

Water Column Monitoring 2014

APPENDIX A: CRUISE REPORT



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Preface

This report details the activities of research cruises that were performed as part of the Water Column Monitoring programme of 2014. The research cruises consisted of the following: 1) deployment and retrieval of passive sampling devices by ROV around the Njord A platform; 2) the collection of wild fish caught in the close proximity to Njord A platform, as well as; 3) the collection of reference material from the condition monitoring cruise.

The passive samplers were deployed and successfully retrieved after 3 weeks. The samplers were measured for PAH/NPD compounds and screened for other oil related organic compounds. Four fish species were collected close to Njord A platform and the reference group. The fish species Ling (*Molva molva*), Tusk (*Brosme brosme*), Red fish (*Sebastes sp.*) and saithe (*Pollachius virens*) were sampled for chemical and biomarker endpoints to determine the general health status of the fish in these areas.

Oslo, 2014

Steven Brooks

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1. Passive sampling

1.1 Deployment of passive samplers

Passive samplers were positioned approximately 1 m above the substrate at 6 stations in the vicinity of the Njord A platform. Rigs were constructed in order to hold the passive sampling cages in position and placed at specific locations within 500 m of the platform with the platform's resident ROV (figure 2). The positions of the stations were decided on by the customer to target areas of high sediment contamination and areas of previously known leakage from subsea well deposits, whilst two stations were located slightly further away from the platform (Figure 2, Table 1).

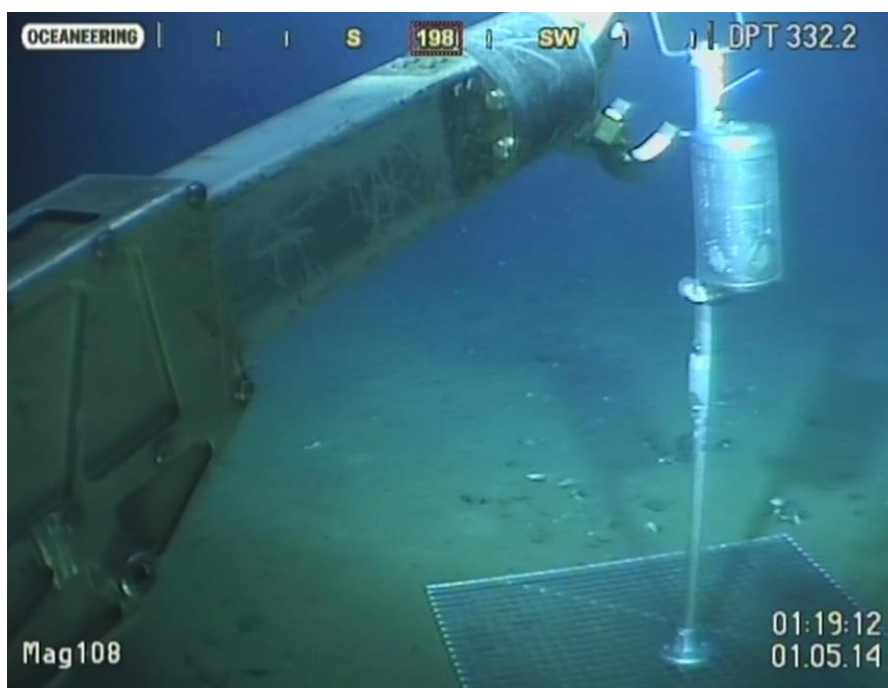


Figure 1. Passive sampler rig positioned on the seabed at Njord A by the ROV. The cage holding the passive samplers is positioned approximately 1m above the sediment.

The passive samplers were deployed on the 30th April 2014 between 20:00 and 04:00 h the following day. A field blank was used on the platform to take into account any uptake in air prior to deployment. At each station 3 LDPE membranes and 3 POCIS membranes were deployed.

