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Mar-Eco

The cruise with M/S Loran

Summer 2004



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Summary

English

M/S *Loran* was hired to operate alongside the research vessel *G. O. Sars* during the second leg of the MAR-ECO expedition in the summer 2004. The vessel should supplement the sampling effort directed at demersal fish and other taxa captured by passive fishing gear. M/S *Loran* operated longlines, gillnets and traps to better explore the ridge and sample species in rugged terrain. Møre Research coordinated this effort. The longliner cruise was conducted without encountering major problems, and the goals were achieved. In 12 fishing days a total of 87 500 hooks (64 longlines, both set along the bottom and vertically) and gillnet sets were made, and only a limited amount of gear was lost. The majority of the stations were sampled with bottom-set longlines. The fishing depth ranged from 450 to 4300 m, and fishes were caught in the entire depth range. At these stations approximately 8800 animals, representing at least 50 different species of fishes and a few invertebrates, were caught. Large fish dominated the catch and the mean weight was 3.4 kg. Chondrichthyans (sharks, rays and chimaeras) were most numerous, but also a number of bony fishes were caught. It remains uncertain whether the samples contain species new to science. A number of fish specimens could not readily be identified to species, only to family or genus level, and these will have to be examined by specialists. The technical success of this cruise was assured through a very professional use of the very advanced ship and efficient gear handling by the very skilled captain and crew.

This report provides a first overview of areas sampled and investigated, methodology, and catches during the cruise on the M/S *Loran*.

Norwegian

M/S *Loran* ble sommeren 2004 leid inn for å opererere sammen med forskningsskipet *G. O. Sars* under gjennomføringen av Del 2 av den internasjonale MAR-ECO ekspedisjonen. M/S *Loran* skulle fiske med line, teine og garn for at også de utilgjengelige områdene på ryggen skulle bli utforsket. Møreforskning Ålesund hadde ansvaret for gjennomføringen av toktet med M/S *Loran*. Toktet ble gjennomført uten store problemer, og målene med toktet ble oppnådd. Kun en liten andel redskap ble tapt. I løpet av 12 fiskedager ble 87 500 krok, fordelt hovedsakelig på bunnline og noe snik, og flere garnsetninger satt ut. Det ble fisket på dyp fra 450 til 4 300 m, og det ble fanget fisk i hele dybdeintervallet. I løpet av toktet ble ca. 8 800 individer fanget, hvorav det ble registrert minst 50 forskjellige arter fisk og evertebrater. I all hovedsak ble det fanget store fiskearter og gjennomsnittsvekten for all fisken var på 3,4 kg. Bruskfisk (hai, skater, havmus) dominerte, men det ble også fanget en rekke beinfisker. Det er fremdeles usikkert om det forekom arter som er ukjent for vitenskapen, men det var flere individer som ikke kunne bestemmes nærmere enn til familie eller slekt. Disse ble tatt vare på og vil bli undersøkt nærmere av eksperter. Skippers og mannskapets erfaringer med fiske på dypt vann, samt båtens spesialtilpasning til for fiske på dypt vann, var uvurderlig for gjennomføringen av toktet. Denne kombinasjonen var avgjørende for at toktet ble gjennomført uten store problemer og med lavt brukstap.

Denne rapporten gir en oversikt over toktet, hvilke områder ble undersøkt, metodene som ble brukt og hva som ble fanget. Nærmere analyser av materialet vil foregå i årene som kommer og bli publisert i senere arbeid fra underprosjektene som er tilknyttet MAR-ECO.

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1 Introduction

The project MAR-ECO, an element of the research programme Census of Marine Life, rises to the challenge of investigating the diverse animal life along the vast underwater mountain chains of the open ocean. MAR-ECO is an international research project in which scientists from 16 nations take part. Norway, represented by the Institute of Marine Research and the University of Bergen, co-ordinates the project which will enhance our understanding of occurrence, distribution and ecology of animals and animal communities along the Mid-Atlantic Ridge between Iceland and the Azores. The groups of animals to be studied are fishes, crustaceans, cephalopods (squids and octopods) and a wide range of gelatinous animals (e.g. jellyfish) living either near the seabed or in midwater above the ridge.

MAR-ECO will adopt the most advanced technology and instruments for observing and sample the animals and to tackle the challenge of working to 3500 m depth or more and in rugged terrain. An international multidisciplinary team of biologists, oceanographers, and engineers is offered this rare opportunity. A number of countries have committed their best research vessels, and in the 2003-2005 field phase a number of research cruises will be carried out. In 2004, a two-month major international expedition was conducted by the new Norwegian vessel RV *G. O. Sars*, but vessels from Iceland, Russia, Germany, the United Kingdom and Portugal will also take part. In June 2003 a Russian-US cruise using the manned submersibles MIR-1 and -2 took scientists to areas never before visited by humans at 4500m below the surface.

RV *G. O. Sars*' two months expedition in 2004 was divided into two parts, Leg 1 and Leg 2. Leg 1 started in Bergen on 5 June and the tasks and priorities were to produce an overall quantitative assessment of the plankton and nekton associated with the Mid-Atlantic Ridge, to collect biological samples in support of the 10 MAR-ECO component projects, add effort at opportunity for cetacean and bird studies and launch moorings and rigs for long-term physical and acoustic data logging. Leg 2 started in the Azores on 5 July and the tasks and priorities were again to provide data and samples to a range of MAR-ECO component projects (primarily those focusing on benthopelagic and benthic fauna) and to retrieve long-term moorings in southern and middle MAR-ECO sub-areas.

The RV *G. O. Sars* operates bottom trawls, but the mid-Atlantic Ridge has extensive rugged rocky areas in which trawls cannot be used. Furthermore, all fishing gears are species and size selective and trawls will only capture a certain fraction of the organisms actually present. In order to make the sampling effort as comprehensive as possible, the Norwegian Longliner M/S *Loran* was hired to support the research vessel *G. O. Sars* during Leg 2. M/S *Loran* operated longlines, gillnets and traps to better explore the ridge and sample species in rugged terrain. Møre Research coordinated this effort.

The longliner cruise was conducted without encountering major problems. Only a limited amount of gear was lost and in 12 fishing days a total of 87 500 hooks (64 longlines, both set along the bottom and vertically) and gillnet sets were made. The majority of the stations were sampled with bottom-set longlines. At these stations approximately 8800 animals, representing at least 50 different species of fishes and a few invertebrates, were caught. The fishing depth ranged from 450 m to 4 300 m, and fish were caught in the entire depth range.

The sampling was concentrated along cross-ridge transects, approximately the same transects visited by the *G.O. Sars*. Along each transect, three different depth strata were fished; shallower than 1500 m, between 1500 and 2500 m and deeper than 2500 m. The aim was to use all three gear types in depth interval on both sides on the ridge. One transect was sampled in the southern MAR-ECO box and two in the northern area (known as the middle MAR-ECO box), one transect on both sides of the Charlie Gibbs Fracture Zone.

Chondrichthyans (sharks, rays, and chimaeras) dominated the catch. Species caught were sleeper sharks (Greenland and little sleeper sharks), false catsharks, portuguese sharks, birdbeak dogfish, lantern sharks, deep-sea rays, catsharks, and gulper sharks. Also a number of bony fishes were caught, including slickheads, wolf-fish, grenadiers, fork-beards, tusk (and several other cod-like fishes), scabbard fish, cuskeels, redfish, cut-throat eels, and a few invertebrates, including corals, crabs, and shrimp. Some fishes were also netted at the surface, including a baby blue shark, a sunfish, a triggerfish, an amberjack and several juvenile wreckfish.

It remains uncertain whether the samples contain species new to science. A number of fish specimens could not readily be identified to species, only to family or genus level, and these will have to be examined by specialists.

This report provides a first overview of areas sampled and investigated, methodology, and catches during the cruise with M/S Loran.

Financing

The longliner cruise was financed by grants from commercial sponsors and public agencies and authorities in Norway and the USA.

Commercial / private sponsors:



Dyrkorn AS;

-provided longlines, traps and discount on gillnets.



Fiskebåtrederne's Forbund (the Norwegian fishing vessel owner's association);

-direct financial support.



Mustad Longline AS

- provided fish hooks



Normarine ASA

-provided suitable bait at discount rates.



Statoil ASA

-provided free fuel and lubricants for entire operation.



Sunnmøre and Romsdal Fiskesalslag

-direct financial support.

Public agencies/authorities



Fiskeridirektoratet (The Directorate of Fisheries);

-direct financial support



Fiskeri- og Havbruksnæringens Forskningsfond (Norwegian foundation managing industry-derived funds in support of fishery and aquaculture research);

-direct financial support



NOAA, National Marine Fisheries Service

- charter for 5 days, direct financial support



Møre og Romsdal Fylkeskommune (Moere and Romsdal County);

-direct financial support



Sogn og Fjordane Fylkeskommune (Sogn and Fjordane County);

-direct financial support

2 Methods and data

2.1 Investigated areas

Two major areas were sampled on the cruise conducted in the period 5 – 17 July 2004 (Figure 1). The southernmost area was north of the Azores and all the stations in the south were placed between 42 and 43 °N (Area I). The area in the north ranged from 50 °N to 55 °N and here as well the M/S *Loran* worked approximately the same cross-ridge transect as used by RV *G. O. Sars*. The stations were placed in two different areas, one south and one north of Charlie-Gibbs Fracture Zone (Area II and Area III).

Along each of the transects of the ridge fishing was conducted in three different depth strata; shallower than 1 500 m, between 1 500 and 2 500 m, and deeper than 2 500 m. The aim was to fish with all three gear types in each interval on both sides of the ridge. One full transect was explored in the southern area (Area I), and two transects were explored in the northern (middle) area, one transect on both sides of the Charlie-Gibbs Fracture Zone (Area II and III). Maps showing the distribution of stations along the three transects are shown in Figure 2 to Figure 4.

The cruise started in Area I on 5 July and a total of 22 stations were fished during 5 days. In Area II a total of 24 stations were sampled during 4 days, and in Area III a total of 18 stations during 3 days were fished. Details about the stations can be found in Appendix IV.

2.2 The vessel

M/S *Loran* (M-12-G) is a commercial Norwegian high-seas longliner. The vessel was built in 1999, but totally rebuilt in 2003 after a major accident. She has a total length of 51 m and maximum width of 11 m, and the main engine is a 2 200 hp Caterpillar. The catch is stored in a freezer (613 m³) with 6 vertical contact freezers with a total capacity of 36 tonnes per day. A horizontal contact freezer and a tunnel freezer for large fish are also available.

The captain during the cruise was Mr Ståle Otto Dyb and the vessel had a crew of 14 including the cook and the engineer.

The vessel is rigged for operating both longlines and gillnets on the same trip. The Mustad Autoline system is used that can rig 68 000 hooks simultaneously. Equipped with the most modern baiting machine, the vessel can set different kinds of hooks at the same time. This baiting machine can bait and shoot up to 250 hooks per minute. The vessel also uses an automatic gillnet hauler and has a storage capacity of 2 000 gillnets.

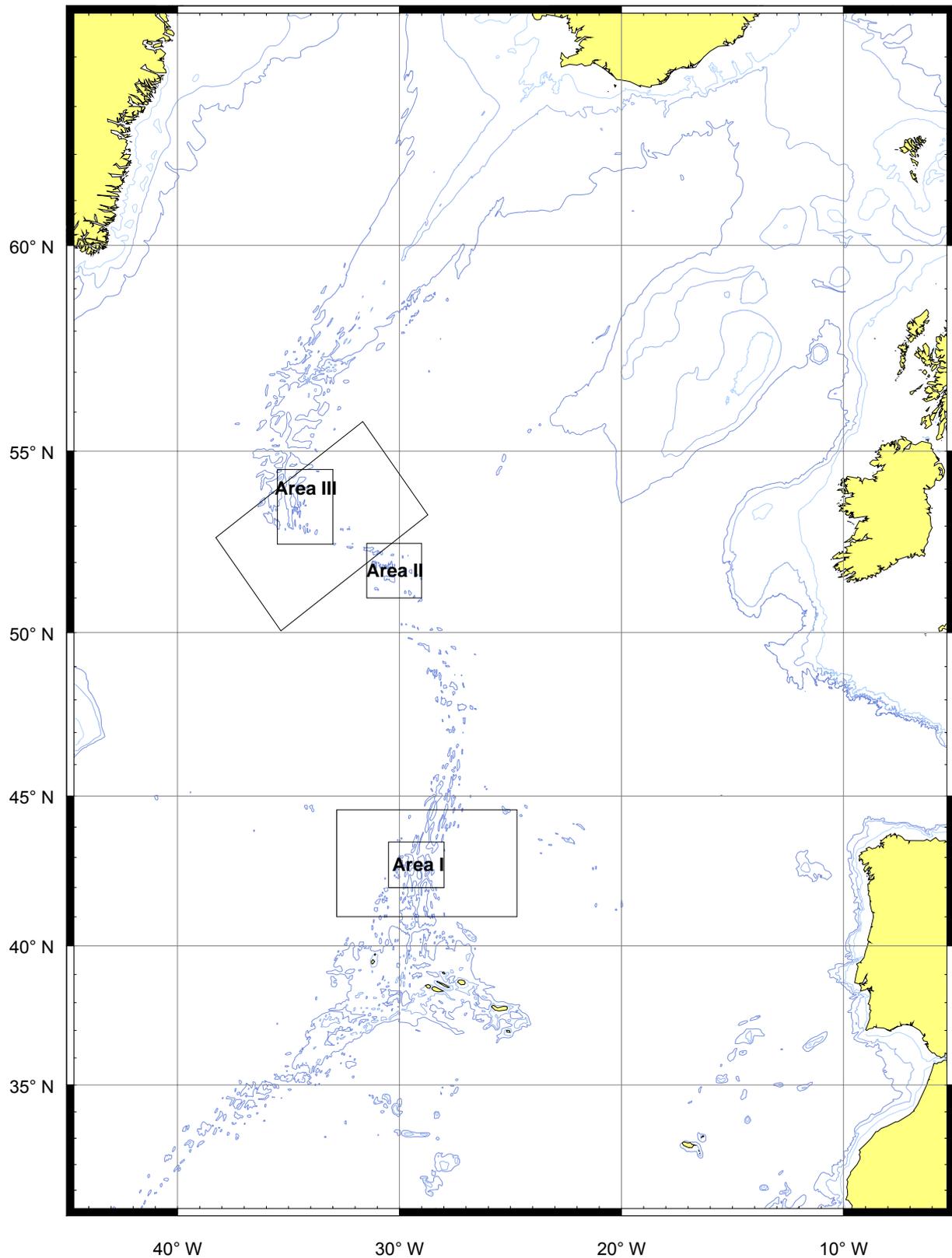


Figure 1 Map showing the Mid Atlantic Ridge from Iceland to the Azores. The two MAR-ECO sub-areas together with the three areas investigated by M/S Loran are marked on the map.

