

3.2 Current and past surveys

Table 3 provides an overview on results and time of sampling for the last B-surveys at site.

Table 3. Present and previously conducted B-surveys at the site.

Date of sampling	Report number	Production status	Location condition
02.09.2025	APN 66881.B01	B-survey fallow period	1
06.11 2024	APN-66218.B01	B survey max biomass	1
17.03.2023	APN 64837.B01	B-survey fallow period	1
26.08 2021	APN 63315.B01	B-survey max biomass	1
25.03.2020	APN-62024.B02	B-survey fallow period	1

3.3 Hydrodynamic conditions

Measurement of dispersing current has been done at the site at 32 m deep in October and November 2019 (Gustavsson, 2019). Dominating current (32 m) is in direction south-east (160-170 degrees). Average current speed is measured to be 6.0 cm/s. Highest current speed is measured to be 21 cm/s and 3.6 % of the measurements are < 1 cm/s.

3.4 Survey design

Sampling stations were placed following an assessment of site configuration and local environmental conditions, i.e. bathymetry and hydrodynamics. An overview of the total 15 sampling stations can be found in Figure 2 with coordinates and depth provided in Table 4. The number of sampling stations were 15 according to guidance in ISO 12878 and NS 9410:2016. The 15 sampling stations are giving good coverage of the local impact zone of the fish farm. Sampling stations were

placed to represent the environmental conditions within the near zone and cover thus both the deeper and shallower areas. The typical depth in the local impact zone is rather homogenous and in the range from 25-35 m with a slightly increasing depth into the fjord (ENE). Samples were collected from depths ranging from 27-35 metres. The station placement is considered representative for an environmental survey of the farm's near-zone and in accordance with the requirements outlined in NS 9410:2016.