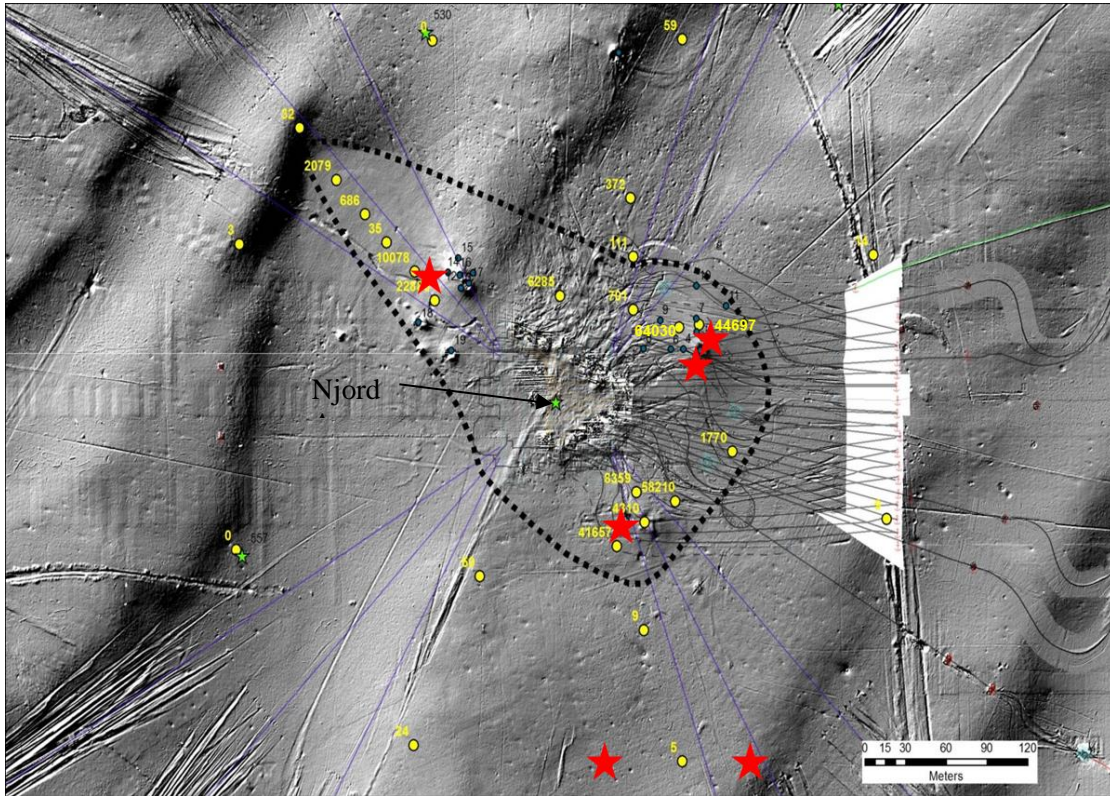


Figure 2. Position of the passive sampling rigs (red stars) around the Njord A platform (small green star).

Table 1. General information on the 6 passive sampling stations

Rig No.	Start of rig prep	Time rig in water	Position	Depth (m)	Time at position	Comment
1	20:25	20:48	60m east from A10	Not noted	Not noted	
2	21:45	22:05	In crater slightly north of rig 1	Not noted	22:32-22:36	
3	00:40	01:00	200m south of A4	330	01:18	
4	01:25	01:49	70m south of transponder 3	332	02:10	
5	02:20	02:40	60m southwest of SMS 7	333	03:05	
6	03:15	03:35	Ca. 65 m NW of a18, in a crater	332	04:07	
Field blank	22:10	22:28				Removed from bag, mounted on a rig.

1.1. Retrieval of passive samplers

The passive sampling rigs were successfully retrieved with the ROV after approximately 3 weeks of exposure on the afternoon of 19th May 2014. Christopher Harman (NIVA) and Rolf Sundt (Statoil) carried out the retrieval, which proceeded as planned. All sampling equipment were in good condition and all samplers intact, with minimal fouling. Air exposure of the samplers was always <5mins, before they were placed in air-tight containers. They were kept cool before freezing several hours later. The following day the samplers were transported by air to NIVA's laboratory in Oslo.