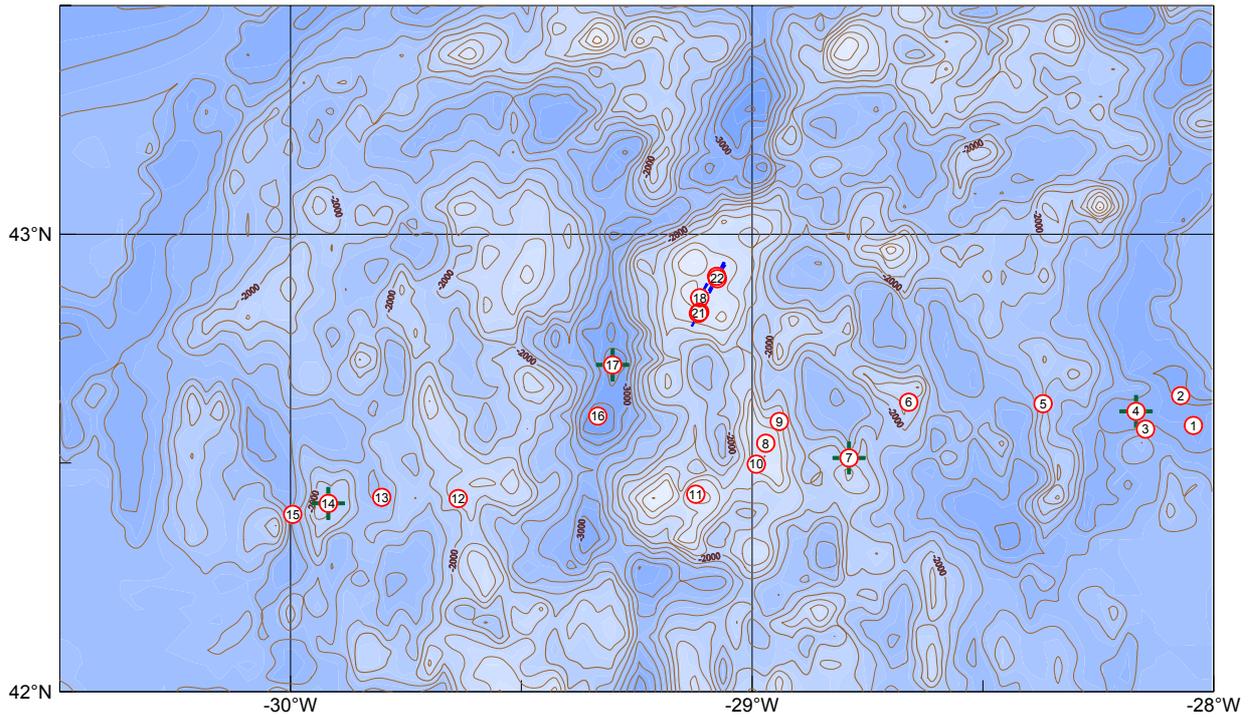


Figure 2 The positions of the stations in Area I on the M.A.R. The numbers are the stations number. ○- bottom longline, ⊖- a vertical longline, ⊕- gillnet.

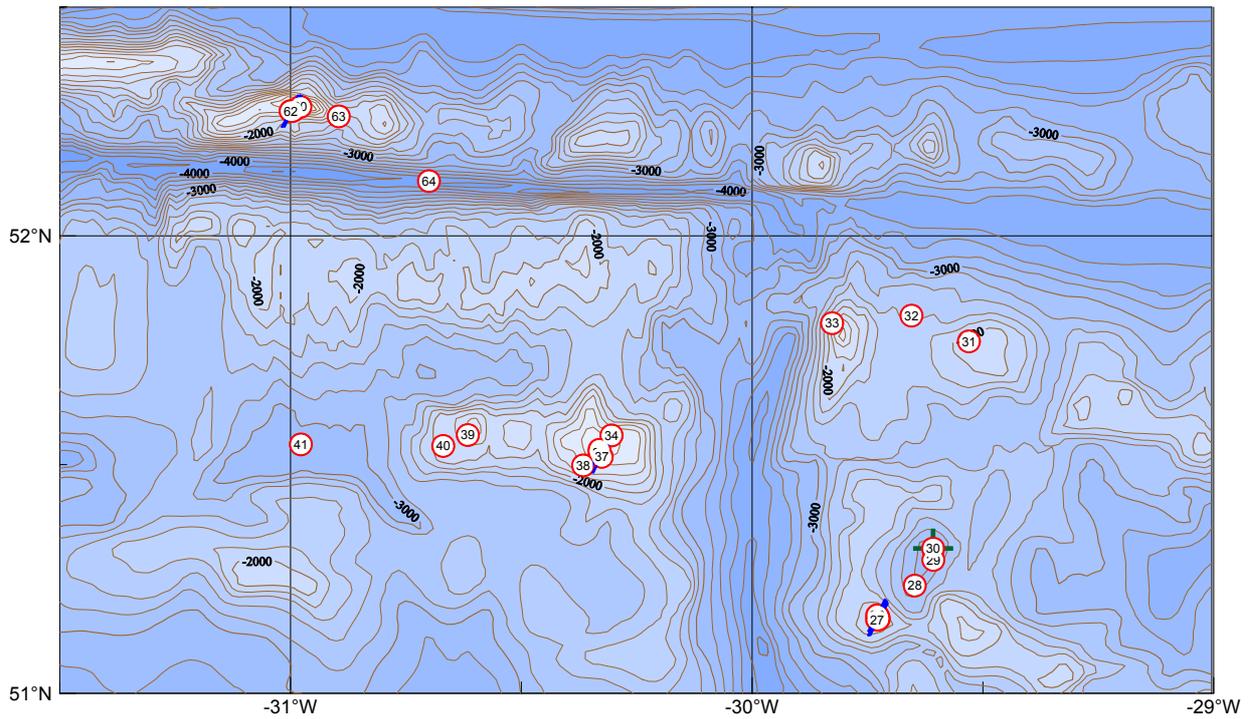


Figure 3 The positions of the stations in Area III on the M.A.R. The numbers are the stations number. ○- bottom longline, ⊖- a vertical longline, ⊕- gillnet.

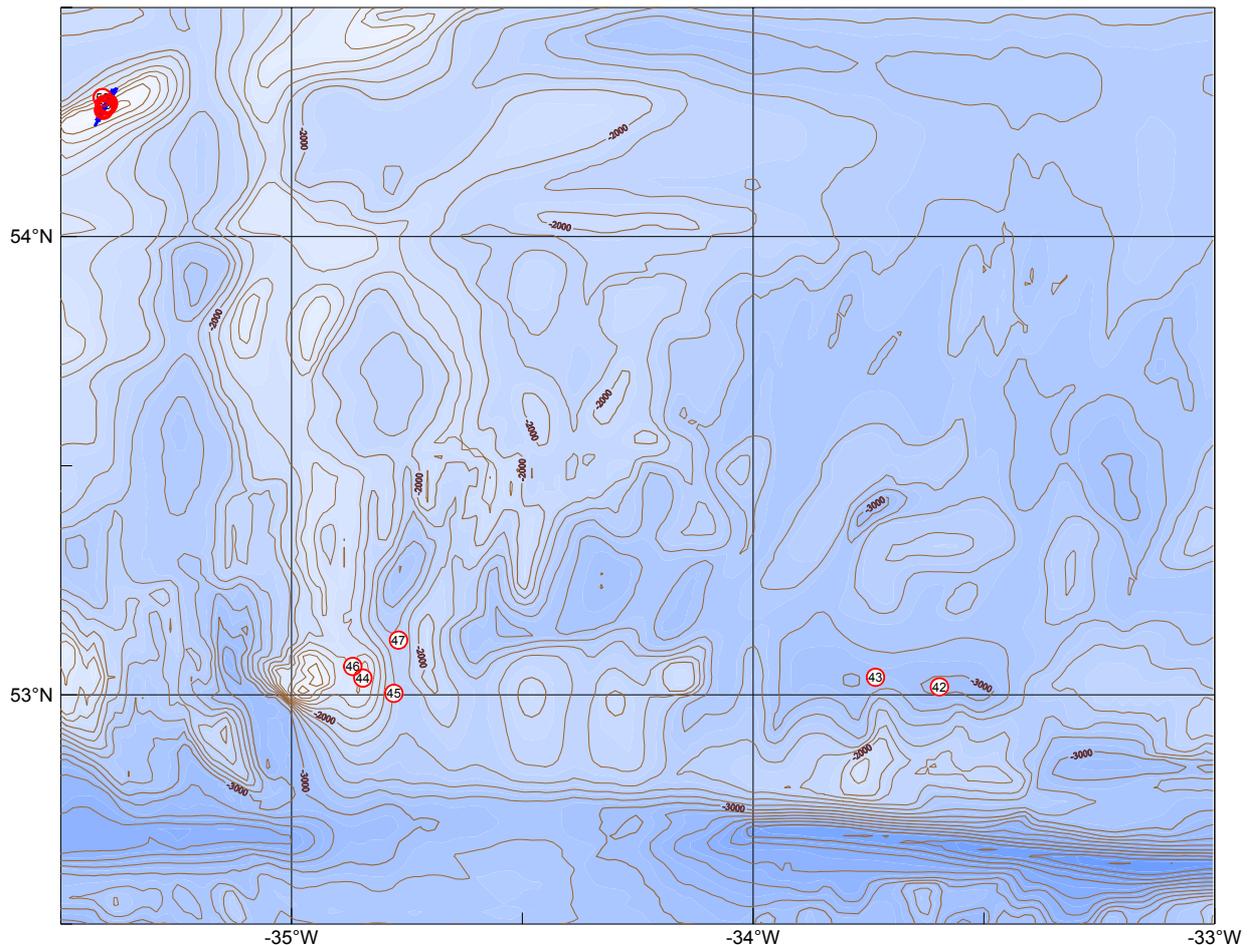


Figure 4 The positions of the stations in Area III on the M.A.R. The numbers are the stations number.
 ○ - bottom longline, ○ - a vertical longline, ○ - gillnet.

2.3 Participants

The scientific participants during the cruise onboard M/S *Loran* were:

Jan Erik Dyb, Møre Research - Norway, Fish biology, PI.
 Ann Helen Hellevik, Møre Research - Norway, Biologist, catch processing.
 Inge Fossen, University of Bergen / Møre Research - Norway, Fish biology.
 Charles Cotton, Virginia Institute of Marine Science, USA - Fish biology.

2.4 Fishing gear

Three major gear types were used during this cruise; longline, gillnets and traps.

The longline was either horizontal (bottom line) or vertical, the latter known in Norwegian as “snik”. The main line was an 11.5 mm urethane rope (Dyrkorn line) and the distance between the hooks was 1.2 m for the bottom line and 0.6 m for the vertical line. The three hook types used were Mustad J-hooks EZ size 13 and 13 W, and circular hook size 14/0. In addition one or two Greenland shark hooks were used next to the anchor (end of the lines). Most of the

lines were set with anchors in both ends, but in order to save time the lines set on the greatest depths were only anchored by one end. A total of 87 500 hooks were set during the cruise.

The gillnets had 66 mm, 88 mm or 110 mm mesh size and the length of each gillnet was 25 m. Normal floats would not withstand the pressure at the relevant fishing depths, hence only a rope with positive buoyancy mounted on the top of the gillnets provided buoyancy. The 66 mm mesh size gillnets had a height of 40 meshes and was made by 0.65 mm monofilament line. The 88 mm gillnets had a height of 35 meshes and was made of 0.70 mm monofilament line. The 110 mm gillnets had a height of 25 meshes and was made by the same line as the 88 mm gillnets. The gillnets were set separately with one end and anchor. A total of 54 gillnets were set during the cruise.

Three different types of traps were used; large modified crab traps, the “Dyrkorn teine” fish trap, and a smaller cylindrical trap designed for sublittoral fishing of wrasses. All the traps were distended by an inner construction. The crab traps are constructed to fish large crabs and has a large plastic opening and mesh size. For this experiment, a small meshed net was fitted on the traps and the plastic opening was replaced with a net opening. The traps were placed in the ends and in the middle of the horizontal longlines. A total of 30 traps were set during the cruise.

2.5 Sampling

The sampling of all easily identifiable species was carried out by the scientific personnel as the gear was being retrieved. The processing included species identification, recording of individual length, weight, stage of maturity, and tissue sampling etc. Species that required further examination were left until all the gear had been taken in. Pictures and preservation of the specimens was also postponed until the end of the fishing operation. If a species had been recorded at earlier stations, only the first hundred specimens were processed. The rest was counted. Some of the specimens had been attacked by sharks on the line, and often only the head and a small part of the body came to the surface. These were only counted. The labelling system was the same as that used onboard the *G.O. Sars*.

2.5.1 Species identification

Many of the species were easily identified using available keys, but some could not be identified with certainty and some were even suspected to be unknown. Sub-samples of all were frozen pending further investigations. The identification literature and sampling protocols used were:

FAO Species catalogues volume 4 (FAO Fisheries Synopsis 1984), and Fishes of the North-eastern Atlantic and the Mediterranean, volume I, II and III (Whitehead *et al.* 1986).

The sampling protocol of the Institute of Marine Research for processing of biological samples (Fotland *et al.* 1998).

2.5.2 Length

The length of fish specimens was measured from the snout to the end of the caudal fin on most species (total length). The rattails (Macrouridae) were measured from the snout to the basis of the first anal fin ray (preanal fin length). Chimaeras were measured from the snout to posterior margin of the second dorsal fin (post second dorsal fin length), and the skates and

rays was measured with both disk width and total length, if the tail was not broken. All lengths were rounded down to nearest whole or half cm.

2.5.3 Weight

A Marel fish balance (Marel M1100 marinevekt 30kg/10g) was used for weighing individual specimens. This balance had a maximum capacity of 30 kg and a resolution of 10 g. Specimens heavier than 30 kg could not be weighed onboard.

2.5.4 Sex, maturity stage, and gonads

A five-point scale was used to record gonad maturity of teleosts (General maturity description, IMR, Norway, Appendix II). For the Chondrichthyans a maturity scale developed by Mathias Stehmann (Stehmann, 1987) was used. The females are classified into 7 stages and the males to 4 stages. (Appendix III)

Gonads collected for further studies were stored in formalin. The sampling was restricted to ovaries with visible oocytes, and both lobes were collected.

2.5.5 Stomachs

Stomachs were extracted and frozen if they appeared to contain food remains. This was only done for specimens that were not preserved ungutted.

2.5.6 Age

For selected teleosts, otoliths (sagittae) were extracted and stored dry in paper envelopes. Otoliths taken from *Brosme brosme* went to Kristin Helle, Institute of Marine Research – Norway, and otoliths taken from the other bony fishes went to Inge Fossen, University of Bergen – Norway.

Dorsal fin spikes were collected from sharks and chimaerids, and stored frozen in separate plastic bags.

2.5.7 Histology and genetics

Samples of muscle tissue were collected for studies of genetics and histology. Between individuals, the knife used was misted with chlorine and flushed in water before cutting. For the genetics samples, tubes pre-filled with preservative were used.

2.5.8 Pictures

Photos of the specimens were taken by the cruise participations. A Sony DCU F828 8 MP camera was used. As many species as possible were photographed, but unfortunately some pictures were lost due to technical failure.

2.5.9 Number of samples

Table 1 lists the taxa recorded and provides information on measurements and samples taken for each. A total of 8 580 specimens were caught and recorded, and 8 548 of these were fish.

Table 1 Overview of the taxa collected during the cruise and the number of measurements and samples taken of each (number of individuals). The taxa are sorted by scientific name, but English and Norwegian common names are also included if such exist.

