Environmental survey with B-methodology, Komagfjord,

Hammerfest municipality 2023

Norwegian Whale Reserve
Akvaplan-niva AS Report: 2023 64849.01

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Summary
The present survey was carried out by Akvaplan-niva AS on behalf of the Norwegian Whale Reserve in connection with the planning of a whale reserve and rehabilitation facility for whales of Arctic origin in the municipality of Hammerfest.

The purpose of the survey using B methodology is to document the environmental condition in the fjord as part of the basis for assessing the fjord's suitability as a whale reserve. Based on the assessment criteria in NS 9410:2016, it is documented that the Komagfjorden at the time of the test had condition 1 - "Very good".

Approval

Ingvild Ytterhus Utengen
Project Manager

Rikke Stabell
Quality control

Key information

Information about the research area and client			
Place	Komagfjord		
County	Troms and Finnmark	Municipality	Hammerfest
Principal	Norwegian Whale Reserve		

Results from a sensory examination with B-methodology in accordance with NS 9410:2016 (main result)			
Parameter group and index		Parameter group and condition	
Gr. II. pH/Eh	0.00	Gr. II. pH/Eh	1
Gr. III. Sensory	0.35	Gr. III. Sensory	1
GR. II + III	0.18	GR. II+ III	1
Date fieldwork	12/07/2023	Date report	20/09/2023
Site condition (NS 9410:2016):			1 - Very good

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1 Introduction

The present investigation was carried out by Akvaplan-niva AS on behalf of the Norwegian Whale Reserve in connection with the planning of a whale reserve for whales of Arctic origin that have lived in captivity, in the municipality of Hammerfest. The Komagfjorden on Sørøya (Figure 1) is considered as a possible location alternative for such a facility.

The purpose of the survey using B methodology is to document the environmental condition in the fjord as part of the basis for assessing the fjord's suitability as a whale reserve. This survey has been carried out using B-methodology, which is used for preliminary and monitoring surveys in farming and includes sediment surveys and fauna assessments in accordance with NS 9410:2016.

The B methodology used in the present investigation was chosen based on its suitability for documenting the fjord's sensitivity and environmental status as a recipient of impact from the activity. The impact of a whale reserve will be feed residues as well as faeces from whales. The results of such an investigation will shed light on the fjord's suitability for a whale reserve in the Komagfjorden.

It is uncertain how extensive the reserve will be, given the amount of feeding and the number of whales in the fjord at the same time. It has therefore been challenging to find a suitable methodology for the survey. B methodology was chosen as it is an established and frequently used survey in Norway, and is covered by NS9410:2016.

Figure 1. South-eastern parts of Sørøya in Finnmark. Komagfjord is marked with a red square. Map from www.fiskeridir.no Directorate of Fisheries, scale 1:40,000.

2 Academic program and methodology

The methodology used in this survey is similar to that used in B surveys for aquaculture facilities. The B survey is a trend monitoring of bottom conditions under and in the immediate vicinity of an aquaculture facility.

Sample stations were placed evenly distributed in the intended fjord to form a general overview of current bottom conditions as well as a basis for further monitoring when the whale reserve is in operation. Sediment samples were taken using a small grab (0.025 m2). Each grab bar was examined with regard to three groups of sediment parameters; fauna survey, chemical survey (pH and redox potential) and a sensory survey (presence of gas bubbles, smell, sediment consistency and colour, as well as thickness of deposited sludge). The sediment parameters are given points (scale from 1-4) according to how much the sediment is affected by additions of organic matter, cf. Appendix 7.1, and the locality gets a state based on it..

The following equipment was used in this investigation:
Grab: Van Veen grab (0.025 m2)
Sieve 1 mm: Akvaplan level
pH meter: Electrode, YSI Professional Plus
Redox meter: Electrode, YSI Professional Plus
Position determination – GPS map 62s
Digital camera

3 Site description and station location

3.1 Location description

The Komagfjord is located on the southeast side of Sørøya in Hammerfest municipality, Troms and Finnmark county. The depth in the fjord varies from very shallow areas to approx. 45 m deep at the far end of the fjord mouth. There is a shallow threshold some distance into the fjord at a depth of 3 m (marked with a red arrow in figure 2), before a deeper pool at the very innermost of around 25 m deep.

