

Institute of Marine Research

CRUISE REPORT

R/V *H. Mosby* - cruise No. 2009615
M/S *Øyfisk* – cruise No. 2009813
10th - 20th June 2009

Coral survey off Northern Norway

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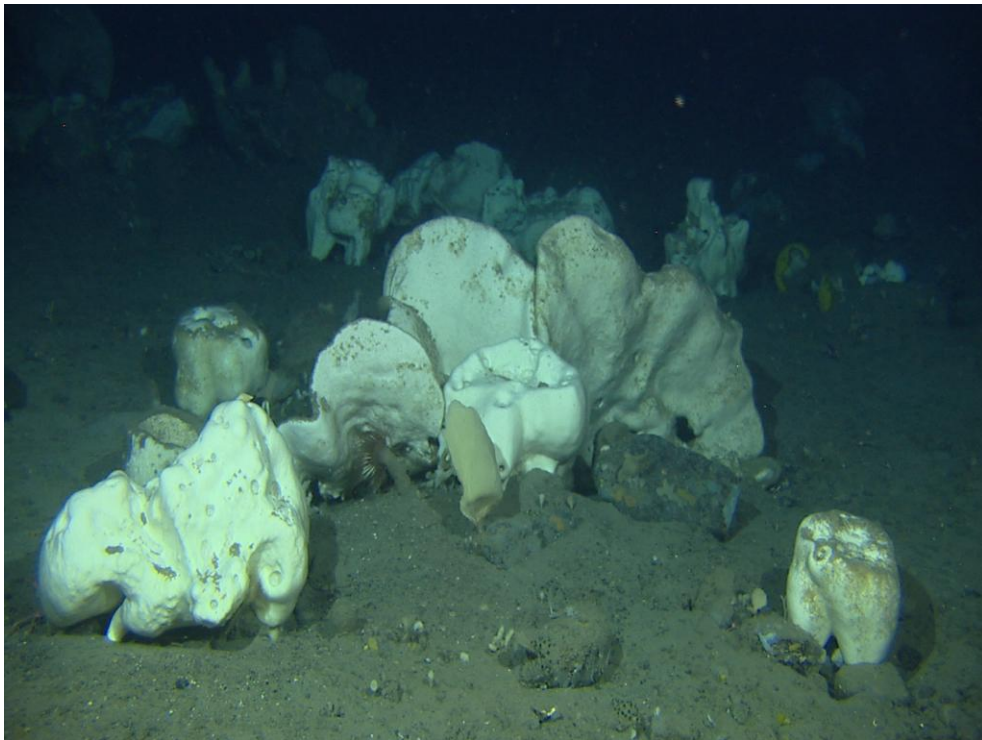


Image grabbed from HD video taken with Campod during cruise 2009615

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ITINERARY

R/V H. Mosby

Departed	Kristiansund	10.06.2009
Arrived	Bodø	20.06.2009

M/S Øyfisk

Departed	Myre (Øksnes)	14.06.2009
Arrived	Myre (Øksnes)	20.06.2009

SUMMARY

The Traena Deep coral reef field was the main target area of the cruises carried out with R/V *H. Mosby* and M/S *Øyfisk* from 10th to 20th June 2009. Small (100*30*10 m) *Lophelia* reefs are widespread in the Traena Deep with about 1500 reefs in a 200 km² large area. The cruises set out to investigate fish and zooplankton abundance and the species composition of fish in blocks with high and low density of small coral reefs and in adjacent control areas without *Lophelia* reefs using underwater video observations, trawling and long line fishing. Fish and zooplankton abundance was also investigated in relation to large scale topography in the Traena Deep and at the Røst Reef using acoustic techniques (Figure 1). The weather was in general good with temperatures between 5 and 12°C in the air and 8 and 11°C at the sea surface. There was a strong breeze most of the time with longer periods of gentle and moderate breeze on the 17th, 18th and 19th of June. All fish sampling was carried out successfully. Unfortunately the zooplankton sampling gear did not function properly so no quantitative information on zooplankton could be obtained. At a 1-km scale there seemed to be no evidence of a relation between the distribution of fish and specific benthic habitats at this time of the year.

OBJECTIVES AND BACKGROUND

The overall objective was to study the distribution of fish and plankton in relation to the occurrence of *Lophelia* cold-water coral reefs and the general topography. Acoustic transects, underwater video observations and long-line fishing was carried out to see if certain fish species were more abundant in cold-water coral habitats than in other structurally complex habitats. To see if the association with particular habitats increases the fitness of individual fish length, weight, age and maturity stage of individual fish caught in high coral density, low coral density and no coral areas during the long line fishing was determined. Stomach content analysis will be used to get an overview of the main food sources of the different species caught and whether that differs in the three different habitat types. Stomach fullness measures will be derived to give an indication of food availability in different habitats.

