Institute of Marine Research

CRUISE REPORTS

R/V *G.O. Sars* No. 2010 103
M/S *Atlantic* No. 2010 802
3-16 March 2010

CoralFISH survey off Northern Norway

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Image taken from the BRIL lander during research cruise 2010 103. Photo courtesy of Thom Linley, University of Aberdeen.

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Contents

ITINERARY

R/V *G.O. Sars*

Departed	Bergen	04.03.2010
Arrived	Bergen	16.03.2010

M/S *Atlantic*

Departed	Kristiansand	03.03.2010
Arrived	Værøy	09.03.2010

SUMMARY

The Traena Deep coral reef field was the main target area of the cruises carried out with R/V *G.O. Sars* and M/S *Atlantic* from 3 to 16 March 2010 (Figure 1). Small (100*30*10 m) *Lophelia* reefs are widespread in the Traena Deep with about 1500 reefs in a 200 km^2 large area (Figure 2). 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, in sponge grounds and in adjacent control areas without large 3 dimensional habitat forming fauna using underwater video observations, deployment of photo landers, trawling and by long line fishing. Fish and zooplankton abundance was also investigated in relation to large scale topography in the Traena Deep using acoustic techniques. Box core samples were taken to estimate infauna biomass at coral and non coral sites. The measurements will be used as input in a food web model of the Trena Deep coral reef field. The area was also visited on two cruises in June 2009 performing similar measurements. The reason for two additional cruises was to study the effect of season on fish abundance at the site.

The weather was almost consistently bad during the whole cruise. There was a gale for the first two days at the Træna Deep (i.e. 7^{th} and 8^{th}), a moderate breeze on the 10^{th} of March and a strong breeze the rest of the days at the cruise. Air temperatures ranged between -2^{o}C at night time to 6^{o}C at daytime, while sea surface temperatures ranged between 4 and 8^{o}C. All fish sampling was carried out successfully. Unfortunately the landers could only be deployed 5 times due to heavy swell.

At a 1-km scale the video transects and lander deployments indicate that there might be a relation between the distribution of tusk and coral habitats. At a larger scale (as measured by the acoustics) and for other fish there was 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 importance of cold water coral (i.e. *Lopehlia*) reefs for fish. Acoustic transects, underwater video observations, deployment of photo landers and long-line fishing was carried out to see if certain fish species were more abundant in CWC habitats than in neighboring habitats. Investigated were areas with a high density of coral reefs, areas with a low density of coral reefs, sponge grounds and areas without three dimensional structure forming fauna. Length, weight, age and the stage of maturity of all fish caught on the long lines was determined to see if associations with particular habitats increase the fitness of individual fish. Stomach content analysis will be used to get an overview of the main food of the different species caught and whether that differs in the four different habitat types. Tissue samples of selected fish and macrofauna were taken to measure stable isotope and fatty acid composition and elucidate potential food sources for the fauna associated with the reefs.

FISH IN CORAL HABITATS

Research cruise number 2010 103 with R/V *G.O. Sars* was undertaken between 4 and 16 of March 2010. Research cruise number 2010 802 with M/S *Atlantic* was undertaken between 3 and 9 of March 2010. The depth in these CWC habitats is 200-400 m.

Acoustic abundance estimations

Acoustic abundance estimations of fish and zooplankton were carried out in a 500 km^2 large area surrounding the Traena Deep. The data were collected with a Simrad ER60 scientific echosounder at a cruising speed of 10 knots. Abundance estimations of fish were generated for the 38 kHz data. Three other operating frequencies were used during the survey (18, 120 and 200 kHz) for trace recognition purposes. Echograms were scrutinized using the software LSSS (Marec). 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 acoustic recordings showed that there was very little fish and zooplankton in the area at the time of the cruise. There were no signs indicating that coral reefs affect fish distribution on a 1 km scale.