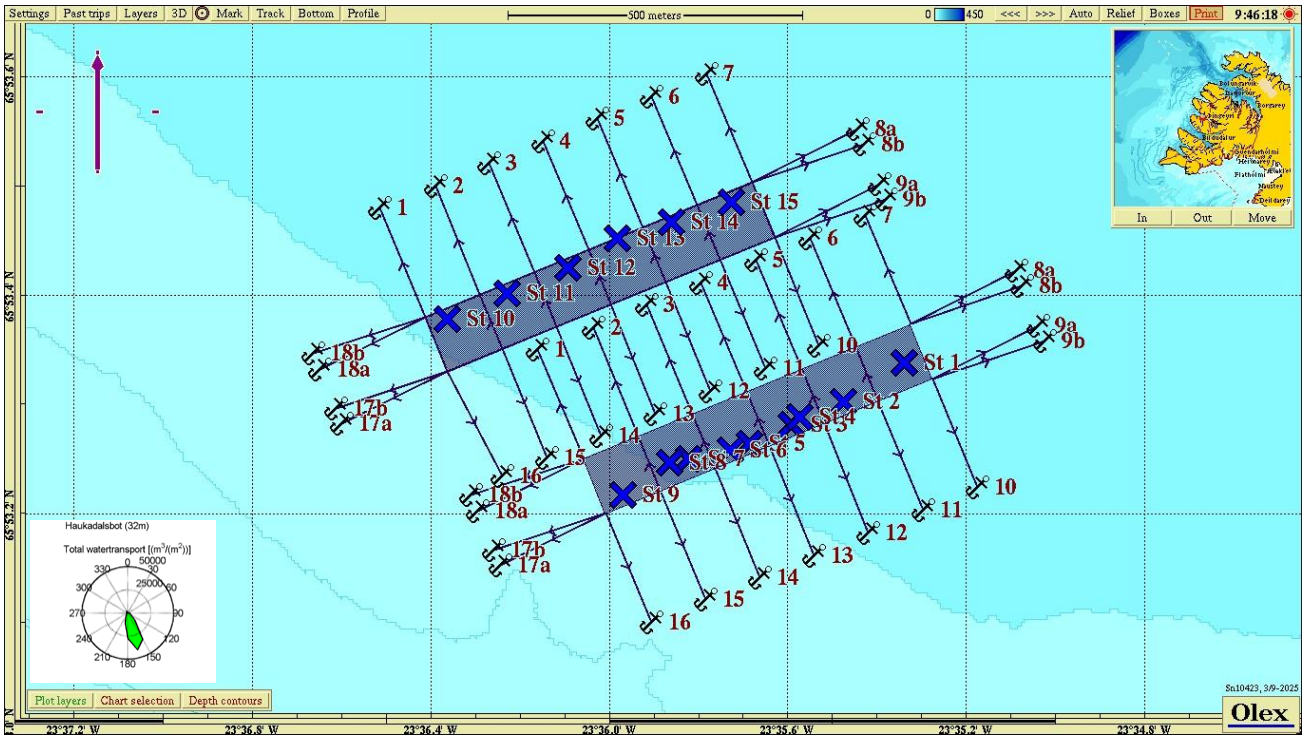

Figure 2. Overview map showing site configuration and local bathymetry at Haukadalsbót. Sampling stations are marked by crosses and colour coded to visualise the environmental status at the respective station following the classification outlined in NS 9410:2016, chapter 7.11 (1 = blue, 2 = green, 3 = yellow, 4 = red). The current rose in the right corner shows the direction of water transport, and the red flag indicates placement of current meter for measuring dispersal current (Gustavsson, 2019).

Table 4. Position and depth of the sampling stations of this survey.

Station number	Northing	Westing	Depth [m]
St 1	65°53,338	23°35,358	35
St 2	65°53,302	23°35,475	34
St 3	65°53,281	23°35,593	34
St 4	65°53,288	23°35,573	33
St 5	65°53,264	23°35,687	31
St 6	65°53,258	23°35,729	31
St 7	65°53,250	23°35,822	31
St 8	65°53,246	23°35,865	31
St 9	65°53,217	23°35,970	27
St 10	65°53,378	23°36,364	31
St 11	65°53,401	23°36,229	32
St 12	65°53,425	23°36,092	33
St 13	65°53,452	23°35,984	33
St 14	65°53,467	23°35,861	34
St 15	65°53,485	23°35,726	35

4 Results

Classified survey results for the different parameter categories as well as the assigned environmental status of the site are shown in Table 5. The complete survey assessment form with results and classifications for each station can be found in the attachment.

Table 5. Results from the environmental assessment of the near zone of Haukadalsbót.

Parameter	Status
Group II parameters (pH/Eh)	1
Group III parameters (sensory)	1
Group II + III – parameters (mean)	1
Environmental status (site)	1

Sediment was recovered at 15 of the total stations (100% soft bottom). The sediments were in general homogenous at the site and consisted primarily of clay in the whole near zone of the fish farm. Fauna was recorded to be present at all stations mainly in the form of polychaetes. There were no signs of out-gassing. Light smell of H_2S was recorded at eight sampling stations and no smell at seven stations. The substrate was light/grey colour at eleven stations and brown/black at four stations. Consistency of the sediment was solid at all the fifteen stations.

Based on the classification of sediment chemistry (pH/Eh) and the sensory assessment all fifteen stations received status 1 – "very good". Overall, the index score for parameter III (sensory parameters) was somewhat higher (0.75) compared with the index score for the parameter II (pH/Eh) (0.00). Status of stations within parameter II (pH/Eh) was all fifteen stations with status 1 – "very good" while within parameter III (sensory) twelve stations had status 1 – "Very good and three stations had status 2 – " good.

In summary, the site receives the environmental status 1 - "Very good" (average group II-III index =0.37).

5 Summary

Applying the indicator thresholds and classification outlined in NS 9410:2016 it is shown that the site Haukadalsbót receives overall site status of 1 – "Very good" at the time of this B survey (fallow period). Samples were collected with a Van Veen grab (0.1 m^2) at 15 stations distributed around the 12 cages in use during last production cycle. Sediment was successfully collected at all the 15 stations and all sampling stations received status 1 – "very good". Three of the four stations with brown/black colour and five of the total eight stations with light sulphur smell were at the southern part of the local impact zone in line with direction of measured spread current at the site. Overall, the site condition is very good but with some clear signs of organic enrichment in patches of the local impact zone revealed mainly through the sensory parameters (colour and smell).