3.2 Station location

Station location was determined through assessment of the bottom topography and design of the fjord. It was considered sufficient to have 10 sample stations for fauna and sensory examination. In contrast to other aquaculture with cages, the entire fjord is to be used as a reserve for whales. Stations are therefore set scattered in the fjord and at various depths, where it is assessed that organic material is likely to accumulate. At the heart of the fjord (marked with a red arrow) there is an elevation that forms a deeper pool at the heart of the fjord. Two stations are set in this part of the fjord. Stations are shown in Figure 2 and Table 4.

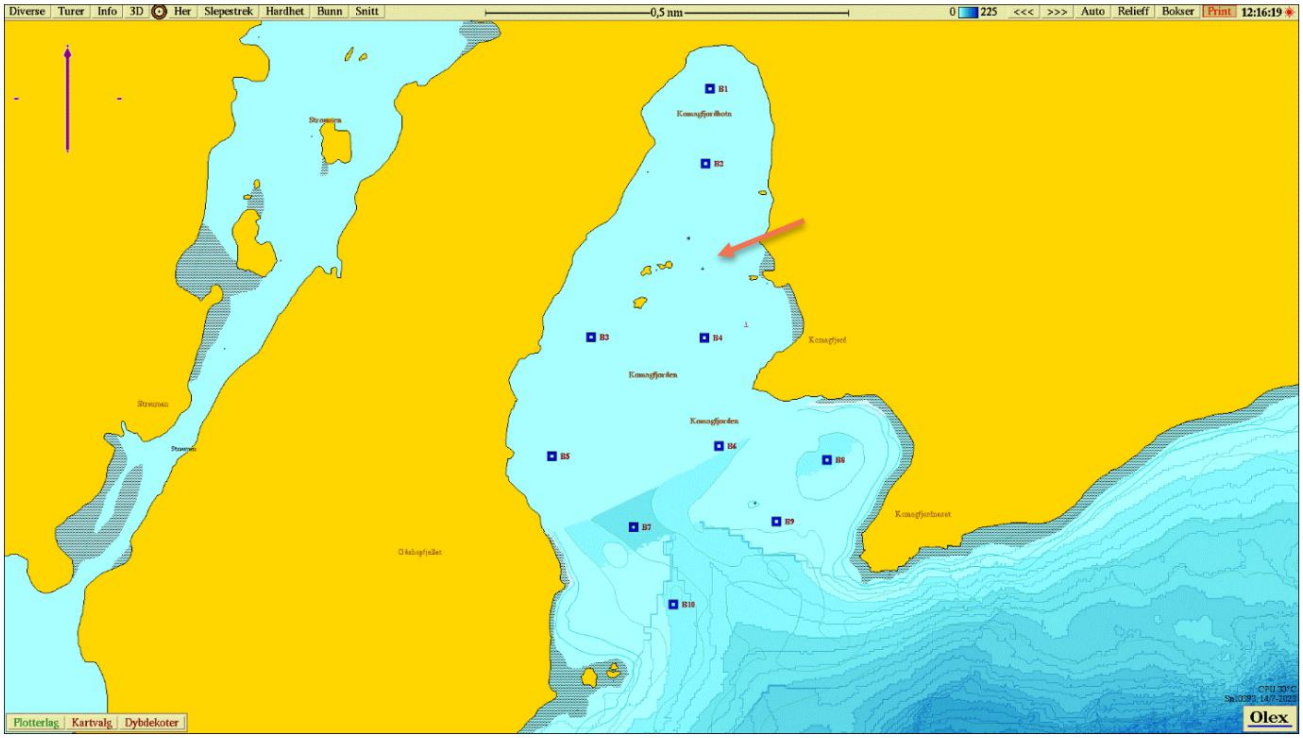

Figure 2. Station locations in Komagfjord, July 2023. The stations are drawn as squares with a color code that describes the condition according to NS 9410:2016 (1 = blue, 2 = green, 3 = yellow, 4 = red). Red arrow shows the threshold area inside the fjord.