Latin name	English name	Norwegian name	# caught	# of mesurments						# of collected samples				# of Picture	
				Standard length	Alternative length	Weight	Sex	Stage	Age	Gonad	Genetic	Stommac	Frozen to museum		
<i>Alopioccephalidae</i>	Slickheads	Glattnode	16	13	3	13	11	11	4	2	-	-	5	1	
<i>Ararhichas denticulatus</i>	Northern wolfish	Blasteinbit	29	29	-	29	29	29	27	2	26	-	2	1	
<i>Arnimora rostrata</i>	Blue arnimora	Arnimora	1110	1051	-	524	767	767	419	38	27	-	1	-	
<i>Aphanopus carbo</i>	Black scabbardfish	Dolkfisk	1	-	-	-	-	-	1	-	-	-	-	-	
<i>Apristurus</i> sp.	x	x	10	9	-	9	8	4	-	-	-	-	7	1	
<i>Balistes capricus</i>	Grey triggerfish	"Avtrekkerfisk"	1	-	-	-	-	-	-	-	-	-	-	-	
<i>Bathyraja pallida</i>	Pale ray	x	2	1	2	1	1	1	-	-	-	-	-	-	
<i>Bathyraja richardsoni</i>	Richardson's ray	x	141	129	133	128	134	93	-	-	-	-	3	-	
<i>Brosme brosme</i>	Tusk	Brosme	628	619	1	367	523	523	172	4	151	-	16	1	
<i>Centrophorus squamosus</i>	x	x	1	1	-	1	-	-	-	-	-	-	1	-	
<i>Centroscyllium coelelepis</i>	Leafscale gulper shark	Brunthå	83	83	-	74	83	83	73	-	-	-	4	-	
<i>Centroscyllium crepidater</i>	Portuguese dogfish	Dyrvannshå	64	64	-	52	63	49	60	-	-	-	2	1	
<i>Centroscyllium okstoni</i>	Longnose velvet dogfish	Bunnhå	117	84	-	43	72	42	18	-	-	-	3	-	
<i>Chimaera monstrosa</i>	Roughskin dogfish	x	12	12	-	10	12	12	7	-	-	-	1	2	
<i>Coryphaenoides sp. 1</i>	Rabbit fish	Havmus	1	1	-	1	1	1	1	-	-	-	1	-	
<i>Coryphaenoides sp. 2</i>	x	x	11	-	10	2	-	-	-	-	-	-	-	2	
<i>Coryphaenoides armatus</i>	Abysal grenadier	Panpret skolest	148	-	130	101	100	99	93	7	-	-	6	1	
<i>Coryphaenoides rupestris</i>	Roundnose grenadier	Skolest	596	-	587	401	386	386	222	13	20	-	2	1	
<i>Deania calcea</i>	Birdbeak dogfish	Gråhå	38	-	29	25	27	27	27	4	10	-	3	1	
<i>Etmopterus princeps</i>	Great lanternshark	Stor svartthå	19	18	-	17	17	13	12	-	-	-	3	1	
<i>Galeus murinus</i>	Mouse catshark	x	4440	1549	1	413	956	459	214	-	-	-	1	1	
<i>Histiobranchius bathybius</i>	Deepwater arrowtooth eel	"Dyphavsål"	4	4	-	3	37	2	-	-	-	-	1	-	
<i>Hoplostethus atlanticus</i>	Orange roughy	Orange roughy	52	51	-	41	2	2	3	-	-	-	1	1	
<i>Hydroleagus affinis</i>	Smalleyed rabbitfish	Brun havmus	122	120	-	105	120	74	73	-	2	-	-	-	
<i>Hydroleagus pallidus</i>	Bigeeyed rabbitfish	Hvit havmus	63	61	-	61	56	17	14	-	1	-	1	-	
<i>Lepidion eques</i>	North Atlantic codling	Dyphavsморide	25	25	-	24	22	22	16	5	-	-	1	-	
<i>Lepidion guentheri</i>	x	x	19	14	-	14	10	10	6	-	3	-	1	3	
<i>Lepidion schmidti</i>	x	x	47	44	-	42	40	40	38	2	3	-	3	2	
<i>Macrourus berglax</i>	Onion-eye grenadier	Is galt	281	-	278	257	263	263	254	18	1	-	3	1	
<i>Mola mola</i>	Ocean sunfish	Manefisk	1	-	-	1	-	-	-	-	-	-	-	-	
<i>Mora moro</i>	Common mora	Mora	4	4	-	3	1	1	2	-	-	-	2	-	
<i>Physcis biennioides</i>	Greater forkbeard	Skjellbrosme	12	12	-	12	11	11	3	2	-	-	-	-	
<i>Polyprion americanus</i>	Wreckfish	Vrakfisk	3	-	-	-	-	-	-	-	-	-	-	-	
<i>Prionace glauca</i>	Blue shark	Blåhai	1	1	-	1	1	-	-	-	-	-	-	-	
<i>Pseudotriakis microdon</i>	False catshark	Kattehai	4	4	-	-	2	-	-	-	-	-	2	-	
<i>Raja bata</i>	x	x	3	3	-	3	3	-	-	-	-	-	3	-	
<i>Raja bathyphila</i>	x	x	13	13	13	13	13	11	-	-	-	-	3	2	
<i>Sebastes marinus</i>	Redfish	Uer	39	37	-	37	33	33	27	-	28	-	-	-	
<i>Seriola dumerilii</i>	Greater amberjack	x	1	-	-	-	-	-	-	-	-	-	1	-	
<i>Somniosus microcephalus</i>	Greenland shark	Håkjerring	1	1	-	1	1	-	-	-	-	-	1	1	
<i>Somniosus rostratus</i>	Little sleeper shark	x	1	1	-	1	1	-	-	-	-	-	1	1	
<i>Spectrunculus grandis</i>	Pudgy cuskieel	x	308	293	31	260	242	242	56	-	12	-	9	1	
<i>Spectrunculus</i> sp.	x	x	55	53	-	48	27	27	17	-	1	-	12	-	
<i>Synsphybranchius kaupi</i>	Kaup's arrowtooth eel	"Dyphavsål"	17	13	-	8	8	8	-	-	-	-	2	-	
<i>Synsphybranchius</i> sp.	x	x	1	1	-	1	1	1	-	-	-	-	-	-	
<i>Anthozoa</i>	Corals	Koraller	20	-	-	-	-	-	-	-	-	-	17	-	
<i>Brachyura</i>	Crabs	Krabbe	7	-	-	-	-	-	-	-	-	-	7	5	
<i>Natantia</i>	Shrimp	Reke	1	-	-	-	-	-	-	-	-	-	1	1	
<i>Invertebra</i>	Invertebra	Evertebrater	4	-	-	-	-	-	-	-	-	-	3	1	
Sum:		Sum:	8580	4426	1221	3144	4088	3399	1859	99	288	-	54	127	29

3 Results

At least 47 different species of fishes were caught during the cruise. Forty of these could be identified with certainty to species but 7 only to nearest genus or family. Four orders and 7 families of Chondrichthyans were recorded and 8 orders and 15 families of Osteichthyes (see Appendix I for orders and families). The average length of all the fishes was 67.9 cm, and the average weight was 3.42 kg. Fishes were caught at all investigated depths and at all stations, except at three stations where the gear was lost or heavily damaged.

In addition to the fishes a range of invertebrate taxa such as corals, crabs and others occurred and these were not immediately identifiable.

3.1 The Fishes

3.1.1 *Alepocephalidae*

En: Slickheads

No: Glatthode



Figure 5 A member of the family Alepocephalidae taken during the cruise.

A total of 16 specimens of Alepocephalidae were recorded but these could not be identified to species. Five specimens were frozen, both from Area I and Area II.

The length distribution of the Alepocephalids is given in Fig. 6. The average weight was 4.51 kg (SD = 1.36 kg, n = 13).

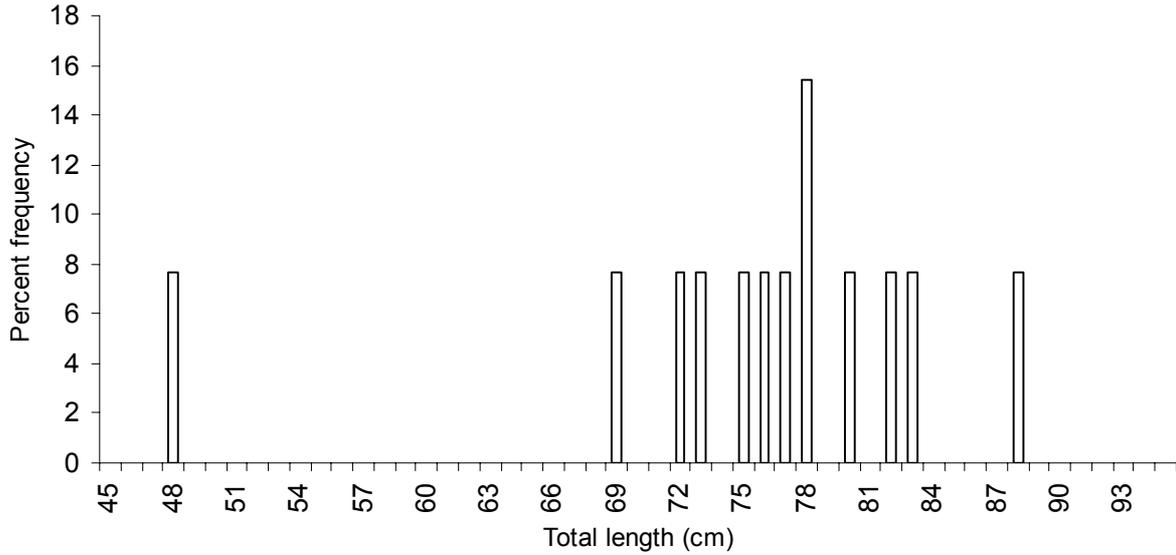


Figure 6 Length distribution of Alepocephalidae (n = 13).

Alepocephalidae were caught in all areas. In Area I they occurred in the deepest stations between 2 600 and 3 000 m on both side of the ridge. In the northern sub-area they occurred both north and south of Charlie-Gibbs Fracture zone at depths between 1 500 and 2 000 m (Figure 7 - Figure 9).

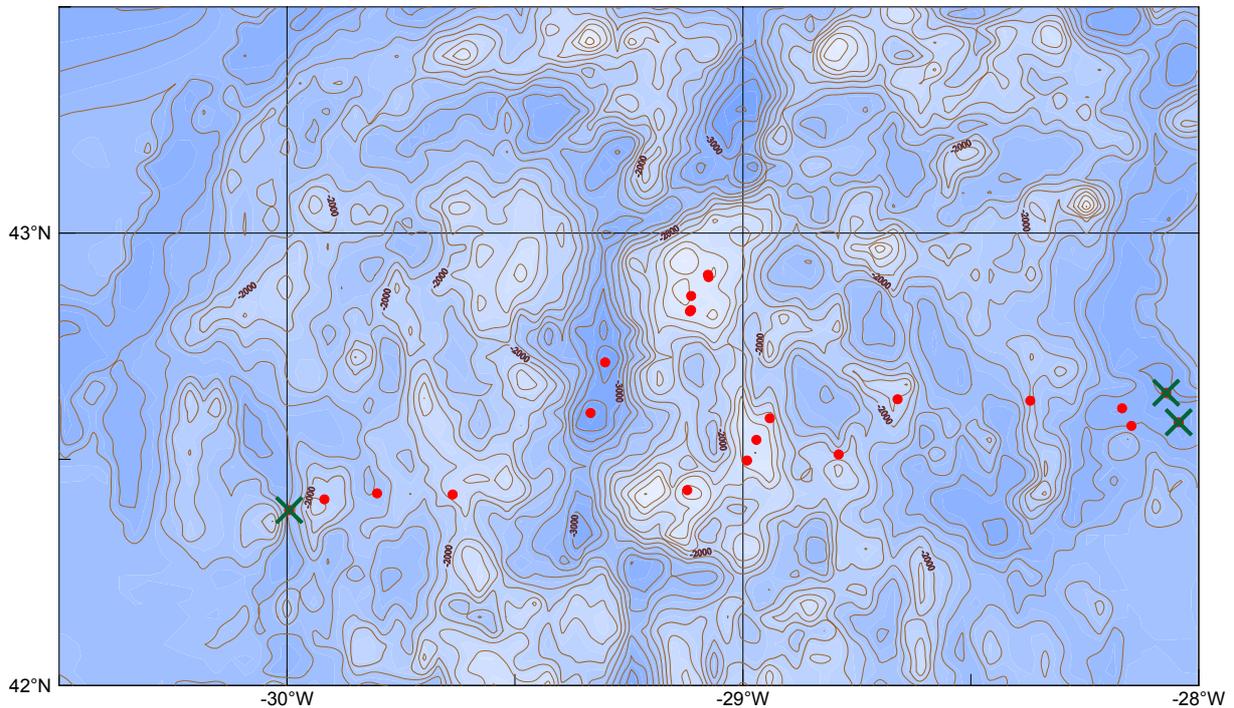


Figure 7 Distribution of Alepocephalidae in Area I. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

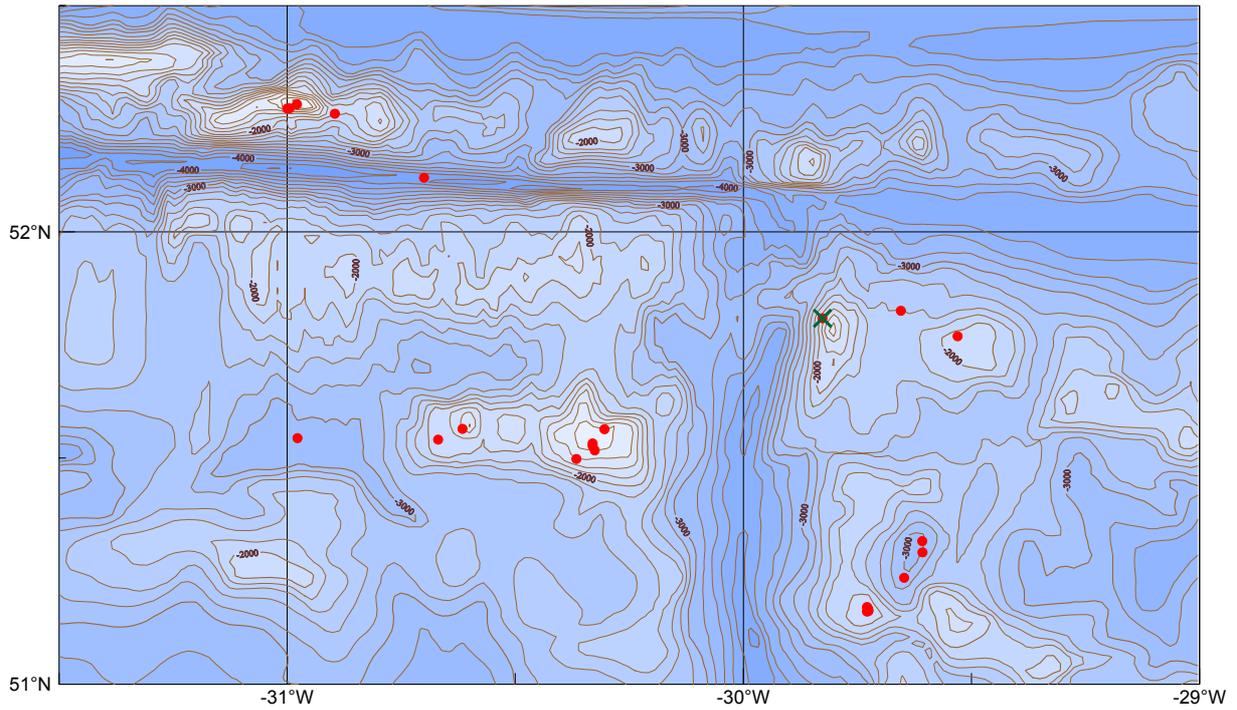


Figure 8 Distribution of Alepocephalidae in Area II. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