Visual observations

Underwater video 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 0.7-1 knot and was kept 3 m above the sea-bed. The camera was mounted in a slightly forward looking angle to increase the field of view and the chance of observing fish. The towed video camera was deployed 12 times resulting in a total of 17 hours with high definition video records. The Campod was very well suited to collect video material of fish. The towed gear runs rather smoothly 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 – significant wave height lower than 3 m. The quality of the shoots was good.

A priori twelve experimental units (geographic plots á 2 x 2 km) had been selected on the basis of multi-beam bathymetric maps and the video observations from 2009 consisting of three plots with high density of coral reefs, three plots with low density of coral reefs, three plots with high density sponge cover and three plots without any three dimensional habitat forming benthic fauna (Figure 2). Due to the heavy swell in the area only 6 plots were surveyed with two 2 km transects in each. These were three plots with high density of reefs and two control plots and one sponge ground plot.

Twelve 2 km long video transect collected in the experimental plots were analyzed on-board. The most common fish species were Norway pout (*Trisopterus esmarkii*), Norway redfish (*Sebastes marinus*), saithe (*Pollachius virens*) and tusk (*Brosme brosme*).

For the Norway pout no differences in abundance were observed between coral and non coral areas. A significantly higher abundance of Norway redfish were observed in the high density coral areas (average of 85 individuals per transect) as compared to the control and sponge areas (average of 39 individuals per transect). Although no statistically significant difference were observed in the abundance of tusk there was a trend indicating that tusk prefer coral habitats. The mean abundance of tusk was 5 individuals per transect in coral areas as compared to 2 in non coral areas. Rabbit fish (*Chimaera monstrosa*) on the other hand was significantly more common in non coral habitats with a mean abundance of 4 in unstructured habitats as compared to 2 in coral habitats.

The reef field had few signs indicating that it had been impacted by fishing activity. During the 9 hours of video observations in the coral habitats one line was observed lying on the sea-bed. In the video footage from the cruise in 2009 (22 h) trawl tracks were observed four times, five lines and two pieces of rope was observed lying on the sea bed.

Photo lander observations
Although hampered by almost consistent bad weather the BRIL (photo lander from the University of Aberdeen) was successfully deployed 3 times during the cruise. It captured 2 360 images at the seabed, at depths of 275-310m (depth calculated via SeaGuard pressure and temperature sensors). Exact location was provided via USBL (Ultra Short Base Line) beacon attached to the lander frame. Locations were selected based on areas previously well investigated by IMR in the hope of combining a wide range of methods within a single area. The areas designated as coral and reference areas are the same classifications as given by IMR and extensive multi-beam and camera transects support the selection of these as representative areas. The Coral area (Figure 2 (HL5), Figure 3) consists of multiple localised and current orientated reefs with well defined boundaries. It is assumed that the high number of reefs in an area will characterise this it as a coral habitat. This allowed the lander to be placed within the reef area but not directly on top of a living reef. Although BRIL's footprint is very small we are reluctant to do any harm unless necessary. The reference area (Figure 3) is in the eastern part of the survey area. It consists of open sandy seabed and drop stones. While other locations within this region contain abundance of sponges, they are fewer and much smaller in size at the reference station and it is hoped that they do not define the habitat here.

Opportunistic scavengers attracted to the bait were dominated by tusk (*Brosme brosme*) at both stations. A ling (*Molva molva*) and a forkbeard (*Phycis blennoides*) were seen at the reference station while Norway redfish (*Sebastes viviparus*) and an unknown gadiform fish were seen at the coral area. In the coral area the arrival time of the first tusk was shorter, the maximum number of animals in a single frame was higher and the animals may be larger on average with the occasional very large individual (Figure 4). It is worth noting that the arrival time of the first fish is similar in the reference area. The greater forkbeard arrival time fell between those replicates at the coral sites but was the only fish to visit the bait until later (38 minutes) in the deployment. This indicates that the BRIL landed in close proximity to this individual. No further forkbeards were seen during the deployment, suggesting that this rapid arrival does not indicate a high local abundance. Some behavioural observations were also possible in the tusk. As expected from their commercial long line fishery, the

tusk were not only attracted to the bait but would consume it and were responsible for the vast majority of bait removal (Figure 5). They also appear confident in navigating enclosed spaces and even large fish were seen to pass through the chain links used as ballast (Figure 5).