Table 1. Position and depth of the sampling stations included in the survey.

Station number	Northern latitude	Eastern longitude	Depth (m)
St. 1	70°31.926'	22°50.919'	19
Street 2	70°31.823'	22°50.900'	10
Street 3	70°31.585'	22°50.427'	21
St. 4	70°31.584'	22°50.596'	25
St 5	70°31.421'	22°50.265'	25
St. 6	70°31.435'	22°50.955'	26
St. 7	70°31.324'	22°50.603'	36
St. 8	70°31.416'	22°51.401'	23
St. 9	70°31.331'	22°51.193'	21
St. 10	70°31.217'	22°50.766'	23

4 Results

The results from the classification are shown in Table 5. A fully completed test form with calculation of grades for the tests is attached.

Table 2. Result from classification of the construction zone at Komagfjord.

Parameter	State
Group II - parameters (pH/Eh) Group III – parameters, (sensory) Group II + III parameters (mean value)	1 1 1
LOCALITY CONDITION	1

Sediment was collected at all 10 sampling stations. The sediments at the various sampling stations varied and consisted of mud, stone, gravel and shell sand. Coral gravel was recorded at six stations. Soft sediment was recorded at five stations and grab volume < 1/4 at five stations. The sediments had a natural color and no abnormal smell. Gas bubbles and sludge were also not recorded at any of the stations.

Animals, mostly brushwood, but also echinoderms, crustaceans and shells, were recorded at nine stations.

Chemical and sensory analysis gave the grade 1 - "Very good" at nine stations. A limited amount of sediment only allowed sensory assessment at one station (B5), and is registered as hard bottom in the B form. This station was also given condition 1.

In summary, the survey gave location condition 1 - "Very good".

5 Summary assessment

Based on the assessment criteria in NS 9410:2016, it is documented that the Komagfjorden at the time of the test had condition 1 - "Very good". This is as expected as no form of business is known in the fjord at the present time which could cause organic pollution. A total of 14 grabs were carried out with a Van Veen grab (0.025 m2), distributed over 10 stations placed evenly in the planned area for the whale reserve.

Potential future sedimentation in the form of organic load will be affected by the number of whales in the reserve, possible excess feeding or as a consequence of reduced water exchange caused by installations (nets, rafts etc.). It should also be mentioned that the stations located in the innermost part of the fjord (B1 and B2) had softer sediment than the remaining sample stations. This may be due to the threshold area (marked with a red arrow in Figure 2) which causes reduced water exchange in the innermost part of the fjord. It can be considered that the innermost part is closed to whales to avoid excess load here, possibly a form of fallow to avoid whales in all parts of the fjord at all times.

Regardless, a follow-up survey is recommended when the whale reserve is in operation to document the whale reserve's effect on the seabed. It is appropriate to examine regularly to detect any strain, and then be able to take measures.

6 Literature

Aquaplan level 2021. B survey at Husfjord (21016) 2021, report no: 2021 63482.01 ISO 5667-19:2004.

Guidance on sampling of marine sediments.

Norwegian Standard NS 9410:2016. Environmental monitoring of bottom impact from marine aquaculture facilities.