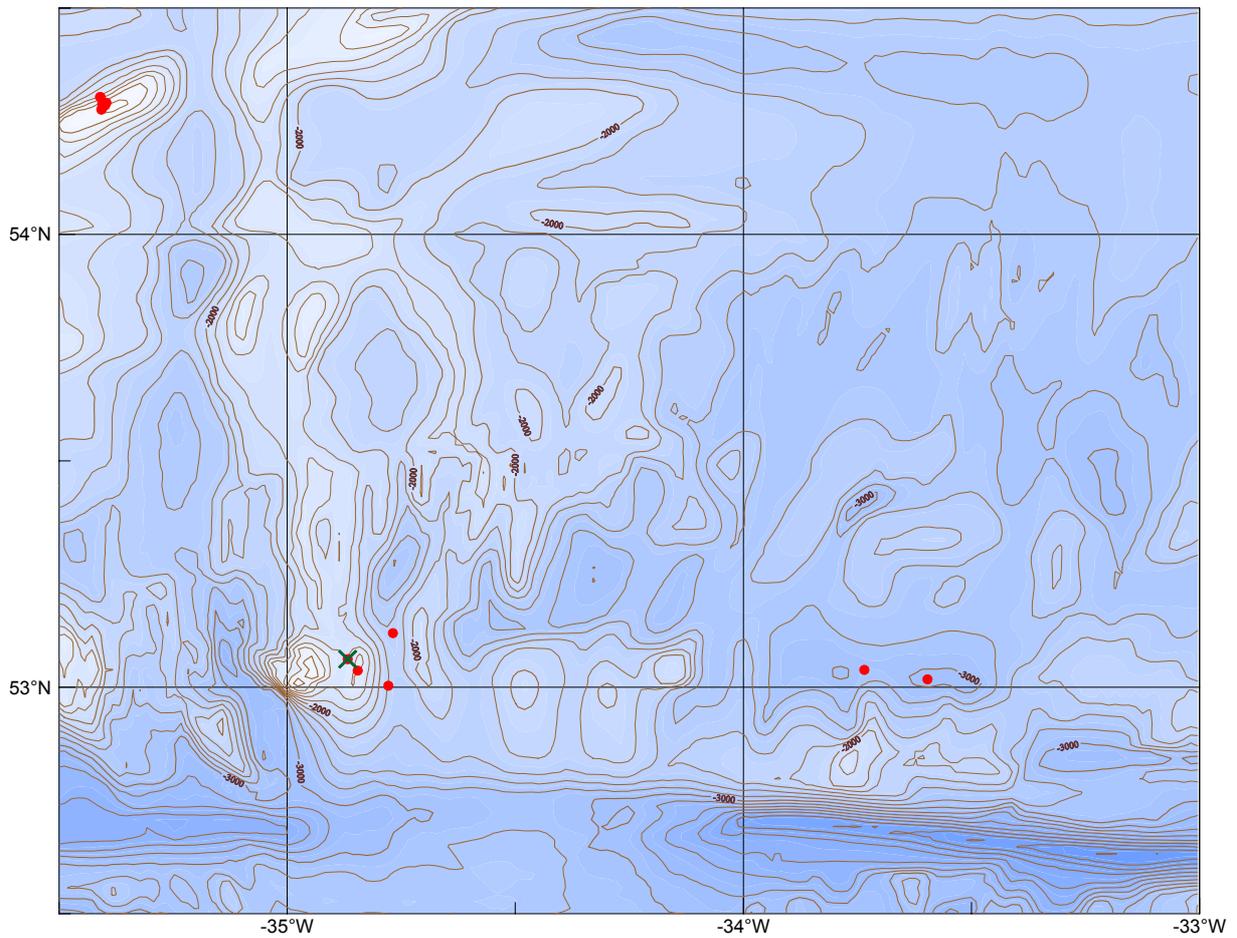


Figure 9 Distribution of Alepocephalidae in Area III. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.2 *Anarhichas denticulatus*

En: Northern wolffish

No: Blåsteinbit

A total of 29 *A. denticulatus* was caught during the cruise. All the catches were made at depths between 1 500 and 2 000 m in the northern sub-area *and* only north of Charlie Gibbs Fracture zone (Figure 11). The length range was 59-126 cm (Mean = 86.9 cm, n = 29, SD = 20.4 cm, length distribution in Fig. 10). The average weight was 9.26 kg (SD = 7.53 kg, n = 29). The sex distribution was almost equal (52 % females).

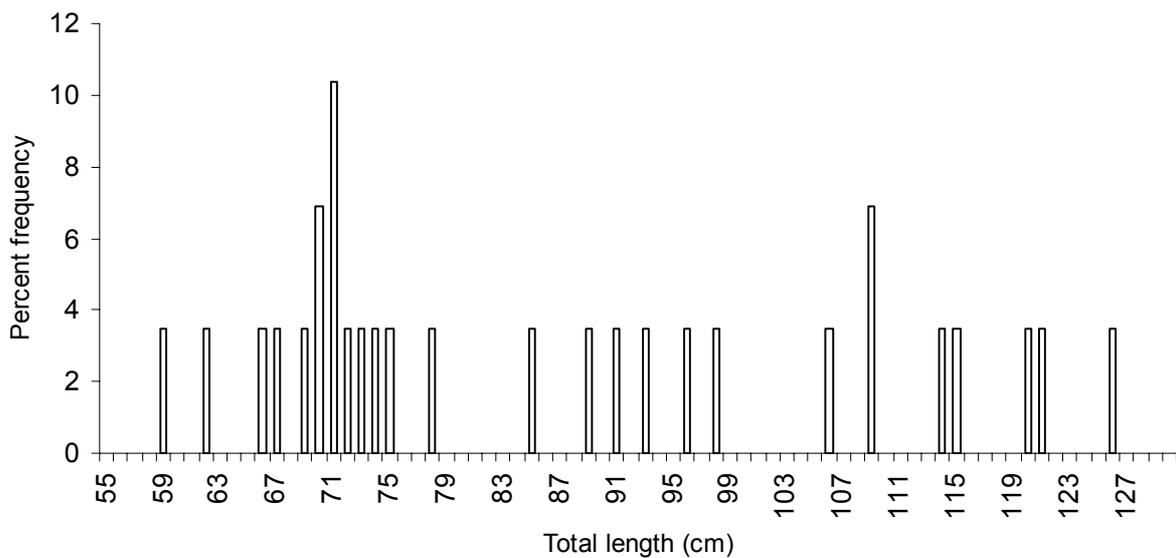


Figure 10 Length distribution of *A. denticulatus* (n = 29).

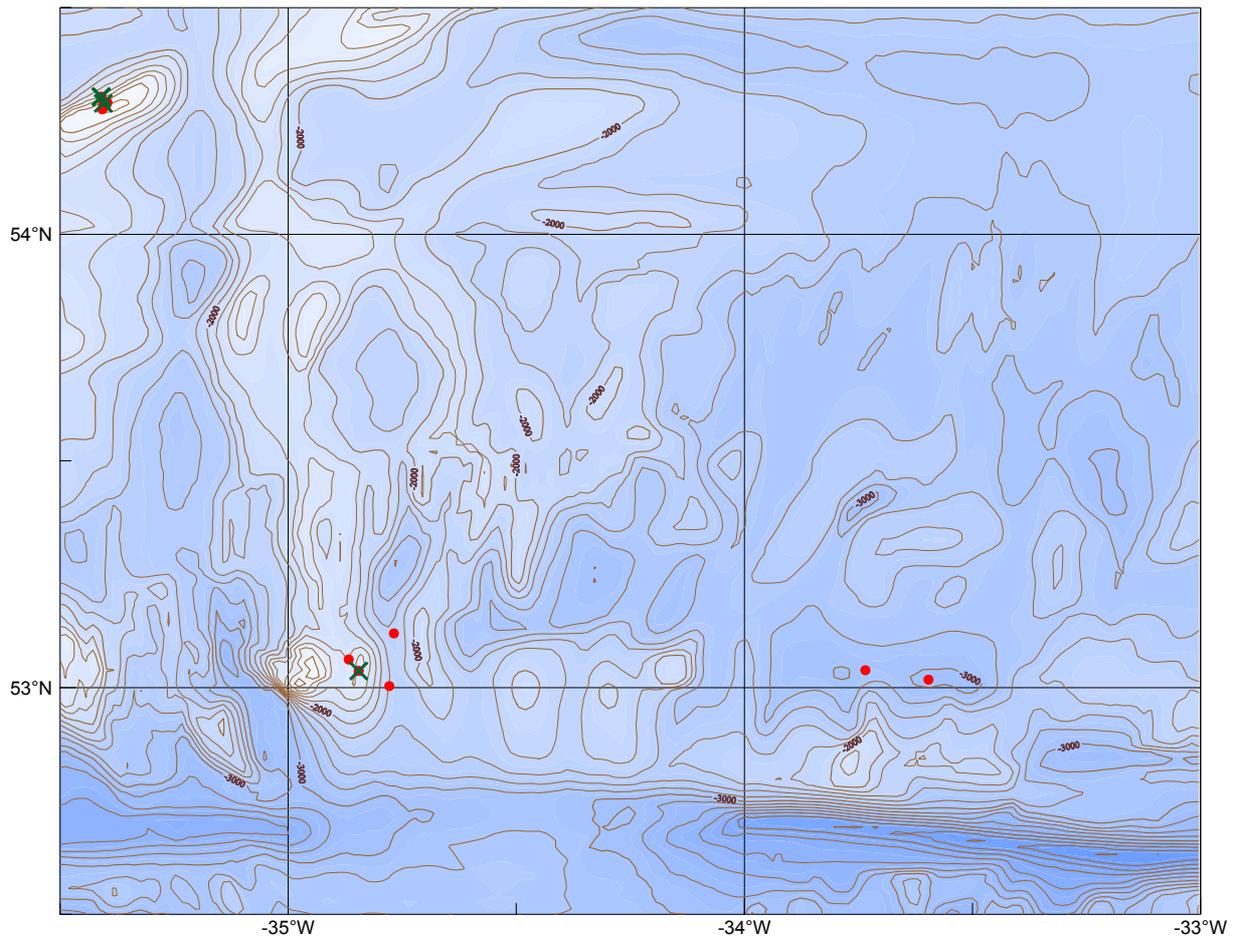


Figure 11 Distribution of *A. denticulatus* in Area III. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.3 *Antimora rostrata*

En: Blue antimora

No: Antimora



Figure 12 Picture of an *A. rostrata* taken during the cruise.

A total of 1 111 individuals of *A. rostrata* were caught during the cruise. The length range was 33-76 cm (Fig. 13) (Mean = 55.9 cm, $n = 1052$, $SD = 6.9$ cm). The average weight was 1.62 kg ($SD = 0.71$ kg, $n = 525$).

The females dominated the catches. 98.4 % of the individuals were females. Males were also smaller than females (Fig. 13), and the largest male was 60 cm.

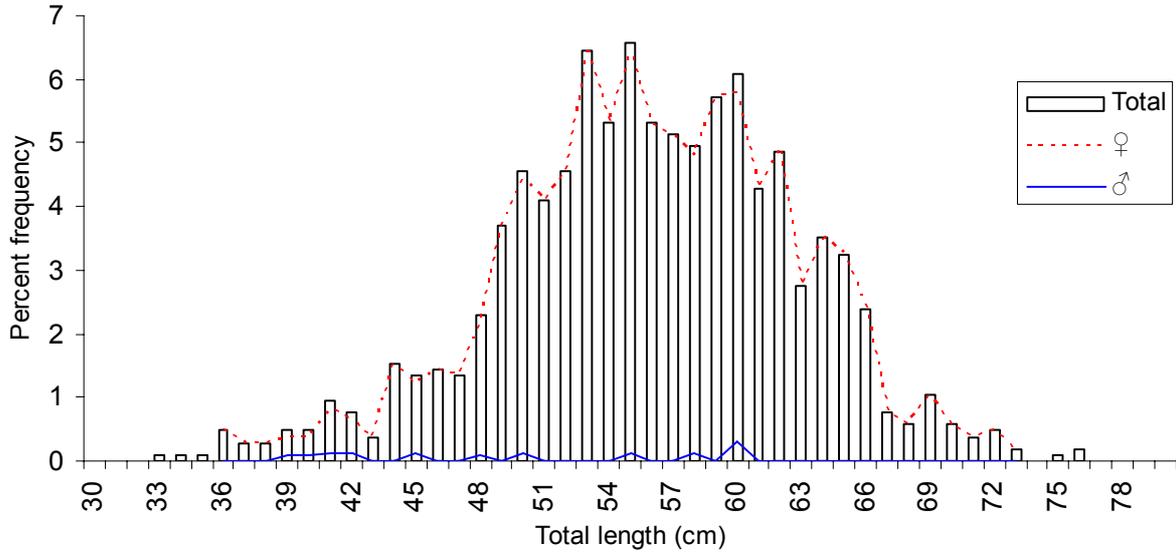


Figure 13 Length distribution of *A. rostrata* (n = 1052). The dotted line shows the portion of the females and the solid line shows the portion of males in each length group.

A. rostrata was caught in all areas at depths between 800 and 3 000 meters (Figure 14 - Figure 16). 90 % was caught between 1 200 and 2 600 m and the largest catches were in Area II in the slopes of the underwater mountains.

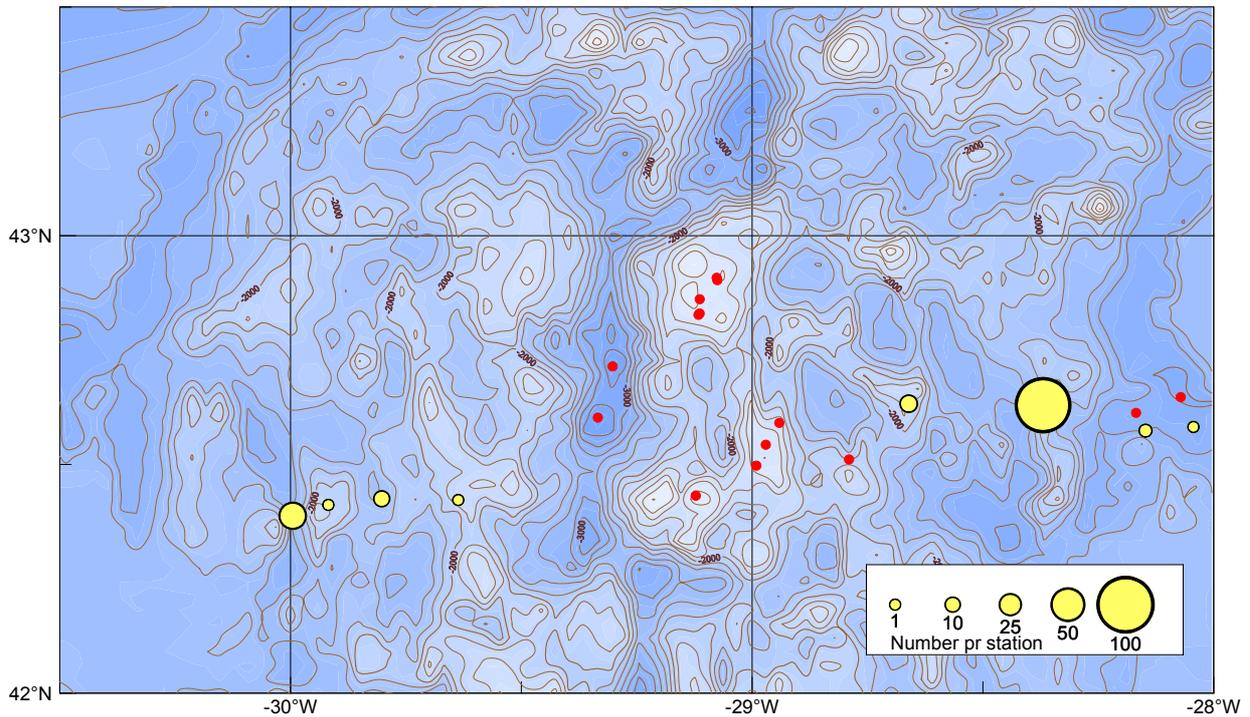


Figure 14 Distribution of *A. rostrata* in Area I. Presence of the species on the stations is marked with a yellow circle where the size is proportional with abundance. Dots are stations with no catch of the taxon.