The NIOZ lander was deployed two times, once in the high density reef area (HL5) and once in the reference area. This lander was fitted with a time lapse camera, video camera, current meter and turbidity meter. Some time was spent on trying out new techniques for the registration of arrival time of fish to the deployed bait. In the coral area continuous recording of the fish arriving to the lander was made with the video camera using infra red light.

Long line fishing

A priori 12 experimental units (geographic plots á 2 x 2 km) had been selected on the basis of multi-beam bathymetric maps and video observation done in 2009. This included three plots with high density of coral reefs, three plots with low density of coral reef, three plots with a high density of large sponges and three plots without three dimensional habitat forming macrofauna. For the experimental fishing two 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.

The fishing was carried out by the autoliner M/V *Atlantic*. During a 4 day period a total of 24 fleets of long-line were set, each containing approximately 1280 hooks. The hooks were baited with squid. Soak time was approximately 4 hours. No consideration to what time during the day the lines were set was taken. 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 for the duration of the cruise. All of 24 planned line transect were set.

Due to difficulties in obtaining the cruise log from this cruise the data have not been processed yet.

Multi-beam mapping

The Traena Deep coral reef MPA (23 * 13 km) had been mapped with multi beam echo-sounders during an earlier cruise. During this cruise a detailed map of seabed topography was produced using multi beam echosounders also of the control area (200 km^2).

Documentary film

Tesche Documentary Film, Leichlingen, Germany, followed and filmed the different operations and work during the whole cruise. They interviewed the different scientists about their work. They also got footage from the coral habitat for use in the

documentary. The aim is to visit and interview scientists that are working with CWC habitats.

SURVEY MAPS AND FIGURES

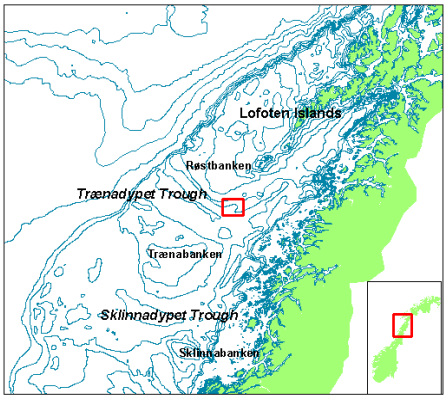

Figure 1. Traena Deep coral reef field marked with red square on the map.