Pers with. Katrine Næss, project manager, Norwegian Whale Reserve
www.fiskeridir.no

7 Appendix

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

Sample form B.1

Company:	Norwegian Whale Reserve	Date:	12/07/2023
Location:	Komagfjord	Location number:	NEW
Sampling officer:	Ann-Cecilie Henriksen		

Gr	Parameter	Points	Test point 1	2	3	4	5	6	7	8	9	10	B%	H%	Index
	Bottom type: B (soft) or H (hard)		B	B	B	B	H	B	B	B	B	B	90	10	
In	Animals > 1mm	Yes (0) No (1)	0	0	0	0	0	0	0	0	0	0			
II	pH	value	7.5	7.9	7.6	7.6	out	7.7	7.6	7.9	7.9	7.9			
	Eh (mV)	ORP	-15	48	82	93		102	110	69	107	110			
		with reference value	185	248	282	293		302	310	269	307	310			
	pH/Eh	from figure	0	0	0	0	out	0	0	0	0	0			0.00
		Condition sample	1	1	1	1	out	1	1	1	1	1			
		Condition, group II	1	Buffer temp	C		Sea temp	8.0 C		Sediment temp	C				
		pH sea 8	ORP sea	20 mV		Oh sea	220 mV		Reference electrode		200 mV				
III	Gas bubbles	Yes (4) No (0)	0	0	0	0	0	0	0	0	0	0			
	Color	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			
		Something (2)													
		Strong (4)													
	Consistency	Fixed (0)		0			0		0		0	0			
		Soft (2)	2		2	2		2		2					
		Solve (4)													
	Grab volume (v)	v < 1/4 (0)				0	0		0		0	0			
		1/4 < v < 3/4 (1)	1	1	1					1					
		v > 3/4 (2)						2							
	Thickness of mud layer	t < 2 cm (0)	0	0	0	0	0	0	0	0	0	0			
		2 < t < 8 cm (1)													
		t > 8 cm (2)													
		Sum	3.0	1.0	3.0	2.0	0.0	4.0	0.0	3.0	0.0	0.0			
		Corrected (*0.22)	0.7	0.2	0.7	0.4	0.0	0.9	0.0	0.7	0.0	0.0			0.35
		Condition sample	1	1	1	1	1	1	1	1	1	1			
		Condition group III	1												
		Mean value group II and III	0.3	0.1	0.3	0.2	0.0	0.4	0.0	0.3	0.0	0.0			0.18
		Condition sample	1	1	1	1	1	1	1	1	1	1			
		Condition groups II and III	1												

pH/Eh Corr.sum Index Average value	State
< 1.1	1
1.1 - <2.1	2
2.1 - <3.1	3
ÿ3.1	4

LOCAL STATUS: 1

Guy ID	K26
pH / Eh ID	Alta 1

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Sample form B.2

Company:	Norwegian Whale Reserve	Date	12/07/2023
Location:	Komagfjord	Location number:	NEW
Sampling officer:	Ann-Cecilie Henriksen		

Test point		1	2	3	4	5	6	7	8	9	10
Depth (m)		19	10	21	25	25	26	36	23	21	25
Number of attempts		2	1	1	1	2+	1	1	1	1	1
Bubbling (in trial)											
Sediment type	Clay										
	Silt										
	Sandy	100	100	50	80		50	80	50	80	80
	Gravel										
	Shell sand			50	20		50	20	50	20	20
Mountain bottom						X					
Stone bottom											
Echinoderms, number				3	3				2		
Crustaceans, number										2	
Shells, number					2			1	1		
Brush field, quantity		12	5	4	3		3	3	6	2	3
Other animals, total number											
Beggiatoa											
For											
Faeces											

Comment

1) Shell in the boy's jaw at the first attempt. 2) Much coarser sand than at B1. Similar to coral gravel. 3) Coral gravel. 4) Coral gravel. 5) Stone in the mouth or empty boy, 4 attempts. 6) Coral gravel. 8) Coral gravel. 9) Coral gravel

Boy	Area [m2]	0.025	Guy ID	K26

Signature sampling officer: Ann-Cecilie Henriksen

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7.2 Pictures of samples at Komagfjord

St	Image before aiming	Image after sifting
St. 1		
Street 2		
Street 3		
St. 4		

St 5 Fjellbunn, empty boy.

St. 6

St. 7

St. 8

St. 9

St. 10