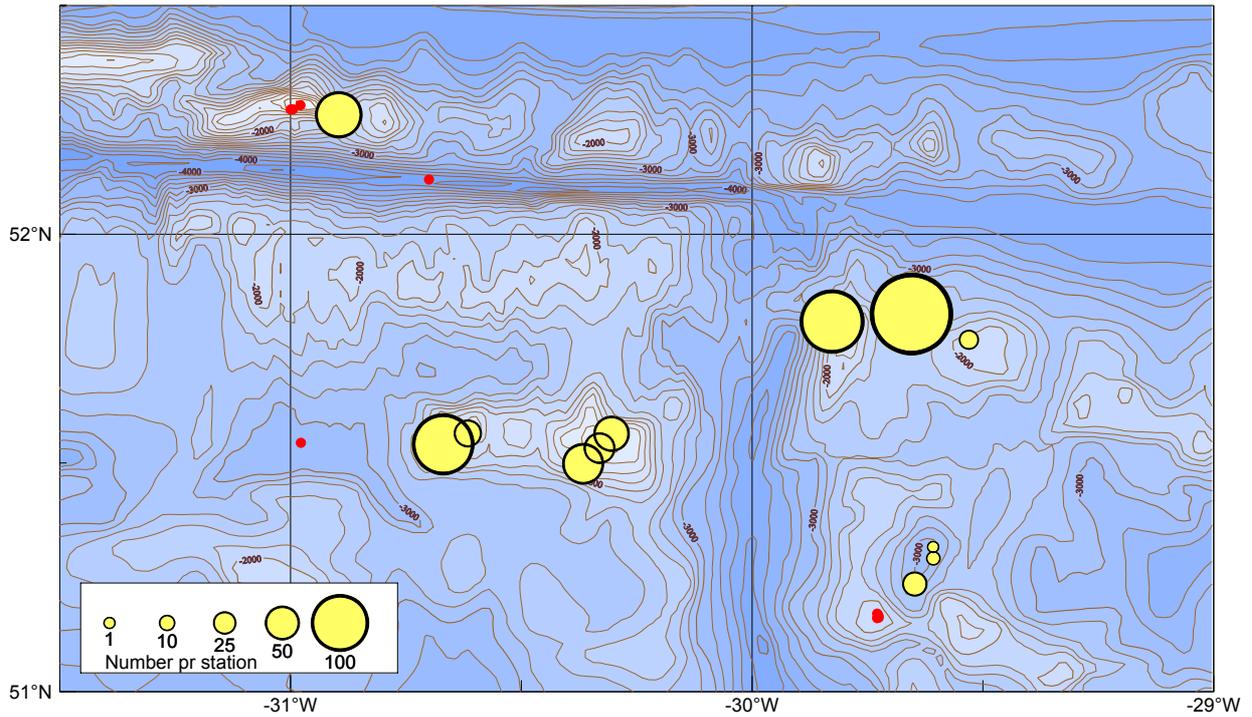


Figure 15 Distribution of *A. rostrata* in Area II. Presence of the species on the stations is marked with a yellow circle where the size is proportional with abundance. Dots are stations with no catch of the taxon.

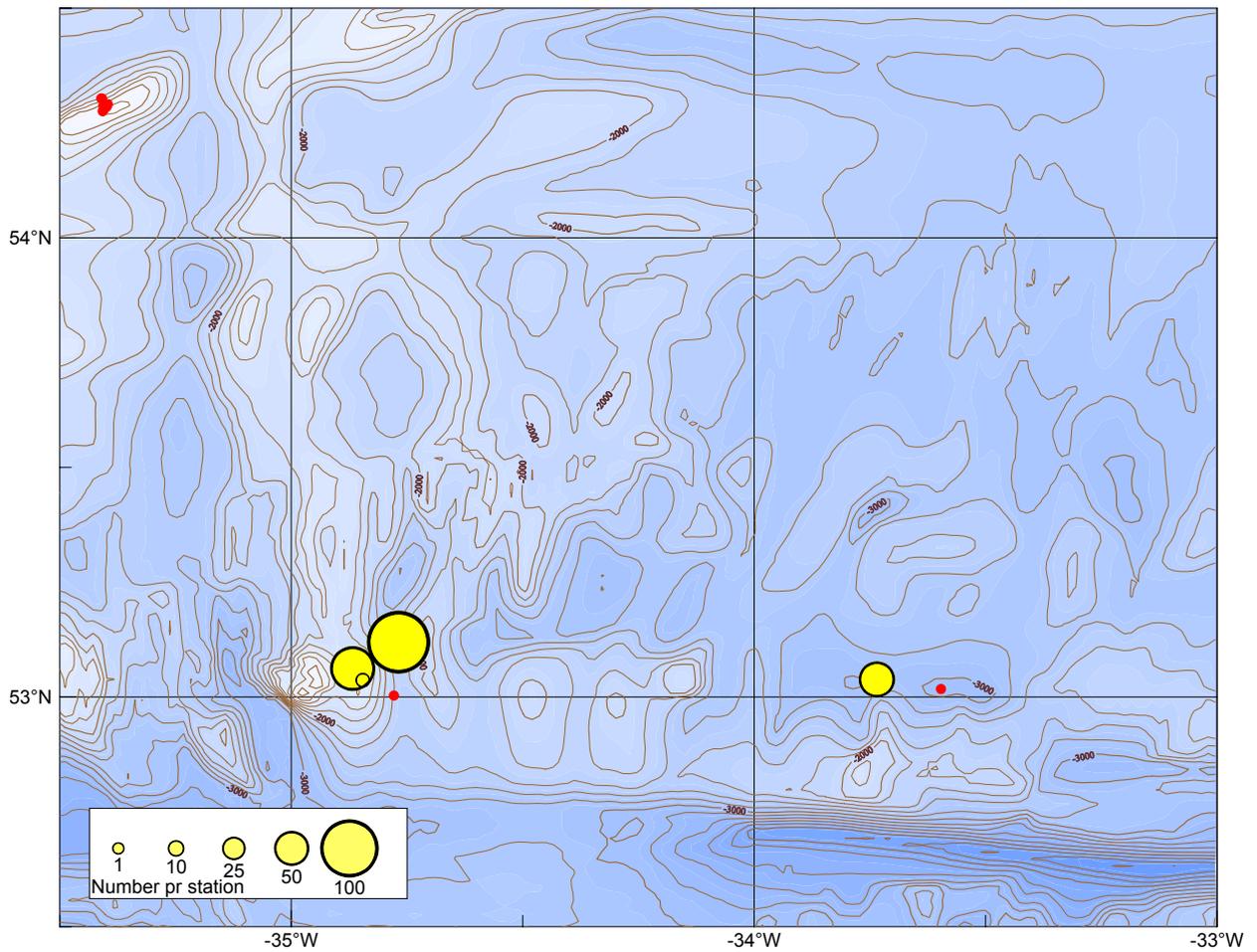


Figure 16 Distribution of *A. rostrata* in Area III. Presence of the species on the stations is marked with a yellow circle where the size is proportional with abundance. Dots are stations with no catch of the taxon.

3.1.4 *Aphanopus carbo*

En: Black scabbardfish

No: Dolkefisk

A single individual *A. carbo*, or rather the head of one, was recorded. The specimen occurred in Area II and it was taken on a vertical line at 786 m dept (Figure 17).

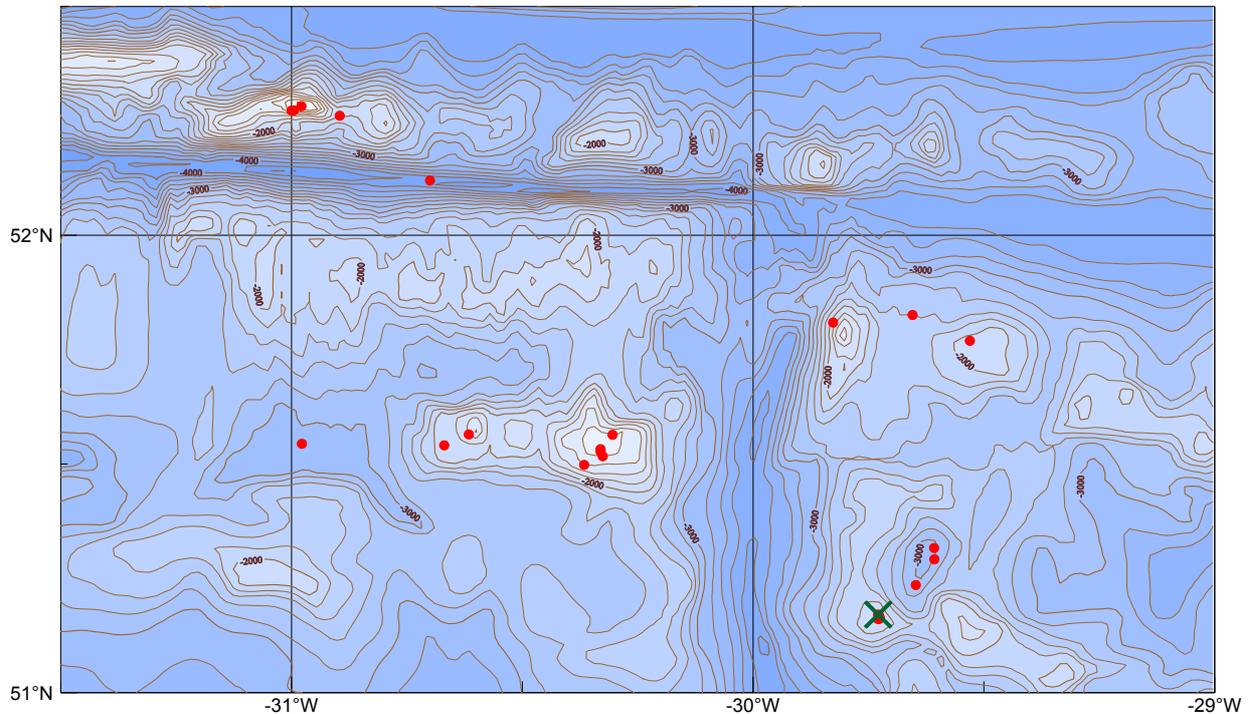


Figure 17 Distribution of *A. carbo* in Area II. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.5 *Apristurus*

En: No name

No: No name



Figure 18 A member of the family *Apristurus* taken during the cruise.

A total of 10 specimens of *Apristurus* were recorded but these could not be identified to species. 8 specimens were frozen. Three of these went to Bergen Museum and five to Charles Cotton, USA for further investigations. The length range was 60-99 cm (mean = 75.0 cm, n = 9, SD = 11.4 cm). The average weight was 1.86 kg (SD = 0.66 kg, n = 9). Three of the eight sexed specimens were females and the largest specimen was a male.

Apristurus was caught in the northern areas both north and south of Charlie Gibbs Fracture zone at depths between 1 200 and 2 100 m (Figure 19 - Figure 20).

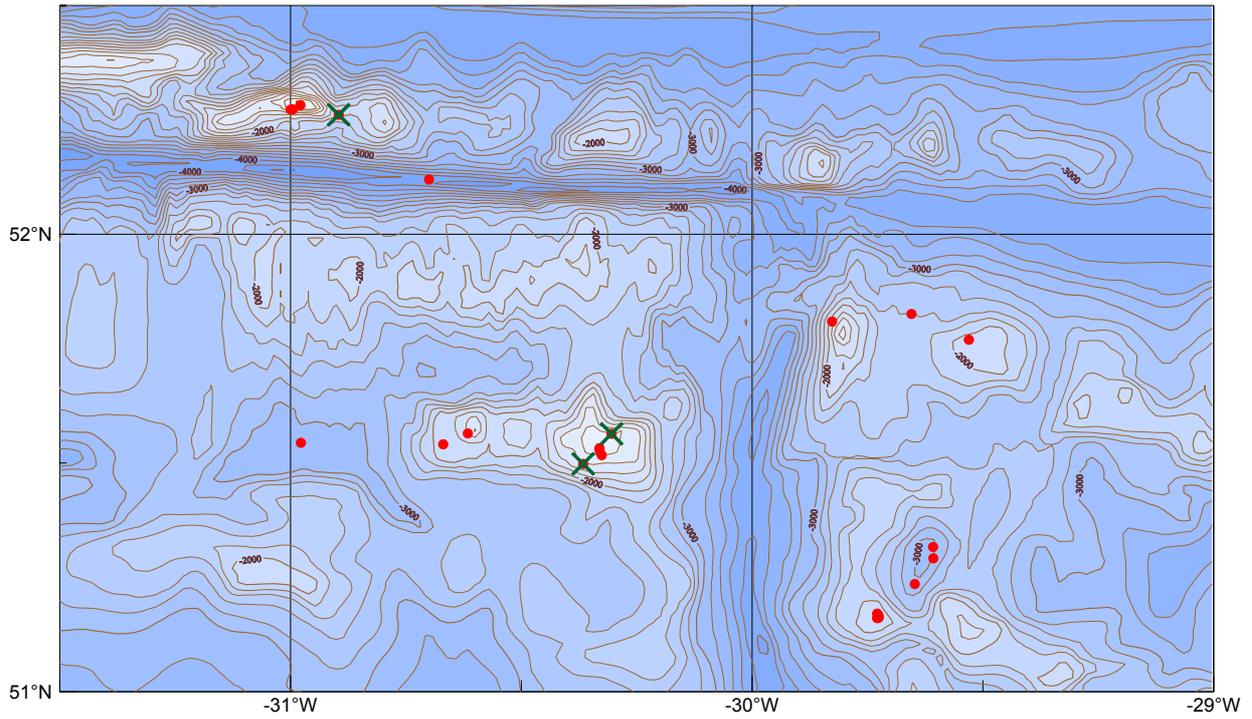


Figure 19 Distribution of *Apristurus* in Area II. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