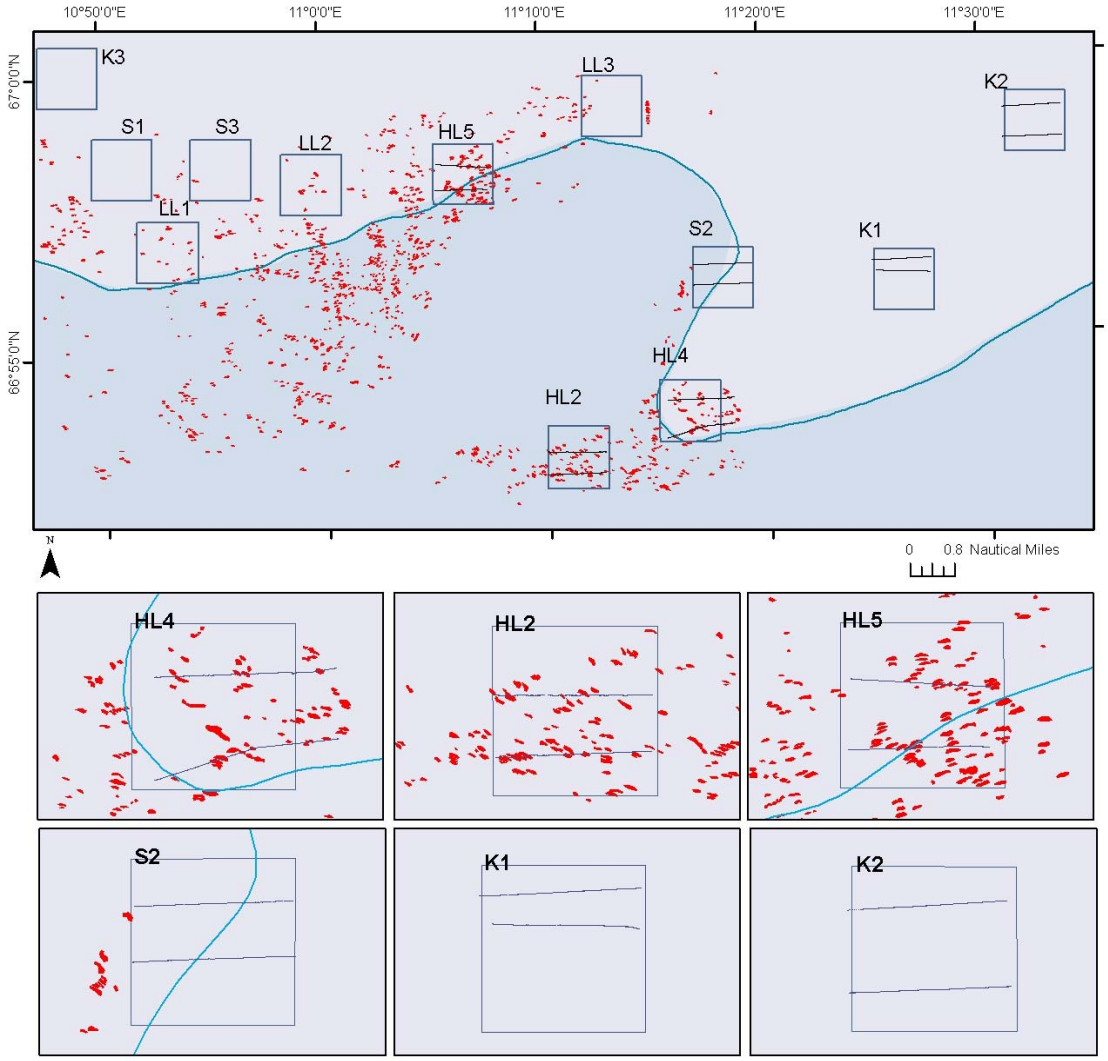

Figure 2. The location of the 12 experimental plots used in the long line and video survey. The reefs are coloured red. Line transect show the path of the 12 underwater video transects taken during the survey. K = control plot, HL = high density reef plot, LL = low density reef plot and S = sponge ground plot.