MAPPING OF FISH IN CORAL HABITATS

Research cruise number 2009615 with R/V *H. Mosby* was undertaken between 10th and 20th of June 2009. Research cruise number 2009813 with M/S *Øyfisk* was undertaken between 14th and 20th of June 2009. The depth in the investigated CWC habitats is 200-400 m.

Acoustic abundance estimations

Acoustic abundance estimations of fish and zooplankton were carried out in a 500 km² large area surrounding the Traena Deep, in a 570 km² large area covering the Røst Reef and the continental shelf break north of the Røst Reef and at two transects crossing the Røst Bank. The acoustic data were collected using the Simrad ER60

scientific echosounder at a cruising speed of 10 knots. Abundance estimations of fish were generated for the 38 kHz data (Figure 2). Three other operating frequencies were used during the survey (18, 120 and 200 kHz) for trace recognition purposes. Echograms were scrutinized using Large Scale Survey System-software. The allocation of area backscattering strengths to species was made by comparison of the appearance of the echo recordings to trawl catches and video recordings.

The acoustics showed that zooplankton were evenly distributed in the surveyed areas and could not be related to any large-scale topographic features (Figure 2A). At Røst the highest numbers of fish in the 10 m zone closest to the sea-bed were registered in the shallow areas north of the reef rather than on the reef proper (Figure 2F). Mesopelagic fish and large pelagic schooling stocks (blue whiting and Atlantic herring) were encountered at the shelf break (Figure 2B-D and Figure 3). In the Træna area the highest densities of fish close to the sea-bed were found in the shallower bank areas north of the coral field. The strongest echo-signals from fish in the Træna Deep were recorded in the middle of the water column at depths between 250 and 330 m. Towed underwater video transects and two bottom-trawl hauls confirmed the presence of a large number of medium sized (40-45 cm) saithe. In this area there seemed to be no relationship between the distribution of the large commercial fish stocks (i.e. saithe, blue whiting, and herring) and cold-water corals.

Visual observations

The underwater video footage was taken using the video rig Campod. The Campod is a light weight, three-legged platform equipped with 2 video cameras, hard disk recording, lights (2x400w HMI), depth sensor, altimeter, laser scaling and transponder for positioning. The rig was towed at a speed of 1 knot and was kept 3 meters above the sea-bed. The camera was mounted in a slightly forward looking angle to increase the field view and the chance of observing fish. The towed video camera was deployed 25 times resulting in a total of 23 hours with high definition video records (Figure 4). The Campod was very well suited to collect video material of fish. The towed gear runs rather quietly above the bottom and does not seem to scare the fish. Due to the constant speed and forward motion the only fish that could follow the camera over larger distances was saithe. The camera is easy to deploy and haul and is relatively easy to run along pre determined transects as long as the weather conditions are ok. On the 17th of June weather conditions were excellent and 9 towed video transect of 2 km each (i.e. 60 minutes) were shot during 18 hours. This means that only 1 hour was spend on launching, hauling and moving between each transect at this site where water depth was around 300 m. The quality of the shots was good.

A priori six experimental units (geographic plots á 2 x 2 km) had been selected on the basis of multi-beam bathymetric maps. During the survey it was found that the *a priori* determined control areas were actually sponge grounds and new control areas, located east of the Træna Deep, were added. Video transects for fish abundance estimations were equally distributed in two blocks with high density of coral reefs, two blocks with low density of coral reefs and two blocks with high density of sponge cover (sponge ground). Four control transects were taken in a habitat of flat surface sediment without significant cover of erect species.

Sixteen, two km long, video transects collected in the experimental plots were analyzed on-board. The most commonly observed fish along the transects were saithe (*Pollachius virens*), Norway haddock (*Sebastes viviparus*), Norway pout (*Trisopterus esmarkii*), tusk (*Brosme brosme*), blue whiting (*Micromesistius poutassou*) and rabbit fish (*Chimaera monstrosa*). No statistically significant differences in abundance or species composition was observed in areas with high or low density of coral reefs, sponge grounds or sedimentary seabed without three dimensional habitat forming species (i.e. control areas). Norway redfish is usually abundant on the reefs but at this site we found that it was also abundant in low coral and no coral habitats. Very weak tendency that tusk prefer coral habitat was observed.

Signs of fishing activity was recorded. During the 23 hours of video observations trawl tracks were observed four times, five lines and two pieces of rope were observed lying on the sea-bed. In addition undefined rubbish was observed three times.