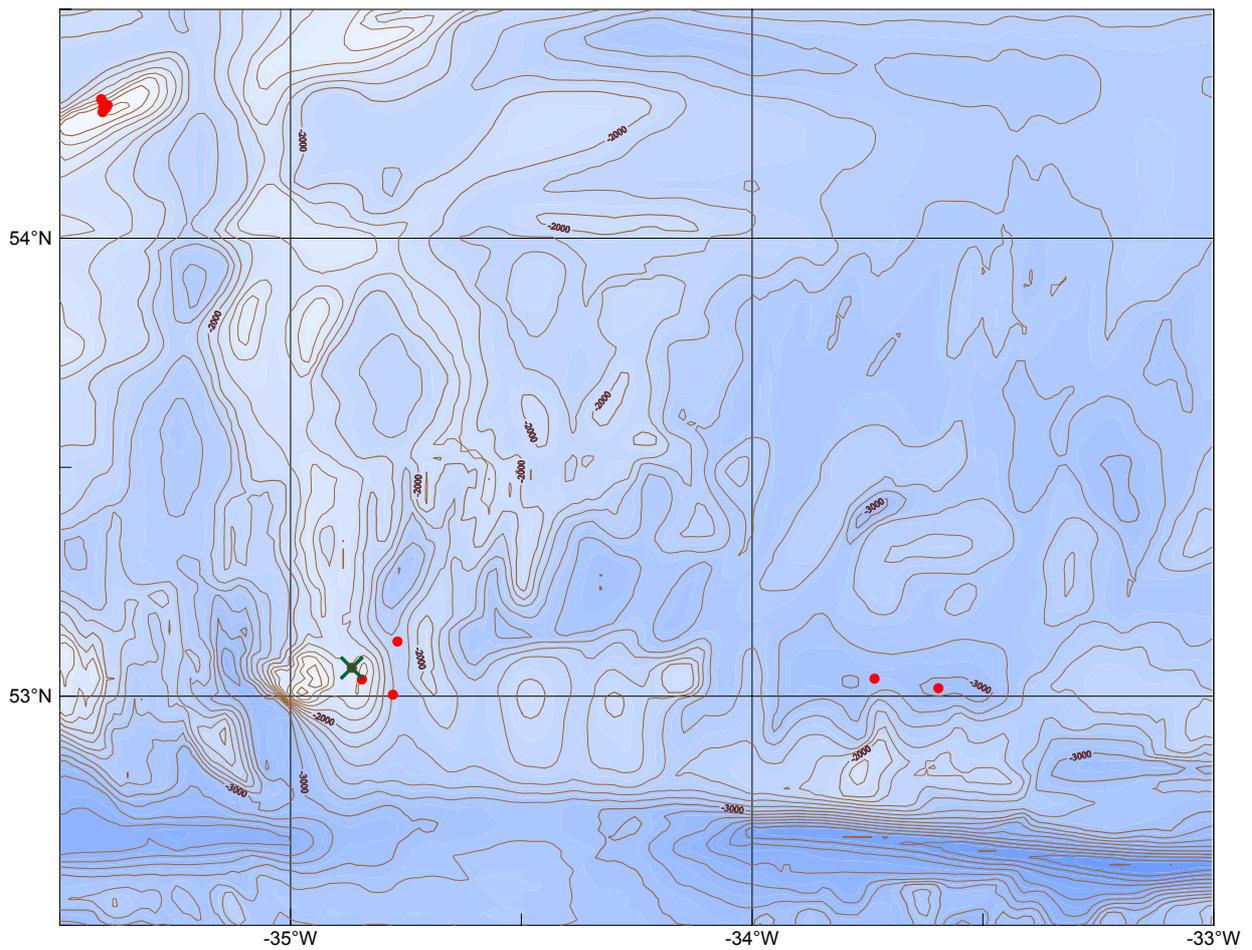


Figure 20 Distribution of *Apristurus* in Area III. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.6 *Balistes capriscus*

En: Grey triggerfish

No: Avtrekkerfisk

One *B. capriscus* was recorded. The specimen was observed under a drifting buoy in the eastern part of Area I and caught on a trolling line.

3.1.7 *Bathyraja pallida*

En: Pale ray

No: No name



Figure 21 Picture of an *B. pallida* taken during the cruise.

Two *B. pallida* were recorded during the cruise. The disk widths were 106 and 40 cm and the smallest weighted 1.41 kg. The largest one was not weighted because of a broken tail. Both specimens were frozen.

B. pallida occurred in Area I. They were caught in the deepest part in the west at 2 600 m depth and in the channel in the middle of the ridge at 3 200 m (Figure 22).

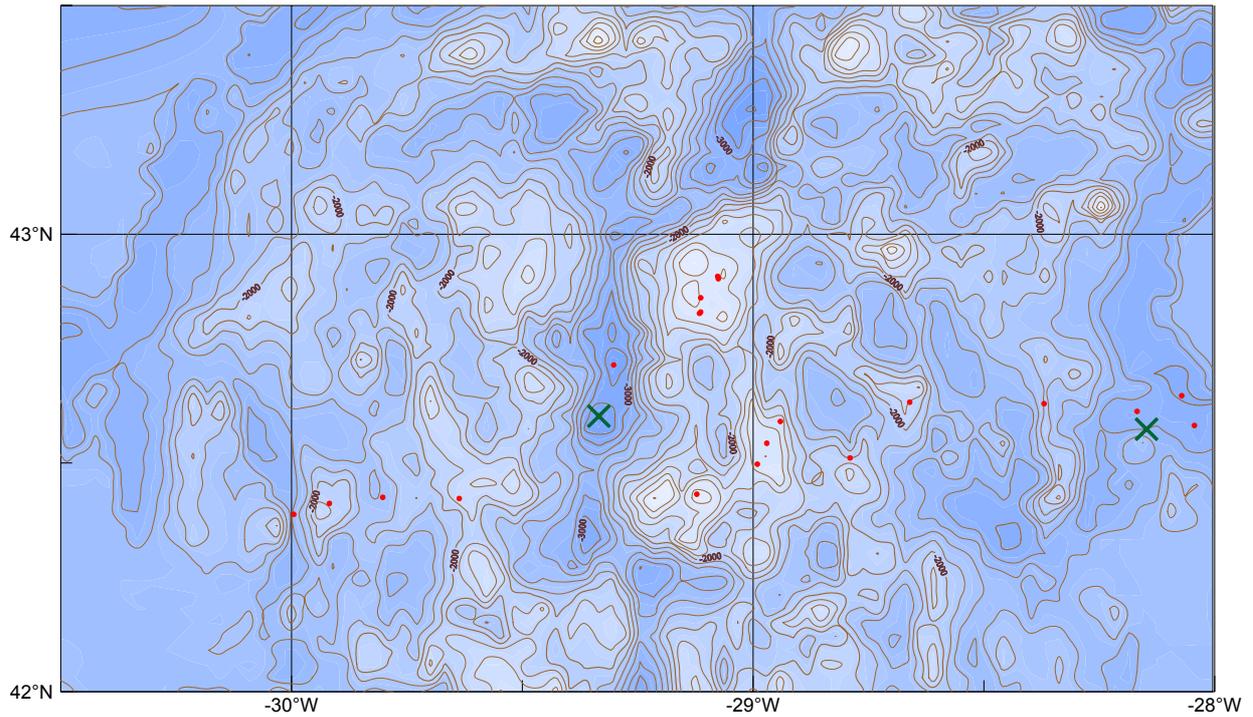


Figure 22 Distribution of *B. pallida* in Area I. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.8 *Bathyraja richardsoni*

En: Richardson's Ray

No: No name



Figure 23 Picture of a *B. richardsoni* taken during the cruise.

A total of 141 *B. richardsoni* was caught during the cruise. The range of disk widths was 30 - 105 cm (length distribution in Figure 24, mean = 64 cm, n = 133, SD = 15.6 cm). The total length range was 40 - 168 cm. The average weight was 7.54 kg (SD = 5.17 kg).

35 % of the *B. richardsoni* caught were females.

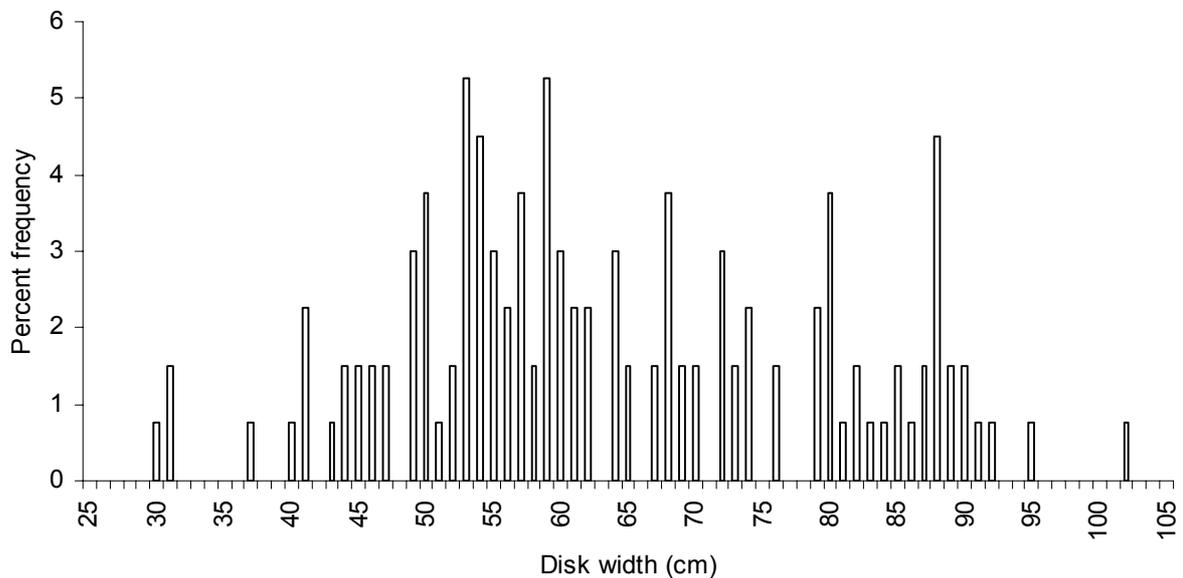


Figure 24 Disk width distribution of *B. richardsoni* (n = 133).

B. richardsoni was caught in all areas on both sides of the ridge at depths between 2 000 and 3 000 m. More than 90 % was caught between 2 200 and 2 700 m dept (Figure 25 - Figure 27).

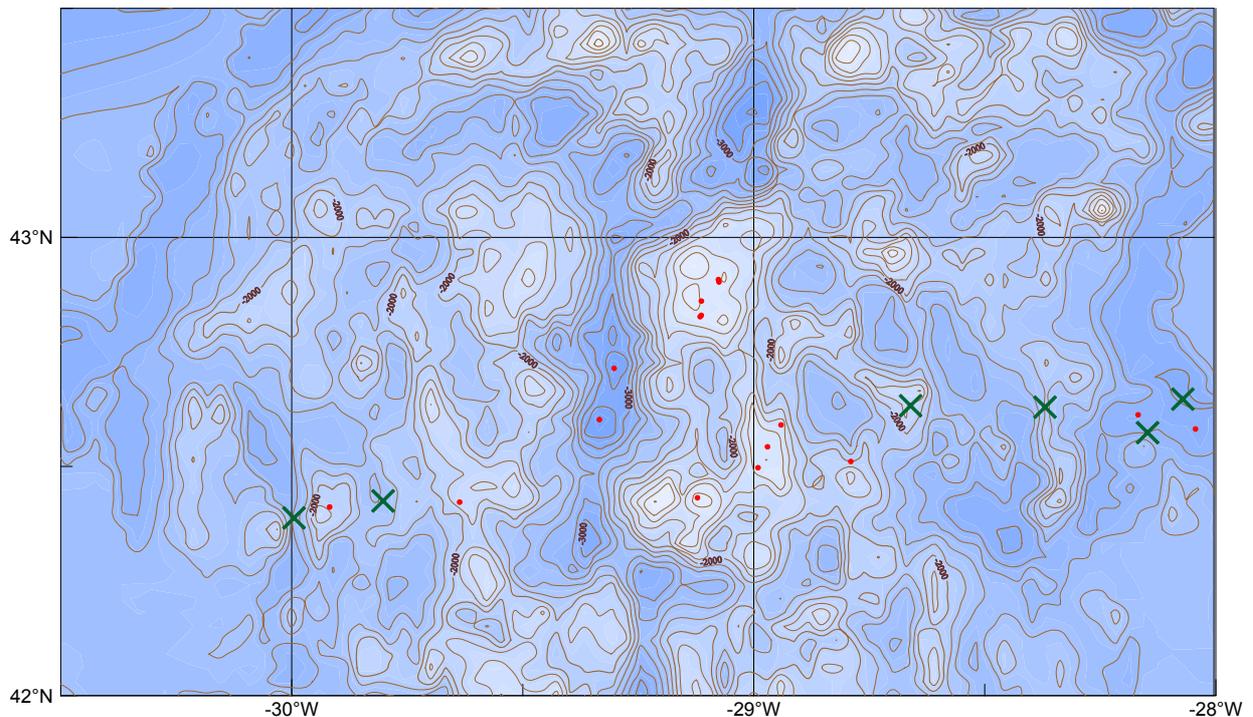


Figure 25 Distribution of *B. richardsoni* in Area I. Presence at a station is indicates by an X. Dots are stations with no catch of the taxon.

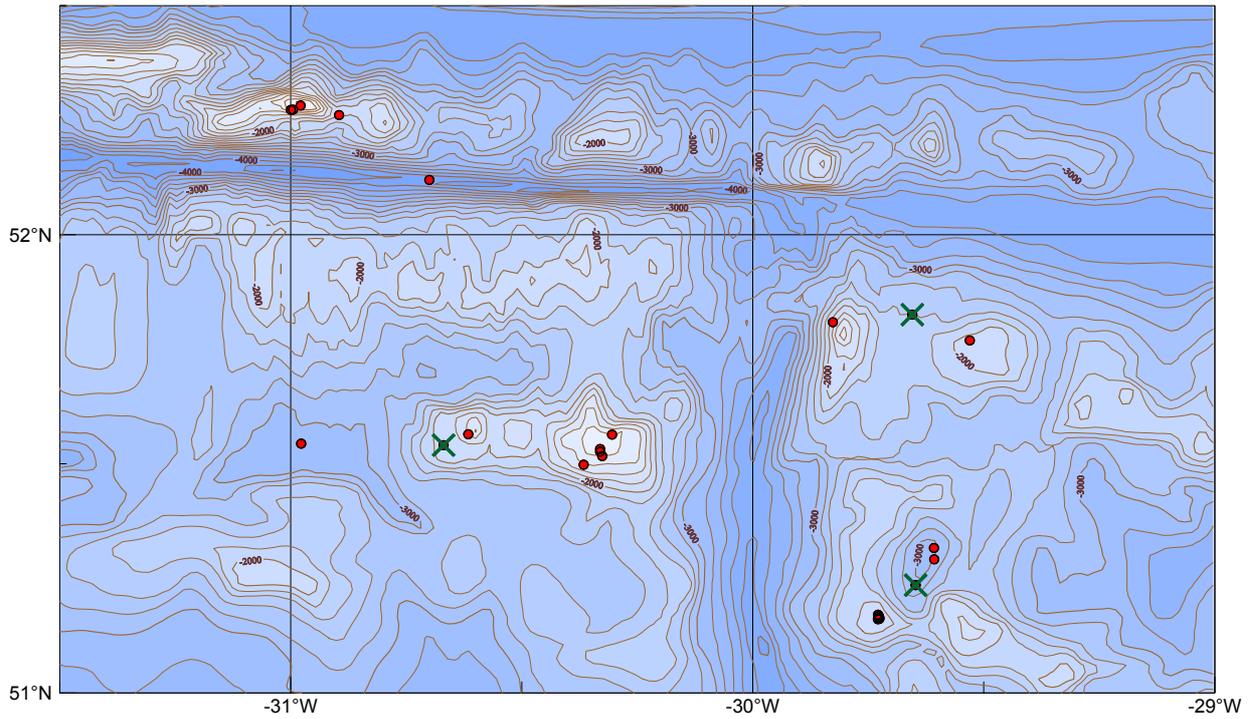


Figure 26 Distribution of *B. richardsoni* in Area II. Presence at a station is indicates by a X. Dots are stations with no catch of the taxon.