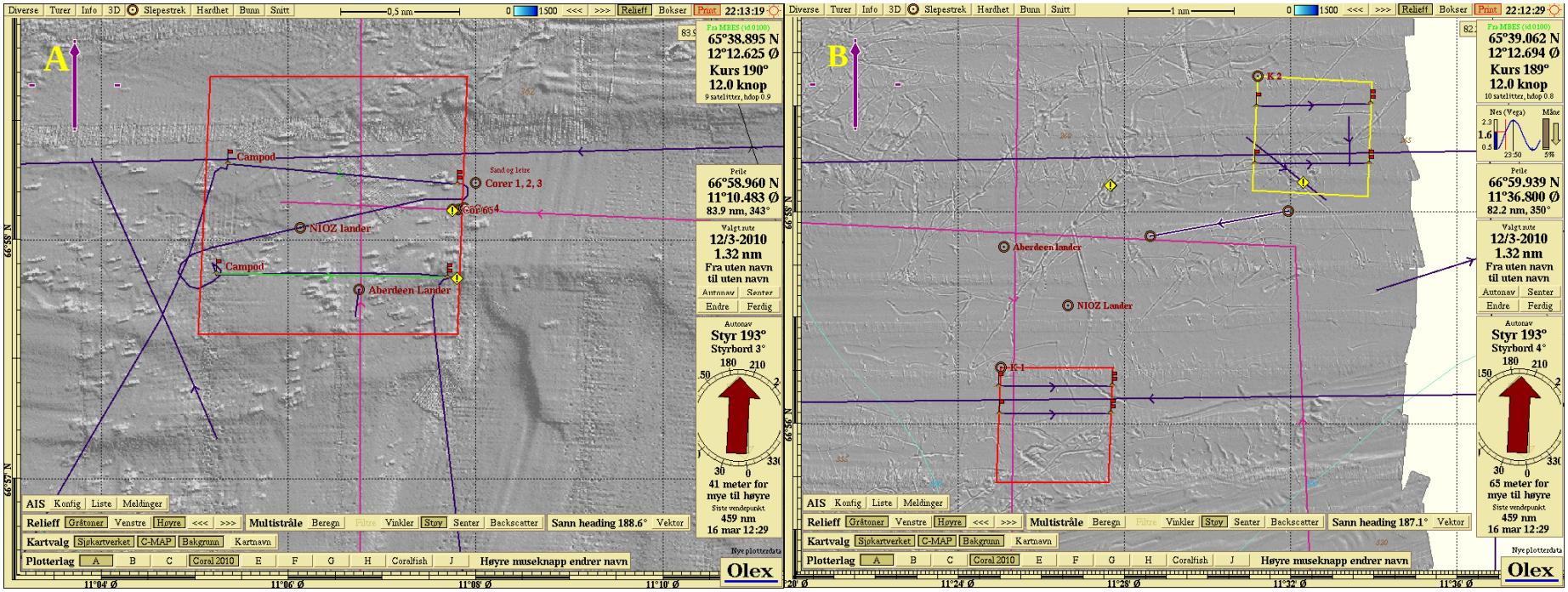

Figure 3. Olex screen grabs of the locations selected. a) The coral area. The lander is placed in an area of open seabed between localised current orientated reefs. b) The reference area. The lander is placed in an area of open seabed far from any reef influence.

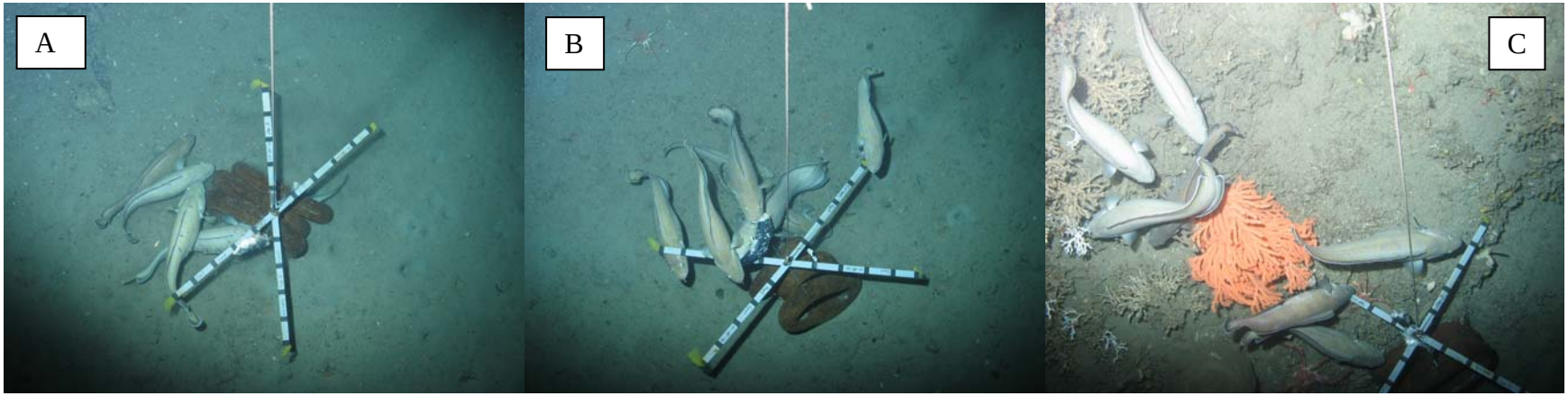

Figure 4. Un-cropped images showing the maximum number of tusk seen at the reference station (A) and the coral station (B and C).