2. WCM offshore cruise

2.1 Research vessel and scientific personnel

The Skandi Stord (Figure 3) departed from Vestbase, Kristiansund on the evening of Monday 26th May 2014 and returned on Wednesday evening 28th May 2013. The scientific personnel onboard the vessel consisted of Steven Brooks (NIVA), Christopher Harman (NIVA), Bjørnar Andre Beylich (NIVA), Stig Westerlund (IRIS), Eivind Larssen (IRIS). The client representatives onboard included Rolf C. Sundt (Statoil), Lars Petter Myhre (Statoil) and Siri Sekkesæter (Statoil).



Figure 3. The Skandi Stord supply vessel used for the offshore cruise.

2.2 The collection of demersal fish species from Njord A

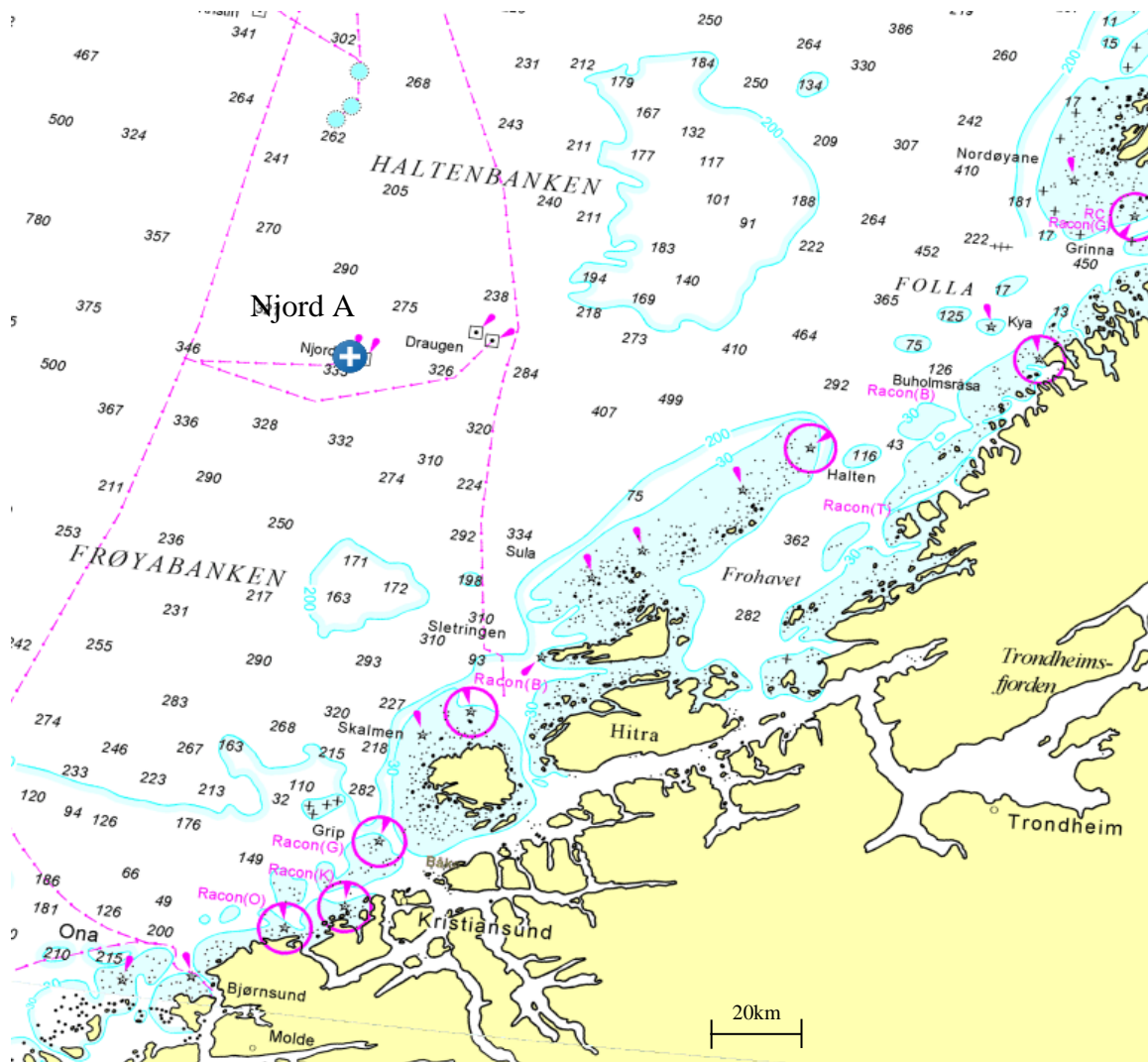


Figure 4. The approximate positions of the Njord A platform.