Long line fishing

A priori six experimental units (geographic plots á 2 x 2 km) had been selected on the basis of multi-beam bathymetric maps. This included two plots with high density of coral reefs, two plots with low density of coral reef and two plots without any *Lophelia* reefs (however the area contained high densities of large sponges). For the experimental fishing, four fleets of long line were set across each plot. Setting direction was parallel with the main current direction at the site and perpendicular to the depth contour. Starting position for the first line was selected randomly from 0 to 1000 m away from the western up-current side of the plot. The second line was set 900 m away from the first one to avoid that one line would “steal” fish from the other. Fishing was carried out two times in each block, the second time with a new randomly selected starting position.

The fishing was carried out by the coastal long-liner M/V *Øyfisik*. During a 5 day period a total of 22 fleets of long-line were set, each containing approximately 1280 hooks. The hooks were baited with squid. Soak time was approximately 4 hours. Fishing was performed with no consideration to what time of the day the lines were set since in June there is light 24 h a day. Catch was registered per 250 m sub-section of the line (160 hooks). All fish was identified, weighed and length determined and analyzed for sex and degree of maturity. Stomachs were collected whenever possible. From each subsection of the line otoliths were collected for age determination for a maximum of 10 individuals per fish species. By-catch of sponges and corals were registered.

The long-line fishing was carried out successfully despite rather heavy swell in the area the first days of the cruise. Of 24 planned line transect 22 were actually set (Figure 5). A total of 1083 fish, of which 931 were tusk, were caught in the Træna coral reefs field (Table 3). 14 different species were caught. By-catch of coral and sponges in the line fishery were almost non-existent.

The overall mean CPUE of Tusk ($[\text{kg}/\text{hook}] \times 1000$) in the Træna Deep was 72. There was a tendency of higher CPUE in high density reef areas as compared to low density reef areas and no coral areas (99, 72 and 46 respectively). From 2004 to 2008 a CPUE of 90 has been estimated from the ICES area IIa (i.e. the Norwegian Sea).

The CPUE in the Træna Deep was slightly lower than that registered from coral areas in mid-Norway by Husebø et al. (2002) i.e. 60 ([ind./hook] x 1000) in coral habitats and 40 in non coral habitats. In the Træna Deep 48 ([ind./hook] x 1000) were registered in high density coral habitats, while 37 were registered in low coral density habitats and 24 in no coral habitats. No statistically significant difference in tusk abundance was found in high, low or non coral habitats. A trend of higher mean length in areas with high density of coral reefs was, however, observed.