In a B survey carried out in November 2024 at max biomass for previous generation at the site the overall environmental status was also 1 – "very good" (Gunnarsson, 2024) and of the total 17 sampling stations assessment fifteen stations received status 1 – "very good", one sampling station received status 2 – "good" and one sampling station received status 3 – "bad". In the 2024 survey the substrate was light/grey colour at fourteen stations and brown/black at three stations and there was no smell of sulphur recorded at twelve sampling stations and light smell at five sampling stations. Overall, the results are similar between the survey done at last max biomass and the current fallow period survey. The score for the parameter III (sensory parameters) is very similar for the two surveys while the status has improved for the parameter II (pH/Eh), was 0.65 in 2024 but is now 0.00. In 2024 faeces were observed in seven samples and some feeds in two samples but neither were detected in the grab sample at any sampling station in 2025.

The current results from sampling at fallow period in September 2025 indicate that the overall site condition is similar or has improved slightly compared the results at last max biomass despite rather short fallow period at the time of current survey (just over eleven week).

The site is given environmental status 1 – "Very good" following the criteria outlined in NS 9410:2016.

6 References

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

Gunnarsson, S., 2020. Haukadalsbót, Arctic Sea Farm. B-bottom survey fallow period, March 2020. Akvaplan-niva AS report nr. 62024.B01.

Gunnarsson, S., 2021. Haukadalsbót, Arctic Sea Farm. B-bottom survey, August 2021 (maximum biomass survey). Akvaplan-niva AS report nr. 63315.B01.

Gunnarsson, S., 2023. Haukadalsbót, Arctic Sea Farm. B survey (fallow period), March 2023. Akvaplan-niva AS report nr. 64837.B01.

Gunnarsson, S., 2024. B survey at Haukadalsbót November 2024 (max biomass, Arctic Sea Farm ehf). Akvaplan-niva AS report nr. 66218.B01.

Gustavsson, A. 2019. Arctic Sea Farm hf, measurement of spread current at Haukadalsbót fall 2019. Akvaplan-niva AS nr. 61426.

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

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

Norsk Standard NS 9410:2016. Miljøovervåking av bunnpåvirkning fra marine akvakulturanlegg.

Personal reference. Guðmundur Ólafsson, Quality manager Arctic Sea Farm. 2025.

7 Attachments

7.1 Form (B.1 and B.2) NS 9410:2016

Sample scheme B.1

Company	Arctic Sea Farm	Date:	02.09 2025
Site:	Haukadalsbót	Site no.:	SiteItem.LokalitetsID
Fieldworker:	Snorri Gunnarsson		

Gr	Parameter	Point	Sample number									
			1	2	3	4	5	6	7	8	9	10
	Bottom type: S (soft) eller H (hard)		S	S	S	S	S	S	S	S	S	S
I	Animals > 1mm	Yes (0) No (1)	0	0	0	0	0	0	0	0	0	0
II	pH	value	7,69	7,65	7,7|	7,68	7,42	7,55	7,54	7,61	7,43	7,71
	Eh (mV)	ORP	141	143	98	95	92	98	93	94	81	91
		plus ref. verdi	341	343	298	295	292	298	293	294	281	291
	pH/Eh	from figure	0	0	0	0	0	0	0	0	0	0
	Status station		1	1	1	1	1	1	1	1	1	1
			Buffer-temp	12,0 C		Sea temp	11,5 C		Sediment temp		11,1 C	
	pH sea	8,06	ORP sea	143,0 mV		Eh sea	343,0 mV		Reference electrode		200,0 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	
		Brown/black (2)		2					2	2		2
	Smell	None (0)					0	0		0	0	
		Light (2)	2	2	2	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)								1	1	1
		v > 3/4 (2)	2	2	2	2	2	2	2			
	Thickness of slidge (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	4,0	6,0	4,0	4,0	2,0	2,0	6,0	3,0	1,0	5,0
		Corrected (*0,22)	0,9	1,3	0,9	0,9	0,4	0,4	1,3	0,7	0,2	1,1
	Status station		1	2	1	1	1	1	2	1	1	2
	Average group II & III		0,4	0,7	0,4	0,4	0,2	0,2	0,7	0,3	0,1	0,6
	Status station		1	1	1	1	1	1	1	1	1	1

Grab ID	K-3
pH / Eh ID	Ysi proff. Plus

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Sample scheme B.1

Company:	**Arctic Sea Farm**	**Date:**	**02.09 2025**
Site:	**Haukadalsbót**	**Site no.:**	**eltem.Lokalitets**
Fieldworker:	**Snorri Gunnarsson**		