2.2.1 Njord A installation

On Tuesday 26th May 2013, the Skandi Stord arrived at Njord A (Figure 4). The boat moved within the safety zone to approximately 100 m from the platform and was held in position with the aid of its dynamic position (DP) system. Fishing began at approximately 08:00 h with rod and line baited with mackerel and tusk and ling were caught almost immediately. The number and species of fish sampled from around the Njord A platform during two days are listed in table 2. The target number of fish was 20 individuals of three fish species. Due to the depth at Njord A, invertebrates were not sampled (at the request of the customer), but instead an additional fish species, saithe was taken.



Figure 5. The Njord A platform.

Table 2. The number of the different fish species collected from the Njord A platform during two days of fishing.

Platform	Fish species	Latin	No. sampled
Njord A	Ling	<i>Molva molva</i>	20
	Tusk	<i>Brosme brosme</i>	20
	Red fish	<i>Sebastes sp.</i>	20
	Saithe (Coal fish)	<i>Pollachius virens</i>	12

2.3 Fish sampling procedure

A field laboratory was set-up within a large transport container (ca. 30 m³ volume), positioned on the main deck of the Skandi Stord (Figure 6). All equipment necessary for the collection of the fish samples was provided by the scientific crew including liquid nitrogen for the snap freezing of the biological samples and a large chest of dry ice for the preservation of the samples during the cruise and shipment to the NIVA Oslo laboratory. A standardised sampling protocol for all fish was followed (Figure 7). The fish were sampled immediately after collection.



Figure 6. Field laboratory within a shipping container secured on the main deck of the Skandi Stord.