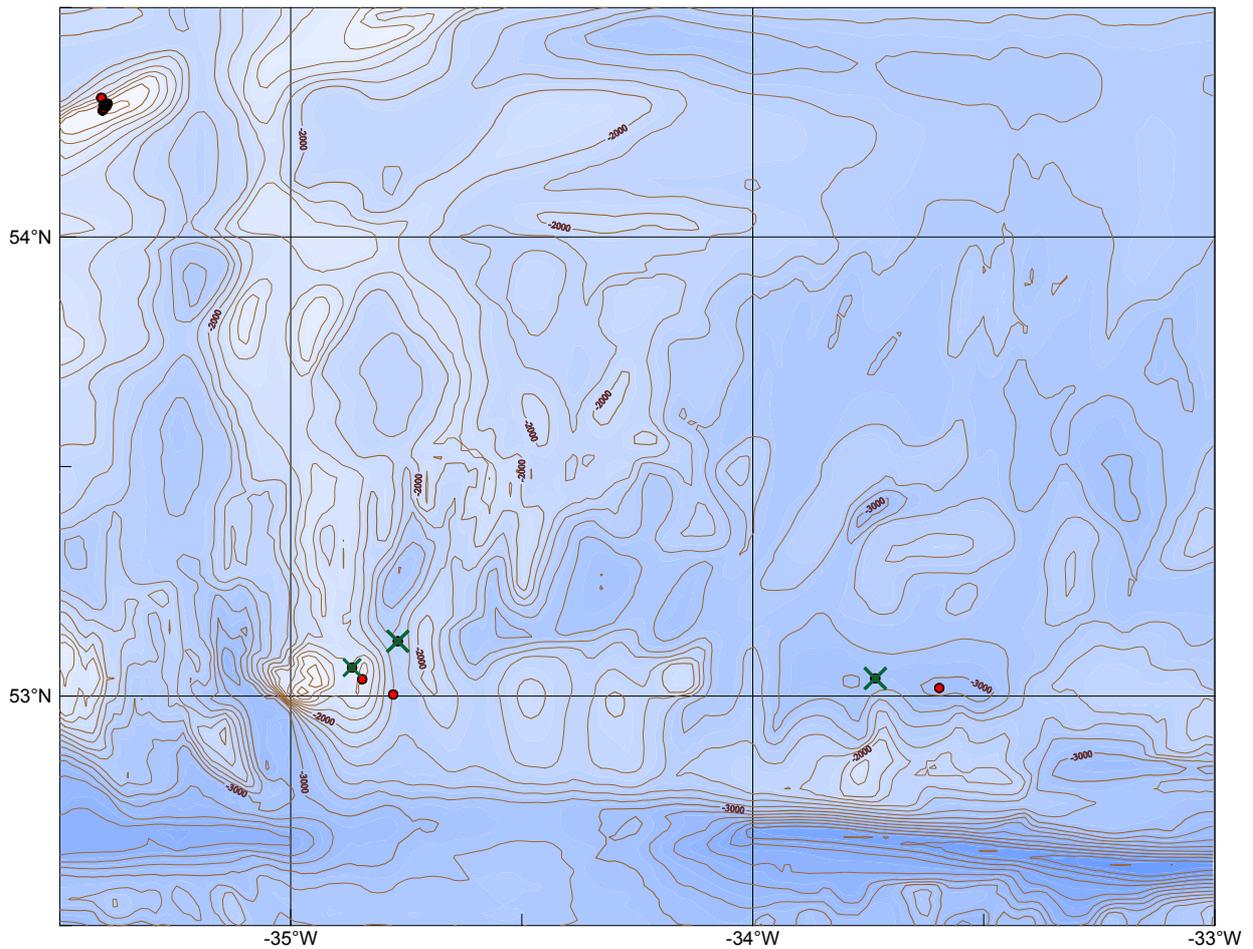


Figure 27 Distribution of *B. richardsoni* in Area III. Presence at a station is indicates by a X. Dots are stations with no catch of the taxon.

3.1.9 *Brosme brosme*

En: Tusk

No: Brosme



Figure 28 Picture of a *B. brosme* taken during the cruise.

A total of 628 *B. brosme* was caught during the cruise. The length distribution is shown in Figure 29 and the range was 29 - 110 cm (mean = 66.3 cm, $n = 619$, $SD = 14.5$ cm). The average weight was 3.76 kg ($SD = 2.83$ kg).

63 % of the *B. brosme* were females. The length distributions of the sexes were almost equal (Figure 29).

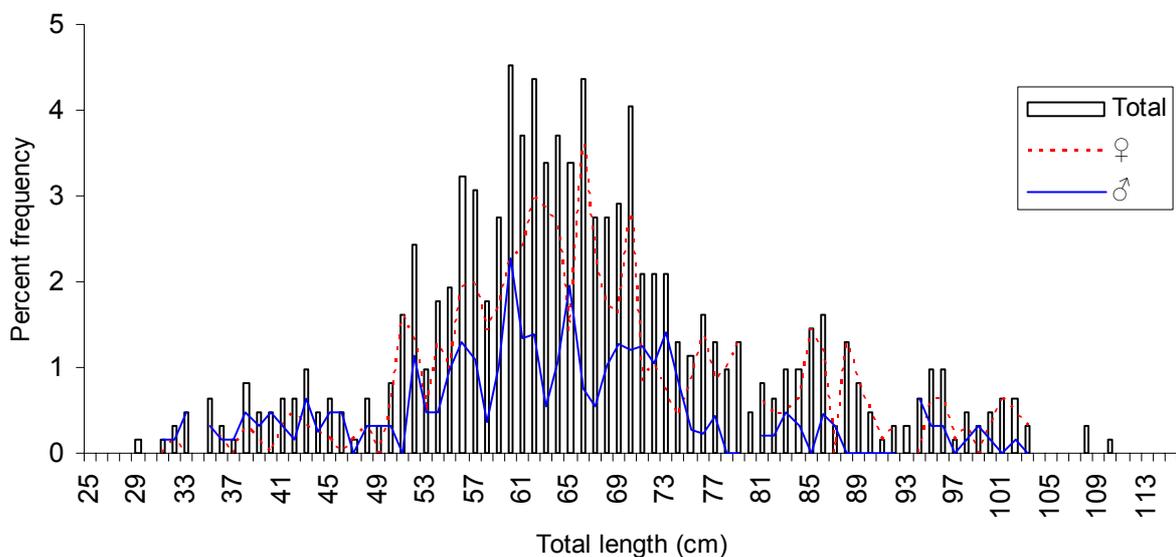


Figure 29 Length distribution of *B. brosme* ($n = 619$). The dotted line shows the portion of the females and the solid line shows the portion of males in each length group.

B. brosme was caught in the northern areas both north and south of Charlie-Gibbs Fracture zone. The catches south of Charlie-Gibbs Fracture Zone were small and the largest catches were on the bank in the northwestern part of Area III. *B. brosme* occurred in depth between 400 and 1 000 meters (Figure 30 - Figure 31).

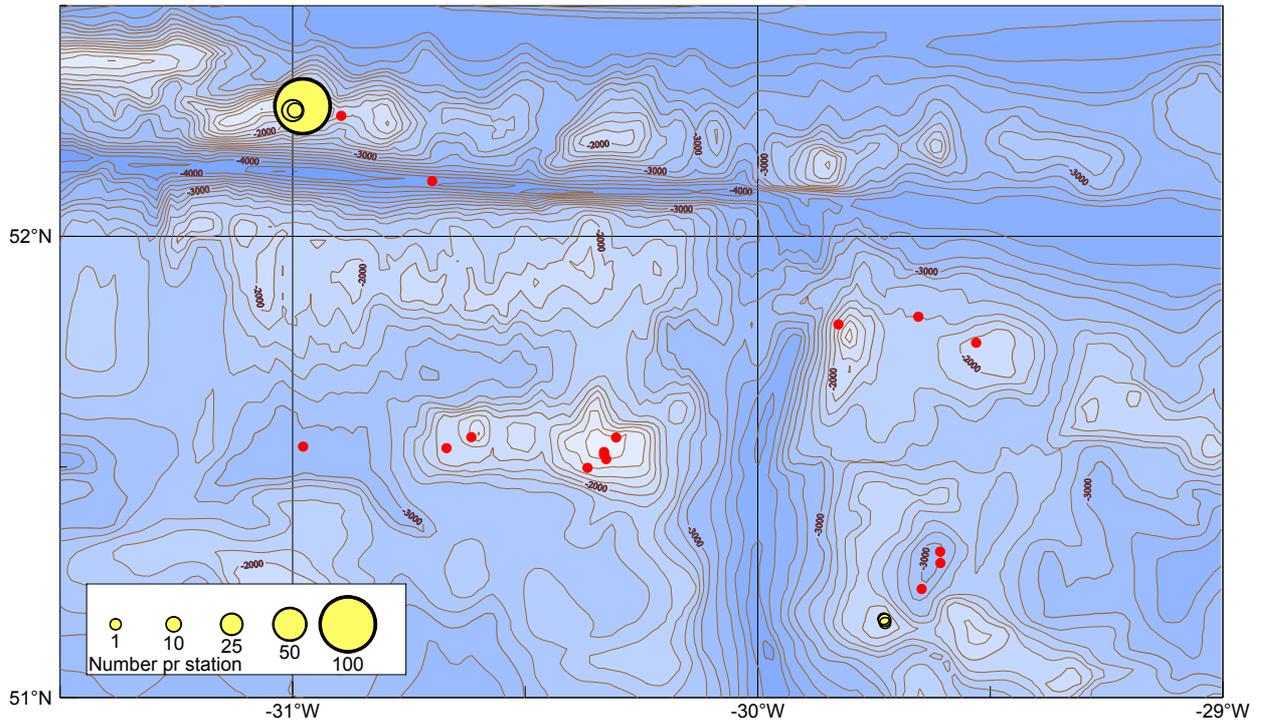


Figure 30 Distribution of *B. brosmе* in Area II. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

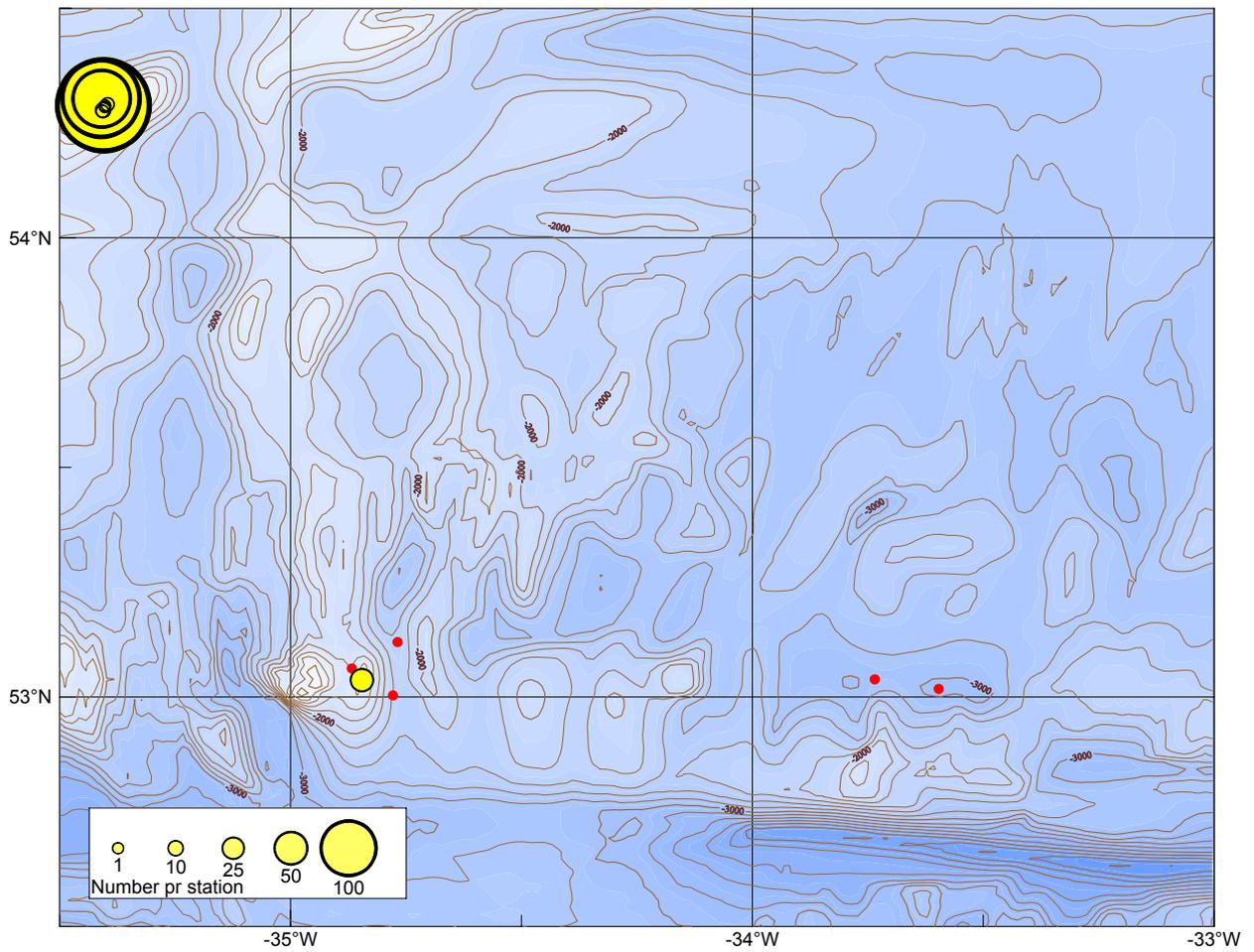


Figure 31 Distribution of *B. brosmе* in Area III. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.10 *Centrophorus*

En: No name

No: No name



Figure 32 Picture of a *Centrophorus* sp. taken during the cruise.

A specimen of *Centrophorus* was recorded but it could not be identified to species. The total length was 115 cm and it weighed 9.54 kg. The specimen was frozen and submitted to Bergen Museum. The specimen occurred in the western part of Area I, and it was taken somewhere between 1 600 and 2 000 m depth.

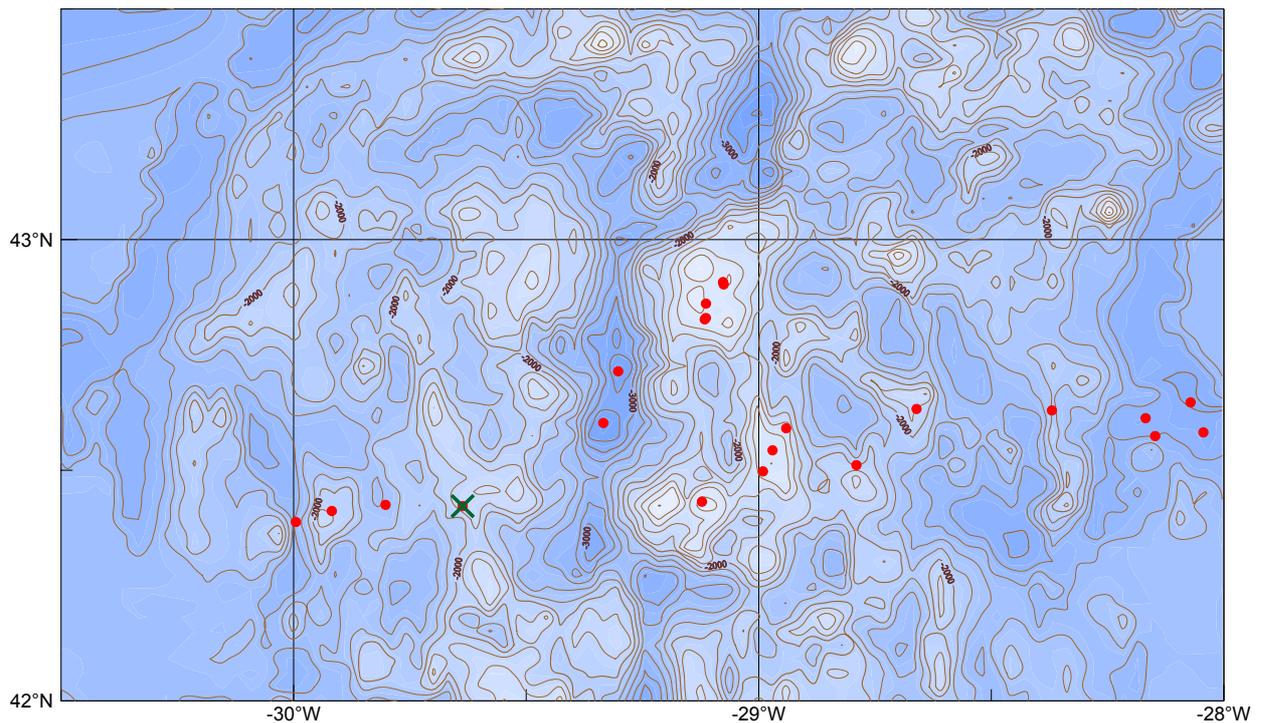


Figure 33 Distribution of *Centrophorus* in Area I. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.11 *Centrophorus squamosus*

En: Leafscale gulper shark

No: Brunhå

A total of 83 individuals of *C. squamosus* were caught during the cruise. The total length distribution is shown in Figure 34 and the range was 100 - 119 cm (mean = 109.2 cm, n = 83, SD = 3.7 cm). The average weight was 9.41 kg (SD = 3.32 kg, n = 52).

