B-survey at Vatneyri, May 2024 (pre survey), Arnarlax ehf

Akvaplan-niva AS Report:
APN 65907.B01

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Contact person	Silja Baldvinsdóttir

Summary

Applying the indicator thresholds and classification outlined in NS 9410:2016 it is shown that Vatneyri receives overall site status 1 – "Very good" at the time of this B survey (pre survey). Samples were collected with a Van Veen grab (0,1 m^2) at 10 stations distributed around the whole local impact zone. All twenty sampling stations received status 1 – "very good". The results indicate that overall, there is little organic load in the local impact zone and can be used to for comparison against results from future B surveys at the site.

Approval

Project Manager

Quality Control

Key information

Site details and license holder information			
Site ID	Vatneyri	Site coordinates	65°37,692N 24°04,507V
County	Patreksfjörður	Municipality	Vesturbyggð
MTB (Maximum allowed biomass)	8.824 tonnes	Operations Manager / Contact	Silja Baldvinsdóttir
License holder / customer	Arnarlax ehf		

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:	New site		

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	0,44	Gr. III. Sensory	1
GR. II + III	0,22	GR. II+ III	1
Date of fieldwork	08.05 2024	Date of report	19.06 2024
Environmental status (NS 9410:2016):			**1**

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1 Introduction

The present survey was conducted by Akvaplan-niva AS on behalf of Arnarlax ehf in connection with the company's planned fish farming activities at the site Vatneyri in Patreksfjörður municipality in Vesturbyggð 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 Patreksfjörður and Tálknafjörður where Vatneyri is located.

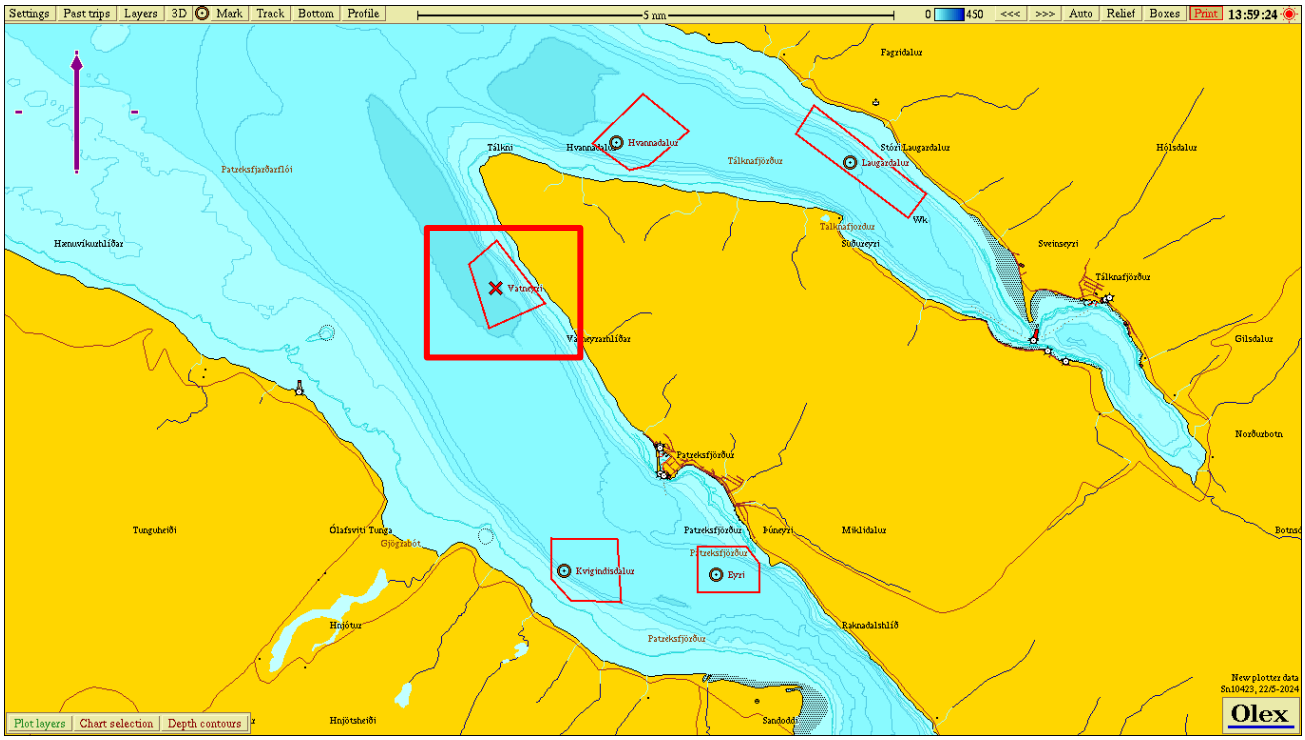


Figure 1. Overview map of Patreksfjörður and Tálknafjörður with Vatneyri marked by red square and an X. Other aquaculture sites are marked with locality name.