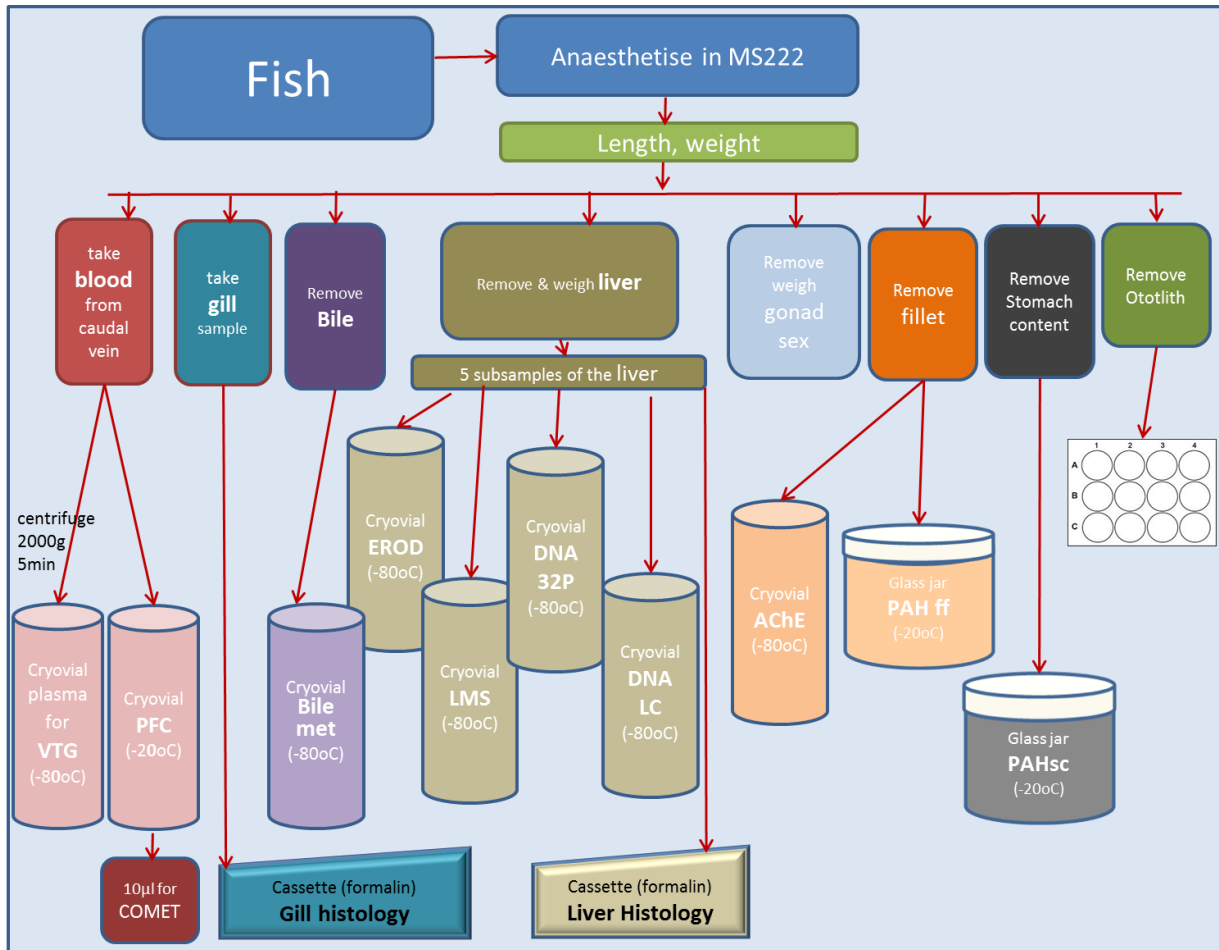


Figure 7. Standardised protocol for the sampling of the collected fish species.

2.4 CTD and turbidity profiles

In order to provide temperature, salinity and turbidity profiles from the water column around the platforms, an SAIV probe was deployed on two separate occasions whilst within the 500 m safety zone of the Njord A platform. The probe was deployed to the sea floor.

3. Collection of reference fish

Fish caught from a clean reference location will be used for comparison with those fish collected from the Njord A platform.

3.1 Reference cruise (IMR)

The Institute of Marine Research (IMR) research vessel, Johan Hjort departed Kristiansund at 11:00 on Tuesday 10th June and returned on Saturday 14th June 2014. In addition to IMR staff, Bjørnar Andre Beylich from NIVA, and Daniela M .Pampanin (IRIS) were onboard the vessel in order to ensure the reference fish samples for the WCM2014 programme were collected using the same procedures as that performed on the Skandi Stord. A log of activities related to the collection of the

reference fish species is shown in the table below. Individual fish measurements can be found in the appendices.

Blood sampling and comet preparations were performed by Bjørnar (NIVA) and Daniela (IRIS), working separate shifts, whilst the sampling of liver, fillet, gills and otoliths was performed by the IMRs environmental sampling crew. Bjørnar and Daniela participated in the sampling of all tissues when not involved in the comet preparation, and can confirm that sampling was done according to the same principles as the Njord A cruise.

Date	Activities	No of trawls	Fish sampled	Area
10.6	Departure from Kristiansund 11:00	5	20	Primary reference area
11.6	Trawling, watersampling and zooplanktonsampling	6	34	Njord/draugen area (several km away from the platforms)
12.6	Trawling, watersampling and zooplanktonsampling	5	2	Haltenbanken
13.6	Trawling, watersampling and zooplanktonsampling	4	17	Eggenkanten
14.6	Arrived in Kristiansund during the night. Demobilization			
17.6	Pallet with comet and chemistry samples arrived in Oslo at 9:30.			

Table 3. The total number of reference fish sampled for the effects monitoring study

Fish	Latin	Number sampled
Red fish	<i>Sebastes sp.</i>	20
Saithe	<i>Pollachius virens</i>	18
Tusk	<i>Brosme brosme</i>	20*
Ling	<i>Molva molva</i>	4
Greater Forkbeard	<i>Phycis bennoides</i>	11**

* includes two tusk that may be unsuitable as reference fish since they were caught in a produced water area.