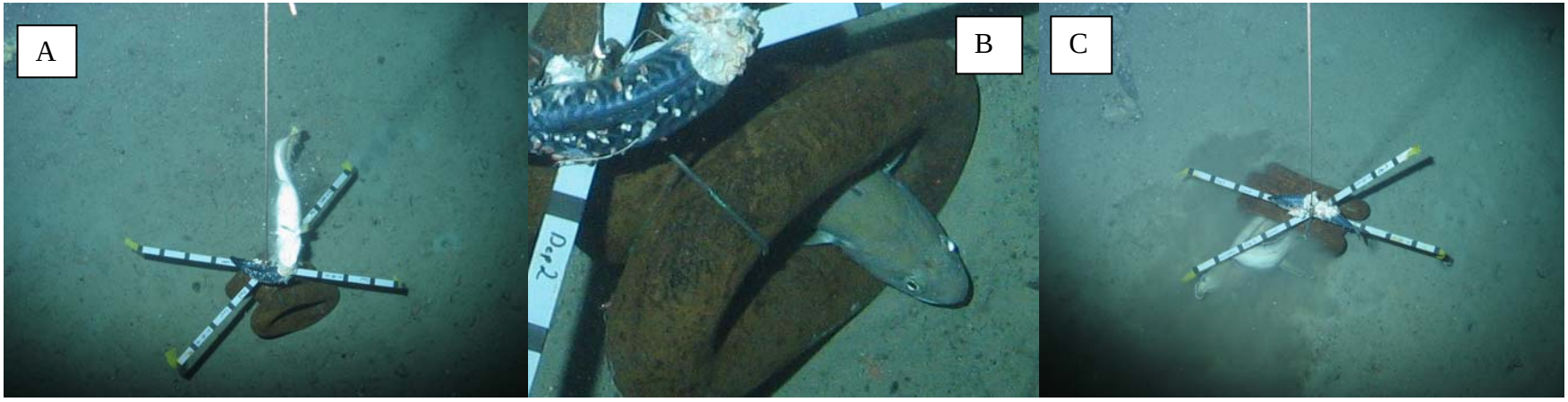

Figure 5. Behavioural observations of tusk: consumption of bait (A) and navigating in confined spaces (chain links used as ballast)(B and C).

APPENDIX

Table 1. Cruise log.