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 Environmental agency (Umhverfisstofnun) 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) beneath and in the close vicinity of the fish cages (near zone). 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 and thickness of sludge) and the presence or absence of fauna. The performance of these indicators against predefined thresholds categorizes the site into four different environmental statutes (Table 1), which are used to determine subsequent sampling frequency. There has been no prior fish farming activity at the site, so this is pre-survey prior to putting out first smolts at Vatneyri site. The number of sampling stations is based on the site's estimated max standing biomass for next generation farmed at the site.

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 mapping tool
Digital camera

3 Site, production and survey design

3.1 Site characteristics and production

The Vatneyri site is in Patreksfjörður, in the outer and northern part of Patreksfjörður and about 5.5 km northwest from Patreksfjörður harbour. The planned cages are lined in a northeast-southeast direction. The depth under cages ranges from about 50-63 m. The fish farm at the site is a 2x8 setup, total 16 cages each with 200 m circumference.

There has been no prior fish farming activity at the site, so this is pre-survey prior to putting out first smolts at Vatneyri site.

Table 2 shows production and feed use for previous generations.

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

Generation of fish (G)	Production (tonnes)	Feed use (tonnes)
New site	0	0

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
08.05.2024	APN 65907.B01	B-survey new site (pre-survey)	1

3.3 Hydrodynamic conditions

Measurement of dispersing current was done at the site in May-June 2020 measurements at 48 m depth (Hermansen, 2020). Dominating current (48 m) is in direction north (345 degrees). Average current speed is measured to be 6.4 cm/s. Highest current speed is measured to be 25.2 cm/s and 4.6 % of the measurements are < 1 cm/s.

3.4 Survey design

The placement of the 10 sampling stations is shown in Figure 2 with positions listed in Table 4. Stations are distributed within the near zone of the new frame position following criteria outlined in NS 9410:2016. The typical depth in the local impact zone is in the range from 50-63 m, with a slightly shallower area on eastern part of the mooring frame i.e. closer to land. The sampling stations had a depth varying from 55 to 63 m. Sampling stations were placed to represent the varied environmental conditions within the near zone and cover thus both the deeper and shallower areas in the whole local impact zone. The placement of sampling stations is regarded to be in accordance with the requirements outlined in NS 9410:2016.