** Not sampled for Comet.

The pallet was stored at Sea Cargo Agencies and picked up by DB schenker on Monday (16.6). The pallet arrived at 9:30 in oslo on Tuesday (17.6) Comet samples were still cold and delivered to analyses within 1 hour. The Histology samples were sent on IRIS' pallet to Stavanger. The stomach content samples and fillet for chemistry were put in the freezer at NIVA. The other samples (stored at -80°C) remained onboard the Johan Hjort in the -80 freezer, until the boat returned to Bergen on the 29th June. Samples were packed in dry ice and shipped to the NIVA laboratory in Oslo.

Fish data from Njord A platform

Code	English	Norwegian	Latin	Length (cm)	weight (g)	gonad weight (g)	Liver weight (g)	Sex
101	Tusk	Brosme	Brosme brosme	74	3610	40	178	F
102	Ling	Lange	Molva Molva	118	9240	1000	570	F
103	Ling	Lange	Molva Molva	96	4750	67	305	F
104	Ling	Lange	Molva Molva	92	4000	56	205	F
105	red fish	vanlig uer	Sebastes sp.	47	950	<5	15	F
106	Forkbeard	Skjellbrosme	Phycis blennoides	56	960	6	85	F
107	Tusk	Brosme	Brosme brosme	84	5700	80	340	F
108	red fish	vanlig uer	Sebastes sp.	41	910	<5	15	F
109	red fish	vanlig uer	Sebastes sp.	44	1060	<5	25	F
110	Tusk	Brosme	Brosme brosme	61	1400	15	125	F
111	Ling	Lange	Molva Molva	123	10500	920	520	F
112	Ling	Lange	Molva Molva	128	9200	140	318	F
113	red fish	vanlig uer	Sebastes sp.	43	410	<5	8	F
114	Tusk	Brosme	Brosme brosme	65	2800	20	100	F
115	red fish	vanlig uer	Sebastes sp.	40	850	<5	12	F
116	red fish	vanlig uer	Sebastes sp.	41	450	<5	17	F
117	red fish	vanlig uer	Sebastes sp.	42	950	<5	19	F
118	Tusk	Brosme	Brosme brosme	60	3020	25	85	F
119	Ling	Lange	Molva Molva	125	11900	1400	770	F
120	red fish	vanlig uer	Sebastes sp.	41	800	<5	12	F
121	red fish	vanlig uer	Sebastes sp.	42	950	<5	7	F
122	Ling	Lange	Molva Molva	117	793	56	340	F
123	red fish	vanlig uer	Sebastes sp.	41	750	<5	15	F
124	red fish	vanlig uer	Sebastes sp.	42	1070	<5	14	F
125	red fish	vanlig uer	Sebastes sp.	43	1200	<5	20	F
126	red fish	vanlig uer	Sebastes sp.	43	820	<5	22	F
127	red fish	vanlig uer	Sebastes sp.	47.5	1520	20	18	F
128	red fish	vanlig uer	Sebastes sp.	44	1170	<5	15	F
129	red fish	vanlig uer	Sebastes sp.	42	510	<5	20	F
130	Ling	Lange	Molva Molva	81	2650	20	125	F
131	red fish	vanlig uer	Sebastes sp.	41	880	<5	16	F
132	Tusk	Brosme	Brosme brosme	65	2200	15	90	F
133	Tusk	Brosme	Brosme brosme	79	5300	<5	235	M
134	Tusk	Brosme	Brosme brosme	63	2600	<5	68	M
135	Tusk	Brosme	Brosme brosme	66	2770	30	132	F
136	Ling	Lange	Molva Molva	148	20500	2600	1180	F
137	Ling	Lange	Molva Molva	159	22500	2300	1250	F
138	red fish	vanlig uer	Sebastes sp.	41	880	<5	12	F
139	red fish	vanlig uer	Sebastes sp.	44	450	<5	20	F
140	red fish	vanlig uer	Sebastes sp.	44	500	6	20	F