SURVEY MAPS AND FIGURES

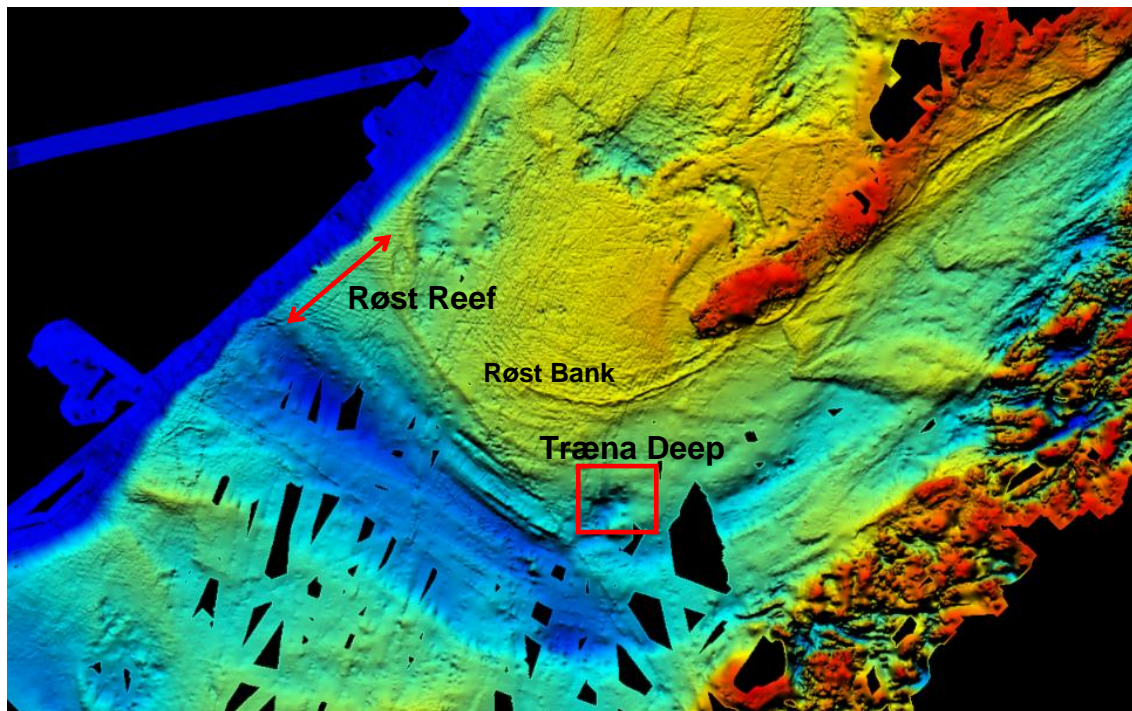
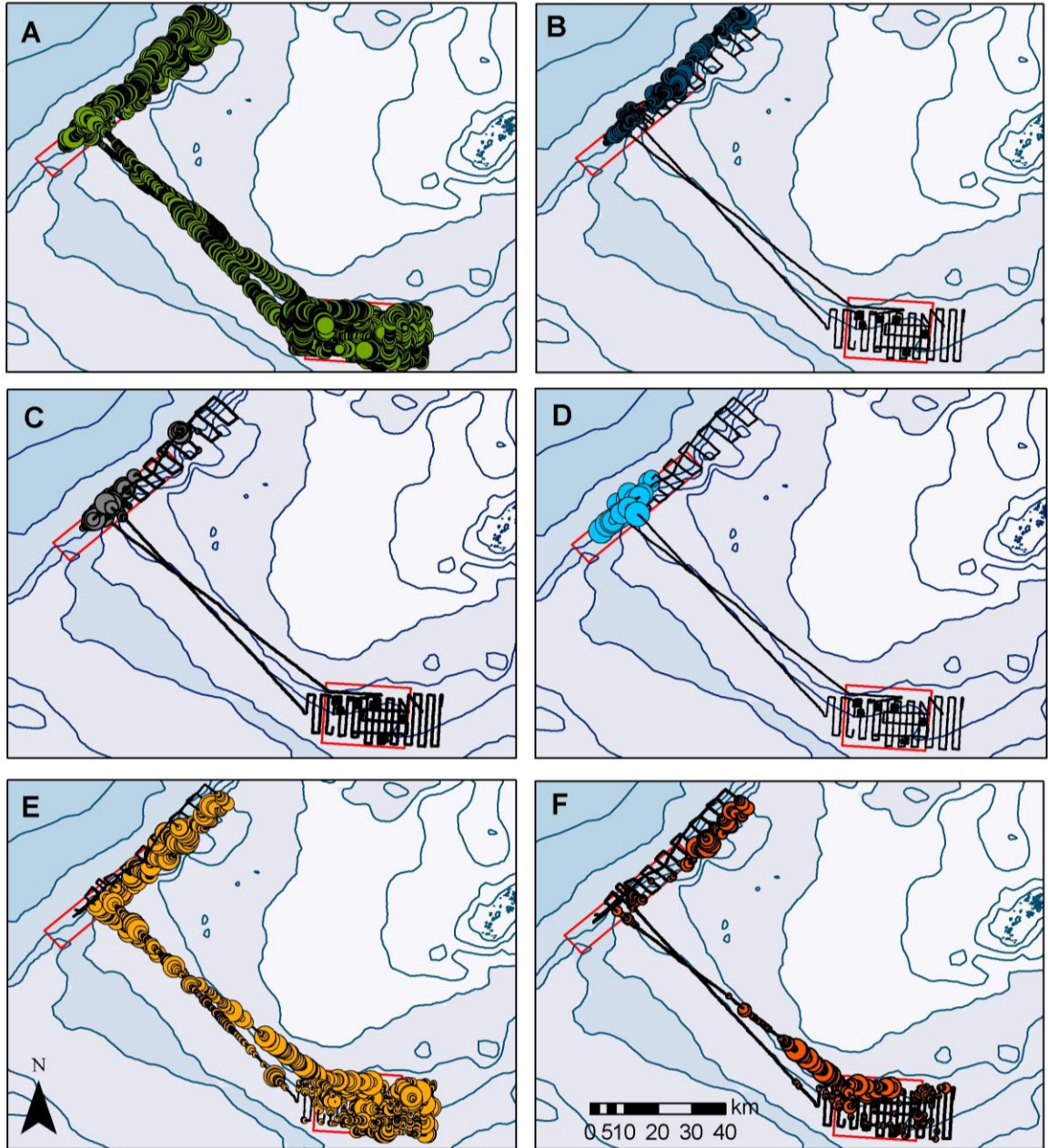


Figure 1. Study areas during cruise 2009615 in June 2009 with RV *H. Mosby*.