Gr	Parameter	Point	Sample number 11	12	13	14	15	16	17	18	19	20	Index S%	H%
	Bottom type: S (soft) or H (hard)		S	S	S	S	S						100	0
I	Animals > 1mm	Yes (0) No (1)	0	0	0	0	0							
II	pH	value	7,72	7,58	7,3	7,61	7,71							
	Eh (mV)	ORP	83	75	92	81	94							
		plus ref. verdi	283	275	292	281	294							
	pH/Eh	from figure	0	0	0	0	0						0,00	
	Status station		1	1	1	1	1							
	Status group II		1											
	pH sea	8,06	**ORP sea**	143 mV		**Eh sea**	343 mV		**Reference electrode**		200 mV			
			Buffer temp	12,0 C		**Sea temp**	11,5 C			**Sediment temp**	11,1 C			
III	Gas bubbles	Yes (4) No (0)	0	0	0	0	0							
	Colour	Light/grey (0)	0	0	0	0	0							
		Brown/black (2)												
	Smell	None (0)		0		0	0							
		Light (2)	2		2									
		Strong (4)												
	Consistency	Solid (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							
	Thickness of slidge (t)	t < 2 cm (0)	0	0	0	0	0							
		2 < t < 8 cm (1)												
		t > 8 cm (2)												
		Sum	4,0	2,0	4,0	2,0	2,0							
		Corrected (*0,22)	0,9	0,4	0,9	0,4	0,4						0,75	
	Status station		1	1	1	1	1							
	Status group III		1											
	Average group II & III		0,4	0,2	0,4	0,2	0,2						0,37	
	Status station		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

Grab ID	K-3
pH / Eh ID	Ysi proff. Plus

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Sample scheme B.2

Company:	**Arctic Sea Farm**	**Date:**	**02.09 2025**
Site:	**Haukadalsbót**	**Site no.:**	**{{SiteItem.LokalitetsID}}**
Fieldworker:	**Snorri Gunnarsson**		

Sample number		1	2	3	4	5	6	7	8	9	10
Depth (m)		35	34	34	33	31	31	31	31	27	31
Number of trials		1	1	1	1	1	1	1	1	1	1
Gas bubbles (in sample)		No	No	No	No	No	No	No	No	No	No
Sediment type	**Clay**	X	X	X	X	X	X	X	X	X	X
	Silt										
	Sand										
	Gravel										
	Shellsand										
Reef											
Rocky bottom (cobbles, boulders)											
Echinodermata, count		4							1		
Crustaceans, count									1		
Molluscs, count						3	4		3	1	1
Polychaetes, count		>10	6	>10	>10	>20	>20	>100	5	>10	>10
Other animals, count											
Beggiatoa											
Feed											
Faeces											

Comments				
Grab	**Area [m^2]**	0,1	**Grab ID**	K-3

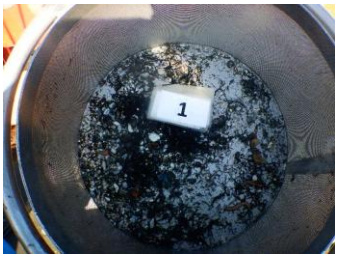
Sample scheme B.2

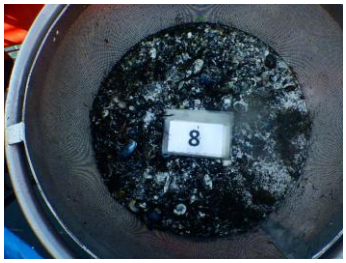
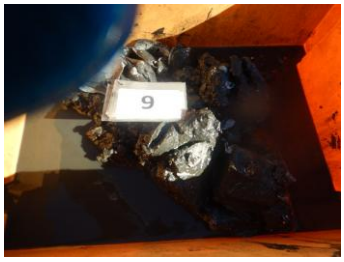
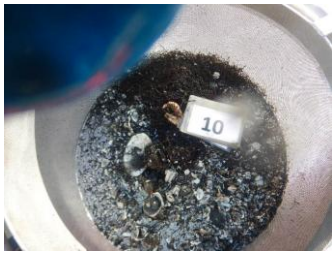
Company:	**Arctic Sea Farm**	**Date:**	**02.09 2025**
Site:	**Haukadalsbót**	**Site no.:**	**{{SiteItem.LokalitetsID}}**
Fieldworker:	**Snorri Gunnarsson**		