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141	Tusk	Brosme	Brosme brosme	69	3400	40	225	F
142	Tusk	Brosme	Brosme brosme	55	1270	<5	40	M
143	Tusk	Brosme	Brosme brosme	85	6700	<5	433	M
144	Ling	Lange	Molva Molva	125	10400	75	660	F
145	Tusk	Brosme	Brosme brosme	72	3700	45	235	F
146	Tusk	Brosme	Brosme brosme	73	3900	45	255	F
147	Ling	Lange	Molva Molva	120	9700	23	690	F
148	Ling	Lange	Molva Molva	157	21500	455	1245	F
149	Tusk	Brosme	Brosme brosme	67	2700	30	200	F
150	Ling	Lange	Molva Molva	114	4400	162	463	F
151	Tusk	Brosme	Brosme brosme	71	3140	58	135	F
152	Ling	Lange	Molva Molva	120	8700	62	615	F
153	Ling	Lange	Molva Molva	95	4750	325	260	M
154	Tusk	Brosme	Brosme brosme	71	3750	<5	263	M
155	Ling	Lange	Molva Molva	117	8300	145	415	F
156	Ling	Lange	Molva Molva	119	8100	152	470	F
157	Ling	Lange	Molva Molva	122	8500	205	330	F
158	Tusk	Brosme	Brosme brosme	82	6200	91	352	F
159	Ling	Lange	Molva Molva	137	16500	1800	1250	F
160	Saithe	Sei	Pollachius virens	64	2500	22	265	F
161	Saithe	Sei	Pollachius virens	56	1570	<5	68	M
162	Saithe	Sei	Pollachius virens	72	4150	20	272	M
163	Saithe	Sei	Pollachius virens	54	1350	7	74	F
164	Saithe	Sei	Pollachius virens	52	1120	<5	40	M
165	Saithe	Sei	Pollachius virens	70	3550	28	138	F
166	Saithe	Sei	Pollachius virens	63	2460	19	98	F
167	Saithe	Sei	Pollachius virens	54	1600	<5	87	M
168	Saithe	Sei	Pollachius virens	57	1800	<5	68	M
169	Saithe	Sei	Pollachius virens	56	1700	<5	45	M
170	Saithe	Sei	Pollachius virens	62	2160	<5	66	M
171	Saithe	Sei	Pollachius virens	77	4010	37	164	F
172	Tusk	Brosme	Brosme brosme	63	2470	<5	149	M
173	Tusk	Brosme	Brosme brosme	84	7350	15	343	M

Fish data from the reference cruise

Code	English	Norwegian	Latin	length (cm)	weight (g)	gonad weight (g)	liver weight (g)	sex
201	ling	Lange	Molva Molva	79	2710	39	103	F
202	ling	Lange	Molva Molva	99	6110	166	82	M
203	saithe	Sei	Pollachius virens	54	1590	1	15	F
204	saithe	Sei	Pollachius virens	55	2070	4	32	F
205	saithe	Sei	Pollachius virens	58	2250	0	44	F
206	saithe	Sei	Pollachius virens	64	2990	2	119	F
207	saithe	Sei	Pollachius virens	61	2520	11	5	F
208	saithe	Sei	Pollachius virens	58	2060	8	33	F
209	saithe	Sei	Pollachius virens	73	3830	6	90	F
210	saithe	Sei	Pollachius virens	52	1630	6.5	41	M
211	saithe	Sei	Pollachius virens	59	2070	7	209	M
212	saithe	Sei	Pollachius virens	55	1840	10	44	M
213	saithe	Sei	Pollachius virens	55	1750	3	5	F
214	saithe	Sei	Pollachius virens				9	F
215	saithe	Sei	Pollachius virens	52	1660	7	24	F
216	saithe	Sei	Pollachius virens	60	2160	12	5	F
217	saithe	Sei	Pollachius virens	56	2040	7	9	F
218	saithe	Sei	Pollachius virens	56	1940	2	12	F
219	saithe	Sei	Pollachius virens	57	2010	1	45	F
220	saithe	Sei	Pollachius virens	55	1920	5	19	M
221	saithe	Sei	Pollachius virens	56	1940	3	156	M
222	tusk	Brosme	Brosme brosme	67	3510	2	28	M
223	tusk	Brosme	Brosme brosme	42	840	5	43	F
224	tusk	Brosme	Brosme brosme	42	880	3	52	F
225	tusk	Brosme	Brosme brosme	47	1645	1	105	F
226	tusk	Brosme	Brosme brosme	58	2590	1	32	0
227	tusk	Brosme	Brosme brosme	46	1215	4	31	0
228	redfish	vanlig uer	Sebastes sp.	49	2215	42	73	F
229	redfish	vanlig uer	Sebastes sp.	45	1500	2	74	F
230	redfish	vanlig uer	Sebastes sp.	46	1740	11	98	M
231	redfish	vanlig uer	Sebastes sp.	44	1350	4	107	M
232	redfish	vanlig uer	Sebastes sp.	43	1215	2	54	M
233	redfish	vanlig uer	Sebastes sp.	45	1630	13	95	M
234	redfish	vanlig uer	Sebastes sp.	48	1900	15	139	F
235	redfish	vanlig uer	Sebastes sp.	51	2150	15	28	F
236	redfish	vanlig uer	Sebastes sp.	44	1365	17	26	F
237	redfish	vanlig uer	Sebastes sp.	50	2315	21	43	M
238	redfish	vanlig uer	Sebastes sp.	54	2955	26	65	M
239	tusk	Brosme	Brosme brosme	59	2600	12	18	0
240	ling	Lange	Molva Molva	53	610	1		