NASC

· 0 - 100 · 100 - 200 · 200 - 300 · 300 - 400 · 400 - 600 · 600 - 2000 · 2000 - 6071

Figure 2. Area backscattering strength (NASC) was averaged over 0.5 nautical miles and integrated from the bottom to the surface for (A) Zooplankton, (B) Mesopelagic fish (i.e. *Maurolicus muelleri*), (C) Blue whiting (*Micromesistius poutassou*) and (D) Atlantic herring (*Clupea harengus*). For Saithe (*Pollachius virens*) NASC was integrated from 10 m above the bottom to the surface in (E) and integrated from the seabed to 10 m above the bottom in (F).

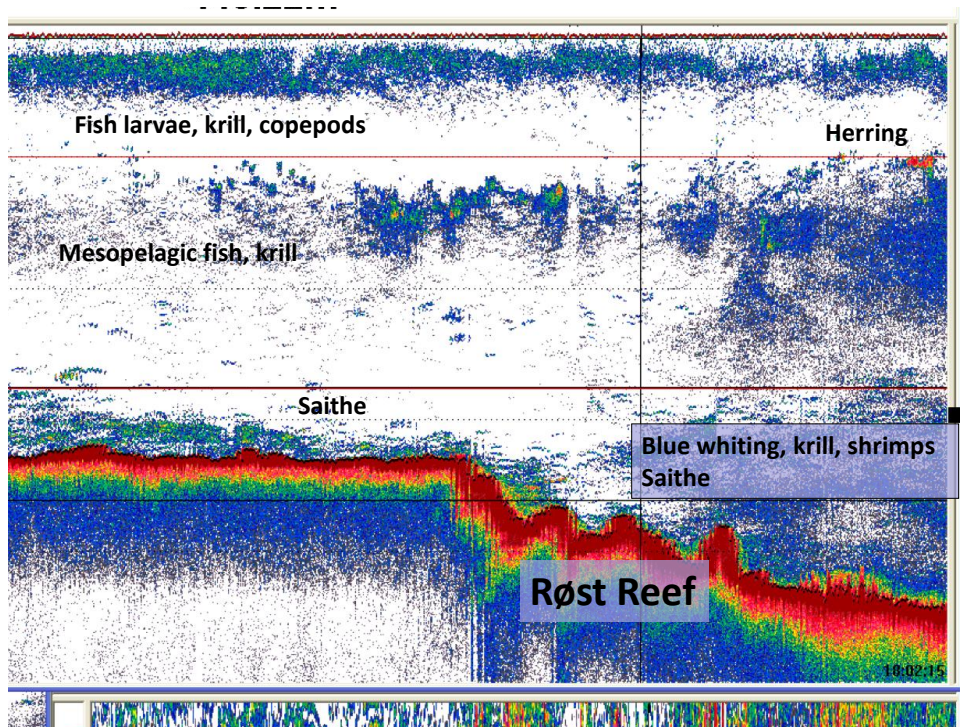


Figure 3. Echogram of a transect across the Røst Reef and identified scatters.