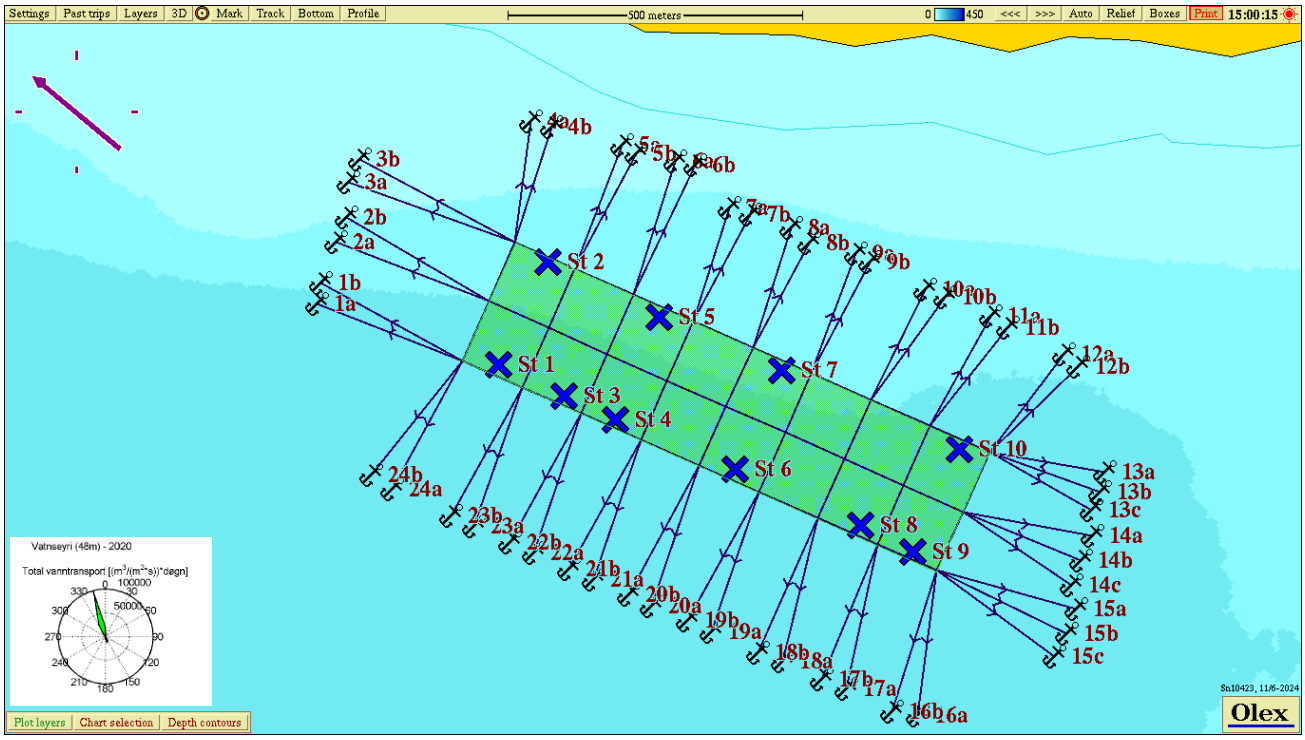


Figure 2. Overview map showing site configuration and local bathymetry at Vatneyri. Sampling stations are marked by crosses and colour coded to visualise the environmental status at the respective station following the classification outlined in NS 9410:2016, chapter 7.11 (1 = blue, 2 = green, 3 = yellow, 4 = red). The current rose in the lower left corner shows the direction of water transport at dispersal depths at the site (Gunnarsson, 2020b).

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

Station number	Northing	Easting	Depth [m]
St 1	65°37,880	24°04,762	63
St 2	65°37,906	24°04,517	65
St 3	65°37,817	24°04,722	62
St 4	65°37,766	24°04,687	62
St 5	65°37,796	24°04,452	59
St 6	65°37,653	24°04,601	61
St 7	65°37,678	24°04,366	60
St 8	65°37,532	24°04,518	61
St 9	65°37,480	24°04,488	61
St 10	65°37,507	24°04,248	61

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 Vatneyri.

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

Substrate was collected at all 10 sampling stations (100% soft bottom). Sediment samples consisted mainly of olive grey mud in all parts of the local impact zone. Fauna was recorded at all stations with polychaetes being most prominent and a few molluscs. No signs of out-gassing were observed at any of the sampling stations. At all stations there was a thin layer of black organic matter in top of the mud sample. Noe smell of H_2S was detected at any sampling stations. The grab was full or ¾ full at all sampling stations.

Based on the classification of sediment chemistry (pH/Eh) and the sensory assessments all ten stations of this survey received status 1 – "Very good". Overall, the index score for parameter III (sensory parameters) was higher than the index score for the parameter II (pH/Eh), or 0,44 for parameter III but 0,00 for parameter II.

Taken together the site receives the environmental status was 1 – " Very good" (average group II-III index =0.22).

5 Summary

Applying the indicator thresholds and classification outlined in NS 9410:2016 it is shown that Vatneyri receives overall site status 1 – "Very good" at the time of this B survey (pre survey). Samples were collected with a Van Veen grab (0,1 m^2) at 10 stations distributed around the whole local impact zone. All ten sampling stations received status 1 – "Very good". The results indicate that overall, there is little organic load in the local impact zone and can be used to for comparison against results from future B surveys at the site.

The site is given environmental status 1 - Very good. In accordance with the frequency of B-surveys specified in NS 9410:2016, the site shall have a new survey at the next maximum load.

6 References

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

Hermansen, S., 2020. Strømmålinger Vatneyri. 5 m, 15 m og spredningsstrøm. Akvaplan-niva AS report nr. 62191.05.

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 akvakulturanlegg.

Personal reference. Silja Baldvinsdóttir, Quality manager, Arnarlax. 2024

7 Attachments

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

Sample scheme B.1

Company:	Arnarlax ehf	Date:	09.05 2024
Site:	Vatneyri, Patreksfjörður	Site no.:	tem.Lokalitet
Fieldworker:	Snorri Gunnarsson		

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	7.49	7.76	7.61	7.67	7.69	7.65	7.65	7.72	7.56	7.64		
	Eh (mV)	ORP	40	86	70	36	25	4	35	38	41	39		
		plus ref. value	240	286	270	236	225	204	235	238	241	239		
	pH/Eh	from figure	0	0	0	0	0	0	0	0	0	0	0.00	
	Status station		1	1	1	1	1	1	1	1	1	1		
	Status group II		1	Buffer temp	11.0 C		Sea temp	3.2 C		Sediment temp	3.0 C			
	pH sea	7.99	ORP sea	221 mV		Eh sea	421 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	0	0		
		Light (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	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		
	Corrected (*0,22)		0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.44	
	Status station		1	1	1	1	1	1	1	1	1	1		
	Status group III		1											
	Average group II & III		0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.22	
	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-3
pH / Eh ID	Ysi professional plus