241	tusk	Brosme	Brosme brosme	42	960	3	17	0
242	tusk	Brosme	Brosme brosme	50	1280	10	6	0
243	tusk	Brosme	Brosme brosme	46	880	2	38	0
244	ling	Lange	Molva Molva	94	1360	155	46	F
245	redfish	vanlig uer	Sebastes sp.	44	1350	4	29	F
246	redfish	vanlig uer	Sebastes sp.	51	1610	15	55	M
247	redfish	vanlig uer	Sebastes sp.	43	1040	13	17	M
248	redfish	vanlig uer	Sebastes sp.	46	1350	16	30	F
249	redfish	vanlig uer	Sebastes sp.	43	980	12	20	F
250	redfish	vanlig uer	Sebastes sp.	46	1165	16	14	M
251	redfish	vanlig uer	Sebastes sp.	45	1025	12	30	M
252	redfish	vanlig uer	Sebastes sp.	53	2340	21	39	F
253	redfish	vanlig uer	Sebastes sp.	42	1030	5	45	M
254	tusk	Brosme	Brosme brosme	60	2460	1	80	0
255	tusk	Brosme	Brosme brosme	46	950	1	6	0
256	tusk	Brosme	Brosme brosme	50	1230	13	65	0
257	tusk	Brosme	Brosme brosme	52	1550	11	80	0
258	tusk	Brosme	Brosme brosme	64	1440	23	7	0
259	greater forkbeard	Skjellbrosme	Phycis blennoides	46	770	4	62	M
260	greater forkbeard	Skjellbrosme	Phycis blennoides	45	660	38	333	F
261	greater forkbeard	Skjellbrosme	Phycis blennoides	43	550	4	68	M
262	greater forkbeard	Skjellbrosme	Phycis blennoides	41	510	3	98	M
263	greater forkbeard	Skjellbrosme	Phycis blennoides	35	310	1	105	M
264	greater forkbeard	Skjellbrosme	Phycis blennoides	43	630	4	143	M
265	greater forkbeard	Skjellbrosme	Phycis blennoides	53	1194	6	106	F
266	greater forkbeard	Skjellbrosme	Phycis blennoides	37	356	1	131	F
267	greater forkbeard	Skjellbrosme	Phycis blennoides	48	930	7	169	M
268	greater forkbeard	Skjellbrosme	Phycis blennoides	61	2110	311	52	M
269	greater forkbeard	Skjellbrosme	Phycis blennoides	32	270	1	110	F
270	tusk	Brosme	Brosme brosme	51	1170	11	33	F
271	tusk	Brosme	Brosme brosme	51	1200	12	34	F
272	tusk	Brosme	Brosme brosme	39	620	1	47	M
273	tusk	Brosme	Brosme brosme	52	1270	11	58	F
274	tusk	Brosme	Brosme brosme	38	520	1	19	M