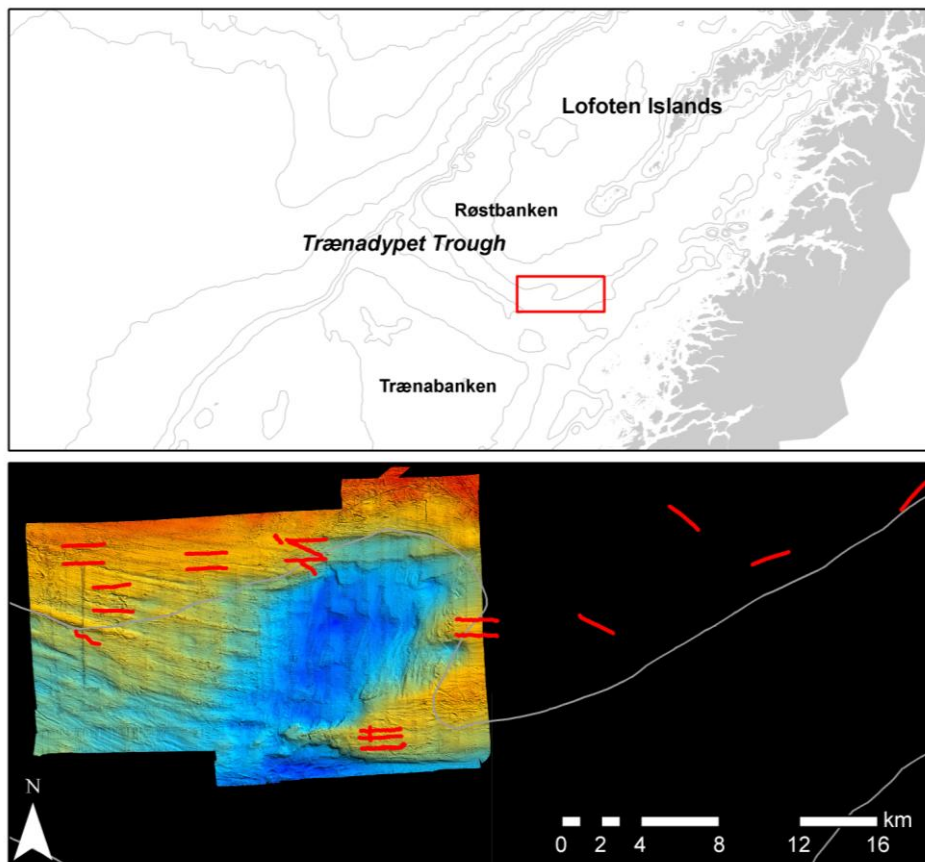


Figure 4. Red lines show the positions of the towed video transects.

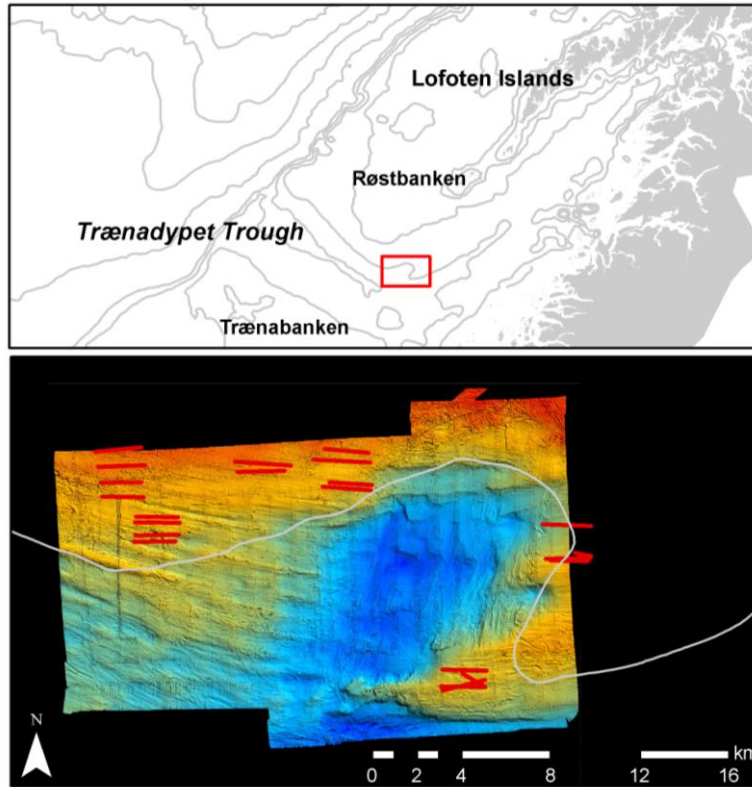


Figure 5. Red lines show the positions of the long-lines set in the Træna Deep.

APPENDIX

Table 1. Narrative of cruise with all sampling stations and tracks. Geographic positions are given as decimal degrees. For tracks only starting position is given.

Location	Date	Activity	Time	Duration	Station	Latitude	Longitude	Depth
	10.06.2009	Left Kristiansund harbour	16:00					
	11.06.2009	in transit						
Træna Deep	12.06.2009	Call in Bodø port to leave equipment	19:00					
	12.06.2009	Arrived in the Træna-Deep study area	15:32					
	12.06.2009	Fisheries acoustics	16:55	00:50:24	in experimental plots	66.9840	10.7960	273
	12.06.2009	Bottom trawl	19:02	00:23:00	119	66.9412	10.8530	292
	12.06.2009	Fisheries acoustics	20:26	12:32:54	Træna Deep	66.9380	10.8370	308
	13.06.2009	Campod-video	10:37	01:34:02	HL2-1500	66.8792	11.2101	305
	13.06.2009	Campod-video	13:08	01:10:35	HL2-600	66.8872	11.2097	299
	13.06.2009	Campod-video	15:02	00:24:29	HL2-ex	66.8829	11.1747	300
	13.06.2009	Campod-video	16:21	01:08:47	NL2-1800	66.9279	11.3249	277
	13.06.2009	Campod-video	18:02	01:06:50	NL2-1000	66.9349	11.3265	283
	13.06.2009	Fisheries acoustics	20:34	02:55:04	in experimental plots	66.9270	11.2810	306
	14.06.2009	Fisheries acoustics	03:44	00:56:24	in experimental plots	66.9610	11.0830	305
	14.06.2009	Fisheries acoustics	06:17	02:52:26	in experimental plots	66.9810	10.8740	272
	14.06.2009	Krill trawl	11:05	00:48:35	120	66.8713	11.1279	-
	14.06.2009	CTD	11:53	00:43:03	420	66.8810	11.1965	302
	14.06.2009	CTD	12:36	00:43:04	421	66.9375	11.3018	300
	14.06.2009	CTD	13:19	00:41:48	422	66.9345	11.1593	401
	14.06.2009	CTD	14:01	00:40:05	423	66.9692	66.1075	305
	14.06.2009	Mocness-plankton	16:05	02:10:05	na*	-	-	-
	14.06.2009	Campod-video	19:16	00:47:22	HL5-1	66.9772	11.0731	290
14.06.2009	Campod-video	20:38	01:00:28	HL5-2	66.9660	11.1264	310	
14.06.2009	Campod-video	22:26	00:44:08	HL5-3	66.9590	11.1173	333	
	15.06.2009	Bottom trawl	07:18	00:20:00	121	66.9708	10.9563	273
Røst Bank	15.06.2009	Fisheries acoustics	08:23	38:07:47	from træna to røst			
	-17.06.2009							
Røst Reef	16.06.2009	Krill trawl	12:56	01:11:00	122	67.3915	9.0594	-