Location	Date	Activity	Time	Duration	Station	Latitude	Longitude	Depth
	04.03.2010	Left Bergen harbour	10:30		-	-	-	-
	- 06.03.2010	in transit						
Træna	06.03.2010	Arrived in the Træna-Deep study	03:22	-	-	-	-	-
	06.03.2010	Campod	05:05	01:26	HL5-1	**66°58.23**	**11°07.81**	286
	06.03.2010	Campod	07:19	01:32	HL5-2	**66°57.86**	**11°05.23**	297
	06.03.2010	CTD with watersamples	09:03	00:16	HL5 (0132)	**66°57.84**	**11°07.80**	321
	06.03.2010	Campod	10:12	02:21	HL4-1	**66°53.13**	**11°09.97**	288
	06.03.2010	Campod	12:33	01:46	HL4-2	**66°52.72**	**11°09.97**	308
	06.03.2010	CTD with watersamples	15:32	00:13	K1 (0133)	**66°55.71**	**11°24.95**	277
	07.03.2010	CTD with watersamples	00:41	00:15	north of S2 (0134)	**66°57.59**	**11°18.03**	314
	06.03.2001	Fisheries acoustics and multibeam	16:00					
	- 09.03.2010	Mapping	14:00	34:00				
	09.03.2010	NIOZ lander deployment	15:00	-	Reference area	**66°57.13**	**11°26.59**	282
	09.03.2010	BRIL lander deployment	23:44	-	Reference area	**66°57.69**	**11°25.10**	275
	10.03.2010	Campod, underwater video transect	05:19	01:26	K1-1	**66°56.15**	**11°25.11**	286
	10.03.2010	Campod, underwater video transect	07:52	01:10	K1-2	**66°56.35**	**11°24.96**	283
	10.03.2010	Campod, underwater video transect	10:09	01:15	K2-1	**66°58.99**	**11°31.17**	271
	10.03.2010	Campod, underwater video transect	11:53	01:19	K2-2	**66°58.45**	**11°31.13**	263
	10.03.2010	Campod, underwater video transect	17:52	01:20	HL2-1	**66°53.53**	**11°18.48**	271
	10.03.2010	Campod, underwater video transect	20:14	01:21	HL2-2	**66°53.99**	**11°18.48**	269
	10.03.2010	Campod, underwater video transect	22:51	01:07	S2-1	**60°56.01**	**11°19.48**	275
	11.03.2010	Campod, underwater video transect	00:47	01:05	S2-2	**66°56.37**	**11°19.49**	292
	11.03.2010	BRIL lander deployment	02:51	-	HL5 among reefs	**66°57.79**	**11°06.76**	310
	11.03.2010	Mocness, zooplankton sampling	09:27	00:42	HL5	**66°57.31**	**11°05.07**	320
	11.03.2010	CTD with watersamples	10:19	00:21	HL5 (0135)	**66°58.46**	**11°03.41**	288
	11.03.2010	NIOZ lander deployment	11:58	-	HL5 among reefs	**66°58.08**	**11°06.24**	304
	11.03.2010	Box core 1	15:06	01:26	HL5, off reef	**66°58.24**	**11°08.01**	323
	11.03.2010	Box core 2	20:00	00:32	HL5, off reef	**66°58.24**	**11°08.00**	324

Location	Date	Activity	Time	Duration	Station	Latitude	Longitude	Depth
	11.03.2010	BRIL lander deployment	21.27	-	HL5 among reefs	**66°57.79**	**11°06.76**	304
	11.03.2010	CTD with water sample	21:56	00:15	HL5 (0136)	**66°57.93**	**11°06.79**	312
	11.03.2010	Fisheries acoustics and multibeam	22:15	10:00	-	**-**	**-**	-
	12.03.2010	CTD with water sample	05:18	00:10	K3 (0137)	**67°00.03**	**10°43.71**	312
	12.03.2010	Box core 3	08:33	00:15	HL5, off reef	**66°58.24**	**11°08.00**	325
	12.03.2010	Box core 4	09:07	00:31	HL5, reef gradient	**66°58.13**	**11°07.87**	317
	12.03.2010	Box core 5	09:51	00:40	HL5, reef gradient	**66°58.13**	**11°07.81**	315
	12.03.2010	Box core 6	10:51	00:35	HL5, reef gradient	**66°58.12**	**11°07.75**	316
	12.03.2010	Bottom trawl	17:28	00:15	between K1 and K2	**66°56.65**	**11°29.15**	285
	12.03.2010	CTD	18:05	00:17	0138	**66°56.02**	**11°26.44**	285
	12.03.2010	Bottom trawl	19:20	00:15	Just south west of K2	**66°57.97**	**11°29.96**	278
	12.03.2010	CTD	19:58	00:21	Between K1 and K2 (0139)	**66°57.18**	**11°27.97**	281
	13.03.2010	CTD	03:15	00:15	SW corner of study area (0140)	**66°53.49**	**10°50.03**	333
	13.03.2010	Multibeam mapping	04:00	21:30	17:30			
	13.03.2010	Pelagic trawl	22:16	00:30	K2	**66°58.24**	**11°27.82**	270
	13.03.2010	Pelagic trawl	00:15	00:30	HL5	**66°57.90**	**11°08.59**	331
	13.03.2010	Left study area	15:12	-	-	**-**	**-**	-
	- 16:03:2010	in transit	-	-	-	**-**	**-**	-
	16.03.2010	Arrived in Bergen. End of cruise.	12:00	-	-	**-**	**-**	-