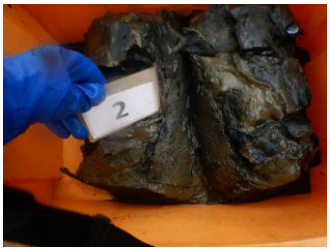
page 1 of 2 pages

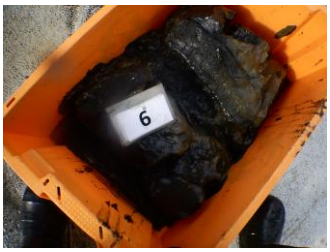
Sample Scheme B.2

Company:	**Arnarlax ehf**	**Date:**	**09.05 2024**
Site:	**Vatneyri, Patreksfjörður**	**Site no.:**	**0**
Fieldworker:	**Snorri Gunnarsson**		

Sample number		1	2	3	4	5	6	7	8	9	10
Depth (m)		63	55	62	62	59	61	60	61	61	61
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											
Crustaceans, count											
Molluscs, count			3	5	4	6	5	3	3	3	10
Polychaetes, count		>20	>20	10	>20	>40	>20	>10	>5	>20	>20
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 Vatneyri

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		

7.3 3D - bathymetry

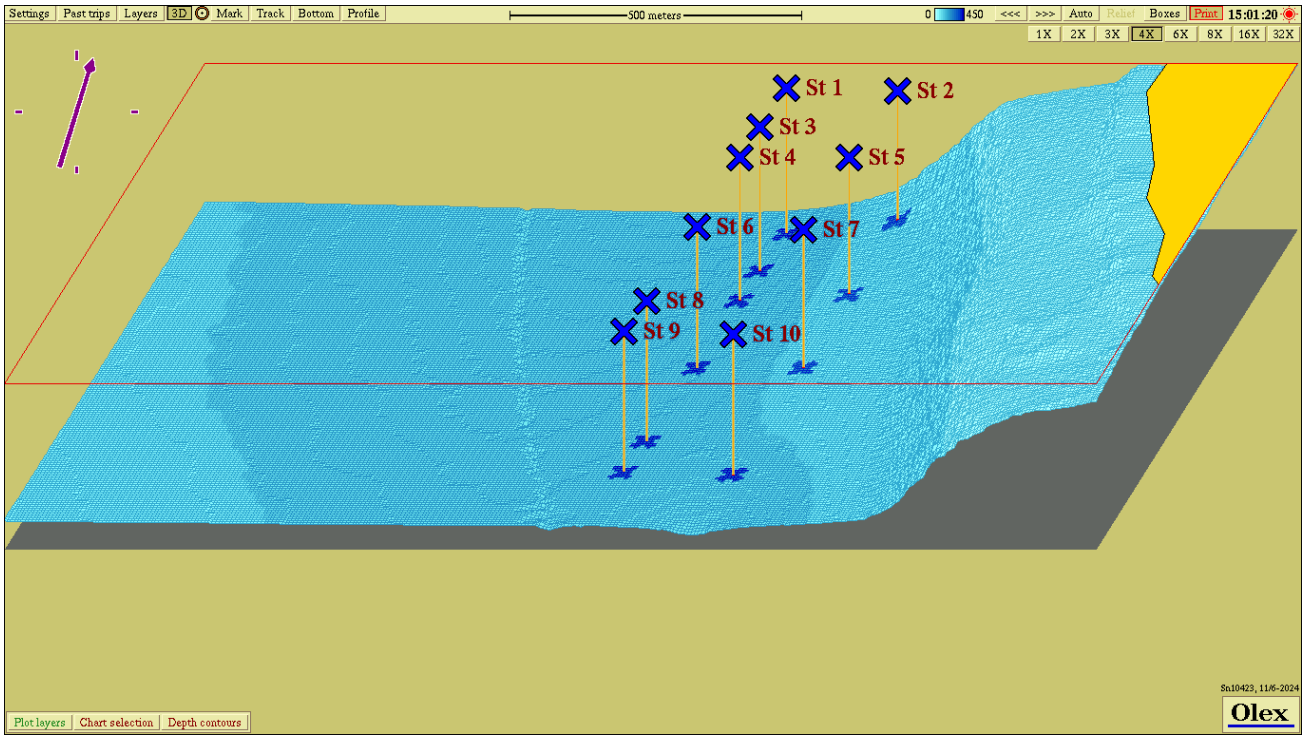


Figure 3.3D-view of bathymetry at Vatneyri with stations as shown in Figure 2 and Table 4.