Location	Date	Activity	Time	Duration	Station	Latitude	Longitude	Depth
	16.06.2009	CTD	17:01	00:51:13	424	67.4372	10.1828	498
	16.06.2009	Mocness	15:17	05:25:00	424-426*	67.2360	9.0353	-
Træna Deep	17.06.2009	Campod-video	6:33	0:50:39	LL2-1	66.9446	10.9052	309
	17.06.2009	Campod-video	7:48	1:04:39	LL2-200	66.9571	10.9022	294
	17.06.2009	Campod-video	9:53	1:02:34	LL1-1	66.9630	11.0148	289
	17.06.2009	Campod-video	11:27	1:06:12	LL1-2	66.9700	11.0156	287
	17.06.2009	Campod-video	13:29	1:03:30	NL1-1	66.9758	10.8740	276
	17.06.2009	Campod-video	14:56	1:05:30	NL1-2	66.9652	10.8713	286
	17.06.2009	Campod-video	17:01	0:45:46	25mintrålhal	66.9304	10.8656	308
	17.06.2009	Campod-video	19:10	0:59:13	HL5-4	66.9656	11.1299	319
	17.06.2009	Campod-video	20:48	1:07:41	HL5-5	66.9750	11.0859	292
	18.06.2009	Mocness-plankton	01:04	0:49:00	425*	66.5771	11.0457	-
	18.06.2009	Krill trawl	03:02	0:43:00	123	66.9719	11.1119	-
	18.06.2009	Krill trawl	06:38	0:49:00	124	66.9689	10.8810	-
	18.06.2009	Krill trawl	08:58	0:49:00	125	66.9306	10.9913	-
	18.06.2009	Krill trawl	13:09	0:47:00	126	66.9379	11.1541	-
	18.06.2009	Campod-video	15:21	1:04:46	HL2-4	66.8841	11.1626	302
	18.06.2009	Campod-video	16:53	1:04:00	HL2-5	66.8792	11.1655	312
	18.06.2009	Campod-video	19:14	1:01:26	Explore 1	66.9359	11.4222	284
	18.06.2009	Campod-video	21:02	1:03:02	Explore 2	66.9836	11.5309	271
	18.06.2009	Fisheries acoustics	22:15	7:33:28	east of study area	66.9760	11.5620	274
	19.06.2009	Campod-video	6:44	1:02:05	Explore 3	66.9559	11.6241	293
	19.06.2009	Campod-video	8:37	0:56:13	Explore 4	66.9777	11.7987	307
	19.06.2009	Campod-video	9:40	0:12:32	Sponge	66.9897	11.8291	292
	19.06.2009	Campod-video	12:20	1:10:49	Sponge2	66.9665	10.9366	282
	19.06.2009	Campod-video	14:03	1:10:25	Coral	66.9513	10.9945	304
	19.06.2009	Left the study area	19:00					
	20.06.2009	Arrived in Bodø. End of cruise.	03:00					

*The mocness zooplankton sampling gear did not function properly and no samples of small zooplankton (i.e. copepods) were obtained on the cruise.

Table 2. Long line fishing with M/S *Øyfisk*. Geographic start and stop positions of each line is given as decimal degrees.