Sample number		11	12	13	14	15	16	17	18	19	20
Depth (m)		32	33	33	34	35					
Number of trials		1	1	1	1	1					
Gas bubbles (in sample)		No	No	No	No	No					
Sediment type	**Clay**	X	X	X	X	X					
	Silt										
	Sand										
	Gravel										
	Shellsand										
Reef											
Rocky bottom (cobbles, boulders)											
Echinodermata, count											
Crustaceans, count											
Molluscs, count											
Polychaetes, count		>20	5	6	7	4					
Other animals, count											
Beggiatoa											
Feed											
Faeces											
Comments											

Grab	**Area [m^2]**	0,1	**Grab ID**	K-3
Signature fieldworker:				

7.2 Images of samples at Haukadalsbót

St	*Image before sieving*	*Image after sieving*
St 1		
St 2		
St 3		
St 4		
St 5		

St 6		
St 7		
St 8		
St 9		
St 10		

St 11		
St 12		
St 13		
St 14		
St 15		

7.3 3D-bathymetry

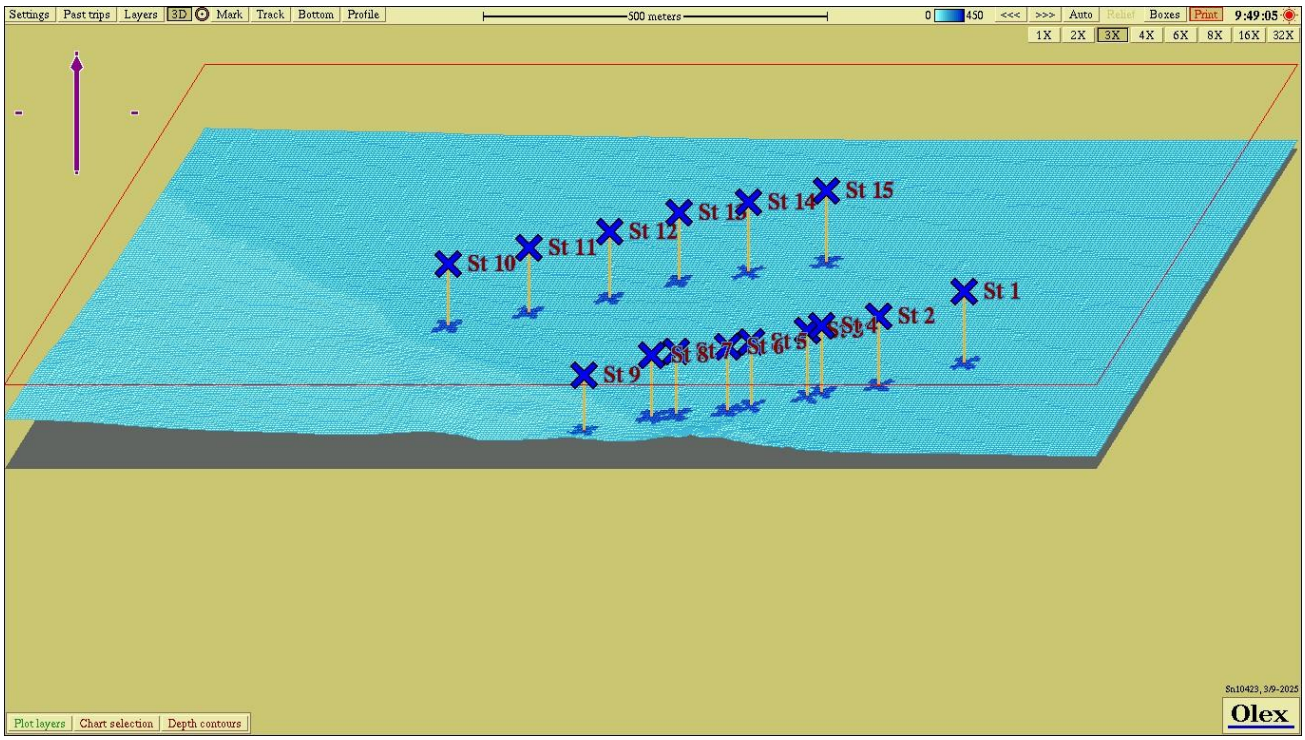


Figure 3. 3D-view of bathymetry at Haukadalsbót with stations as shown in Figure 2 and Table 4. The map is oriented towards the north.