Date	Line no.	Time of fishing (UTM)		Depth (m)		Position of long-line			
		Setting	Hauling	start	stop	Start		Stop	
15.06.09	HL1-1	07:10	11:10	166	312	66.9789 N	11.1083 E	66.9806 N	11.0597 E
15.06.09	HL1-2	10:41	14:41	315	297	66.9672 N	11.1083 E	66.9691 N	11.0598 E
15.06.09	NL2-1	15:39	19:39	299	319	66.9377 N	11.3311 E	66.9395 N	11.3151 E
16.06.09	NL2-2	04:07	08:07	291	316	66.9352 N	11.3283 E	66.9369 N	11.2901 E
16.06.09	HL2-1	06:45	10:45	312	316	66.8894 N	11.2186 E	66.8857 N	11.1743 E
16.06.09	HL2-2	10:30	14:30	323	327	66.8869 N	11.2189 E	66.9707 N	11.1734 E
16.06.09	NL1-1	14:34	18:34	288	290	66.9806 N	10.8777 E	66.9806 N	10.8294 E
17.06.09	NL1-2	04:04	08:04	299	295	66.9670 N	10.8758 E	66.9673 N	10.8328 E
17.06.09	HL1-3	06:36	10:36	299	-	66.9820 N	11.1078 E	66.9845 N	11.0627 E
17.06.09	HL1-4	10:32	14:32	320	301	66.9690 N	11.1090 E	66.9707 N	11.0659 E
17.06.09	NL2-3	13:35	17:35	312	340	66.9496 N	11.3323 E	66.9515 N	11.2831 E
17.06.09	NL2-4	16:52	20:52	289	303	66.9362 N	11.3311 E	66.9377 N	11.2858 E
18.06.09	HL2-3	04:01	08:01	312	323	66.8932 N	11.2205 E	66.8944 N	11.1751 E
18.06.09	HL2-4	07:00	12:45	305	305	66.8876 N	11.2166 E	66.8921 N	11.1950 E
18.06.09	NL1-3	10:46	16:40	273	271	66.9871 N	10.8749 E	66.9869 N	10.8262 E
18.06.09	NL1-4	15:15	20:38	290	297	66.9739 N	10.8739 E	66.9739 N	10.8310 E
18.06.09	LL1-1	15:52	22:20	316	312	66.9513 N	10.9106 E	66.9516 N	10.8655 E
19.06.09	LL1-2	00:23	04:40	309	308	66.9496 N	10.9060 E	66.9495 N	10.8630 E
19.06.09	LL2-1	01:32	06:32	282	282	66.9789 N	11.0273 E	66.9806 N	10.9699 E
19.06.09	LL2-2	04:02	09:02	301	295	66.9769 N	11.0200 E	66.9767 N	10.9721 E
19.06.09	LL1-3	06:26	11:26	294	293	66.9582 N	10.9093 E	66.9598 N	10.8668 E
19.06.09	LL1-4	09:04	14:04	-	-	66.9562 N	10.9117 E	66.9576 N	10.8658 E

Table 3. Catches of fish in each long line set in the Træna Deep.

			HL1-1	HL1-2	HL1-3	HL1-4	HL2-1	HL2-2	HL2-3	HL2-4	NI1-1	NI1-2	NI1-3	NI1-4	NI2-1	NI2-2	NI2-3	NI2-4	LI1-1	LI1-2	LI1-3	LI1-4	LI2-1
Species																							
Brosme	Tusk	<i>Brosme brosme</i>	51	84	27	51	51	75	6	56	57	28	20	62	21	18	20	19	61	51	40	49	37
Gråsteinbit	Wolf fish	<i>Anarhichas lupus</i>	2			2	1	2		1				1							1		
Havmus	Rabbit fish	<i>Chimaera monstrosa</i>	7	3	2	2	2	1	3						2	3							
Hyse	Haddock	<i>Melanogrammus</i>		3				1	1				9				1		1	2		1	1
Hågjel	Blackmouth catshark	<i>Galeus melastomus</i>	2	1	2		6	2	3	2		2			1	2		2	2	3		1	
Lange	Ling	<i>Molva molva</i>		1			1		1						1			1	1	1			
Rundskate	Round ray	<i>Rajella fyllae</i>													2		2						
Svarthå	Velvet belly lantern shark	<i>Etmopterus spinax</i>		1			3	1	4						2	2	7	2	2	5			
Vanlig uer	Ocean perch	<i>Sebastes marinus</i>						1								1		1			1		
Trollkrabbe	Northern stone cab	<i>Lithodes maja</i>			1	5		3			3	2		1					1	2			
Torsk	Cod	<i>Gadus morhua</i>									1												
Sei	Saithe	<i>Pollachius virens</i>										1											
Flekksteinbit	Northern wolffish	<i>Anarhichus denticulatus</i>			1																		
Kloskate	Thorny skate	<i>Amblyraja radiata</i>				1																	
total			62	93	33	61	64	86	18	59	61	33	29	64	29	26	30	25	68	64	42	51	38
count			4	6	5	5	6	8	6	3	3	4	2	3	6	5	4	5	6	6	3	3	2