The males dominated the catches. 99 % of the species was males and the biggest specimen was a male (Figure 34).

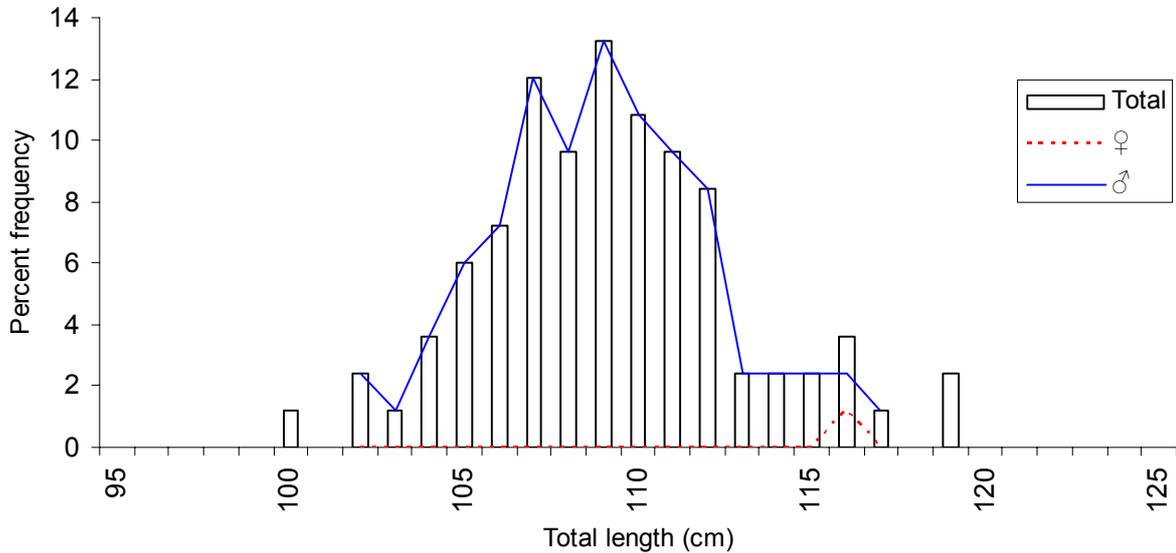


Figure 34 Length distribution of *C. squamosus* (n = 83). The dotted line shows the portion of the females and the solid line shows the portion of males in each length group.

C. squamosus was caught in Area I on both sides of the ridge. It occurred at depths between 1000 and 3300 meters, but was most numerous between 1000 and 1300 m (Figure 35).

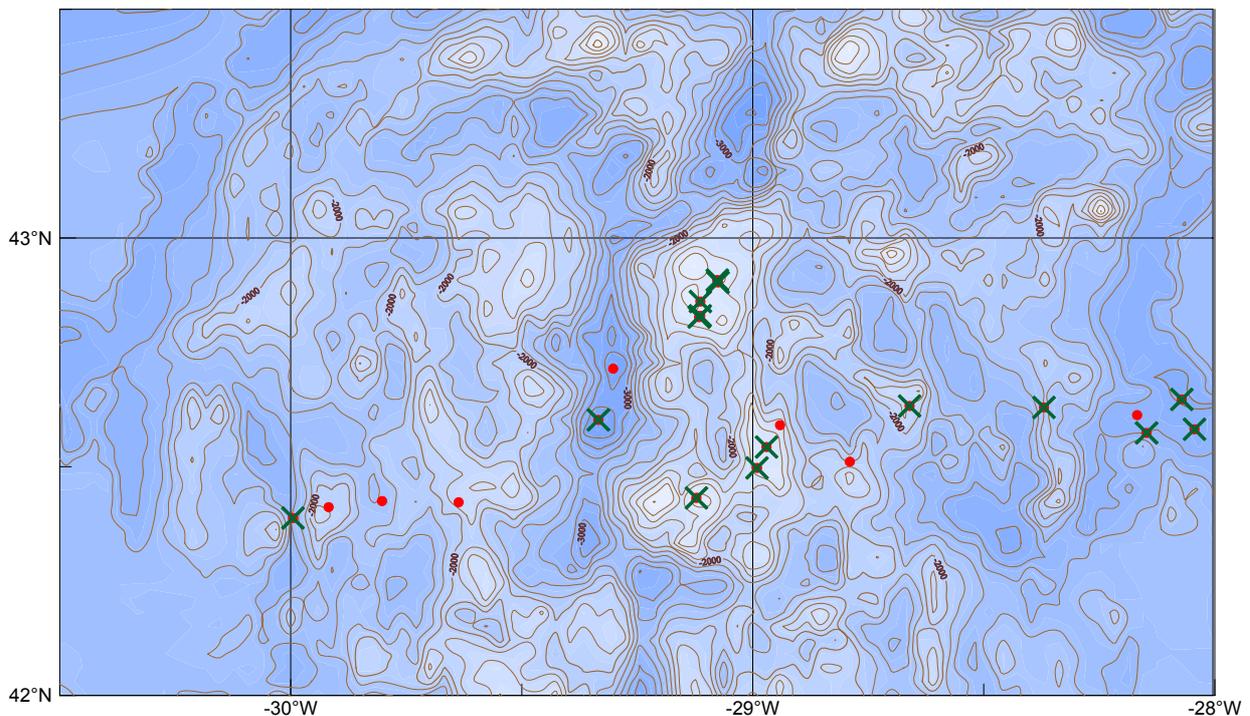


Figure 35 Distribution of *C. squamosus* in Area I. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.12 *Centroscymnus coelolepis*

En: Portuguese dogfish

No: Dypvannshå



Figure 36 Picture of a *C. coelolepis* taken during the cruise.

A total of 64 *C. coelolepis* was caught during the cruise. The total length distribution is shown in Figure 37 and the range was 81 - 121 cm (mean = 103.9 cm, $n = 64$, $SD = 9.8$ cm). The average weight was 9.41 kg ($SD = 3.32$ kg, $n = 52$).

63 % of the specimens were females. Males were also smaller than females and the largest male was 101 cm (Figure 37).

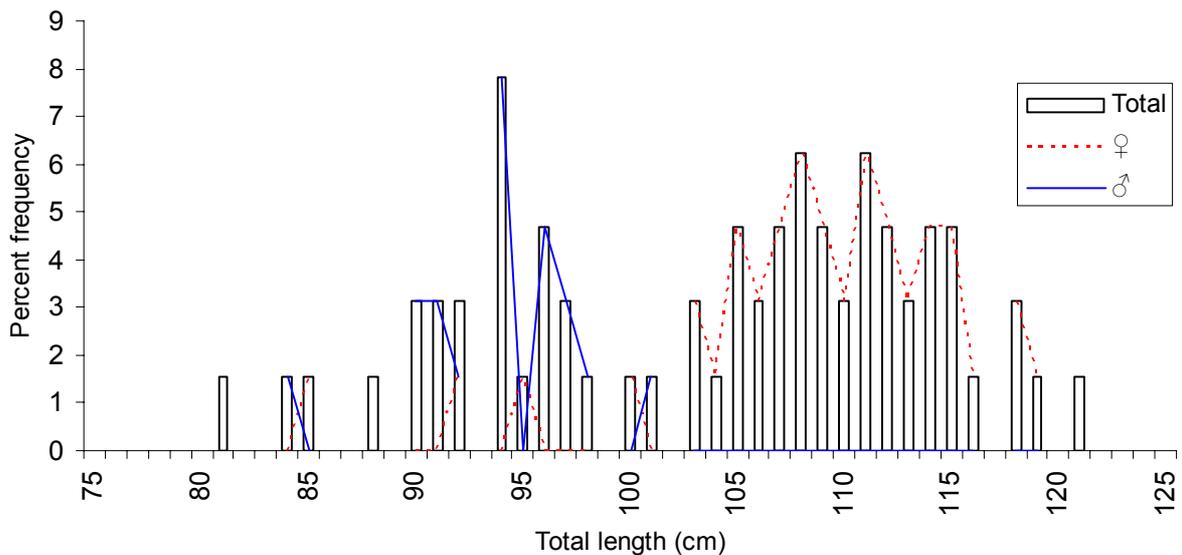


Figure 37 Length distribution of *C. coelolepis* ($n = 64$). The dotted line shows the portion of the females and the solid line shows the portion of males in each length group.

C. coelolepis was found in Area I on both sides of the ridge. It occurred at depths between 1000 and 1900 meters (Figure 38).

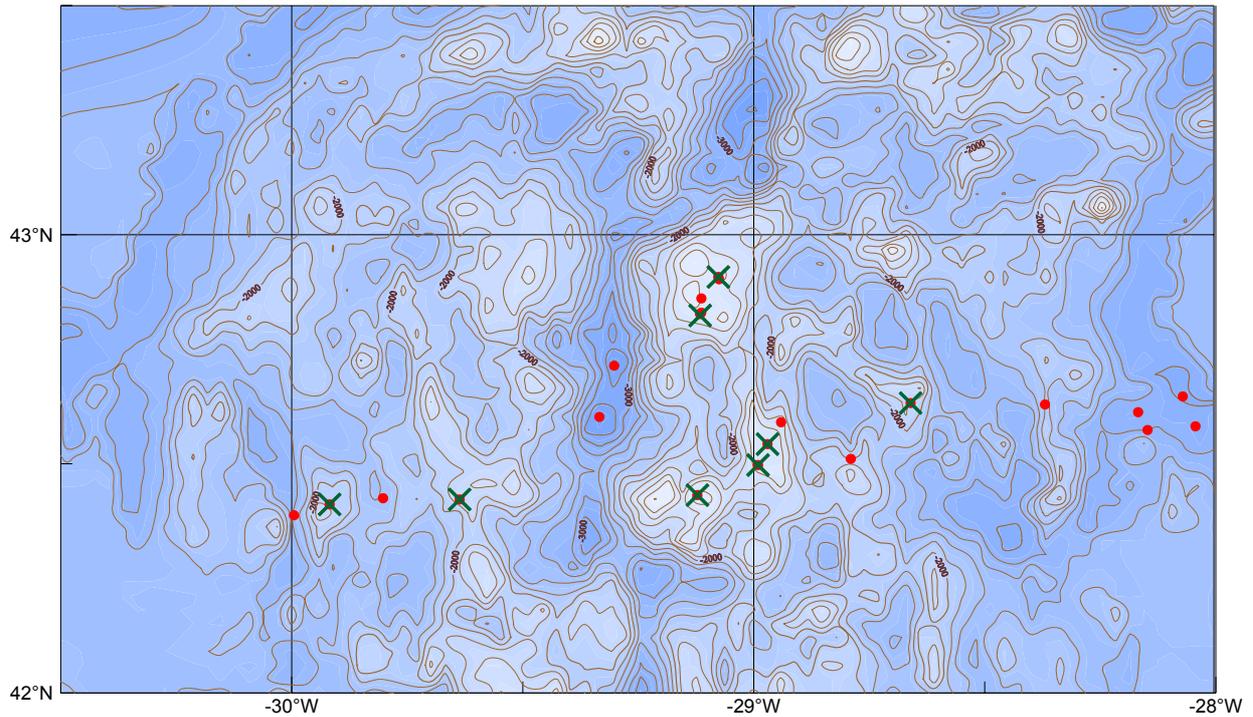


Figure 38 Distribution of *C. coelolepis* in Area I. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.13 *Centroscymnus crepidater*

En: Longnose velvet dogfish

No: Bunnhå

A total of 117 *C. crepidater* was caught during the cruise. The total length distribution is shown in Figure 39 and the range was 38 - 99 cm (mean = 70.7 cm, $n = 84$, $SD = 10.0$ cm). The average weight was 1.90 kg ($SD = 0.84$ kg).

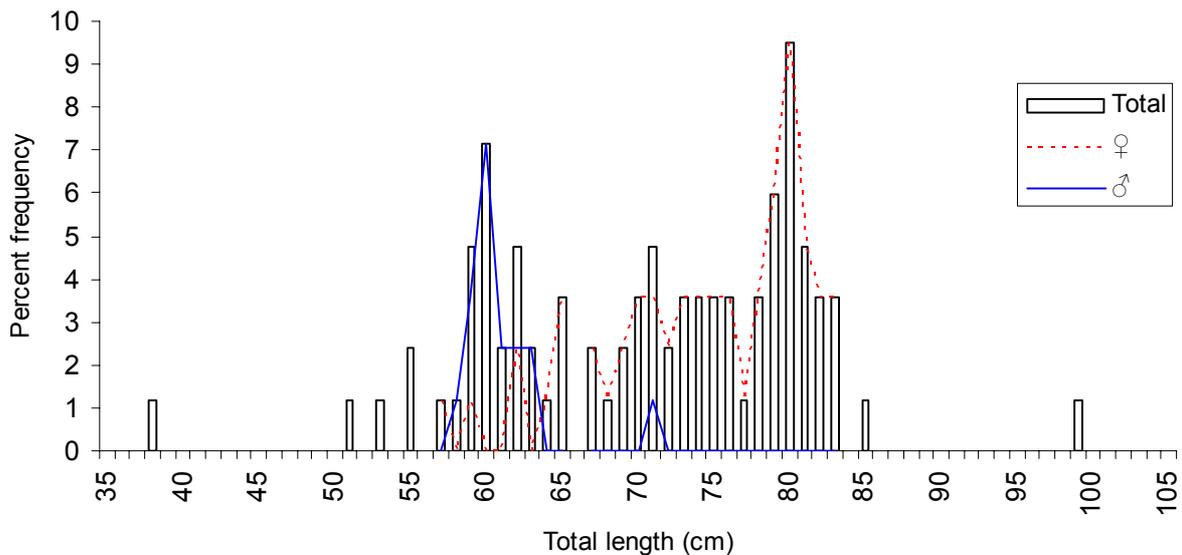


Figure 39 Length distribution of *C. crepidater* ($n = 84$). The dotted line shows the portion of the females and the solid line shows the portion of males in each length group.

78 % of the specimens were females. Males were smaller than females and the largest male was 71 cm (Figure 39).

C. crepidater was caught in Area I on the central part of the ridge. It occurred at depths between 1 000 and 1 600 meters (Figure 40).

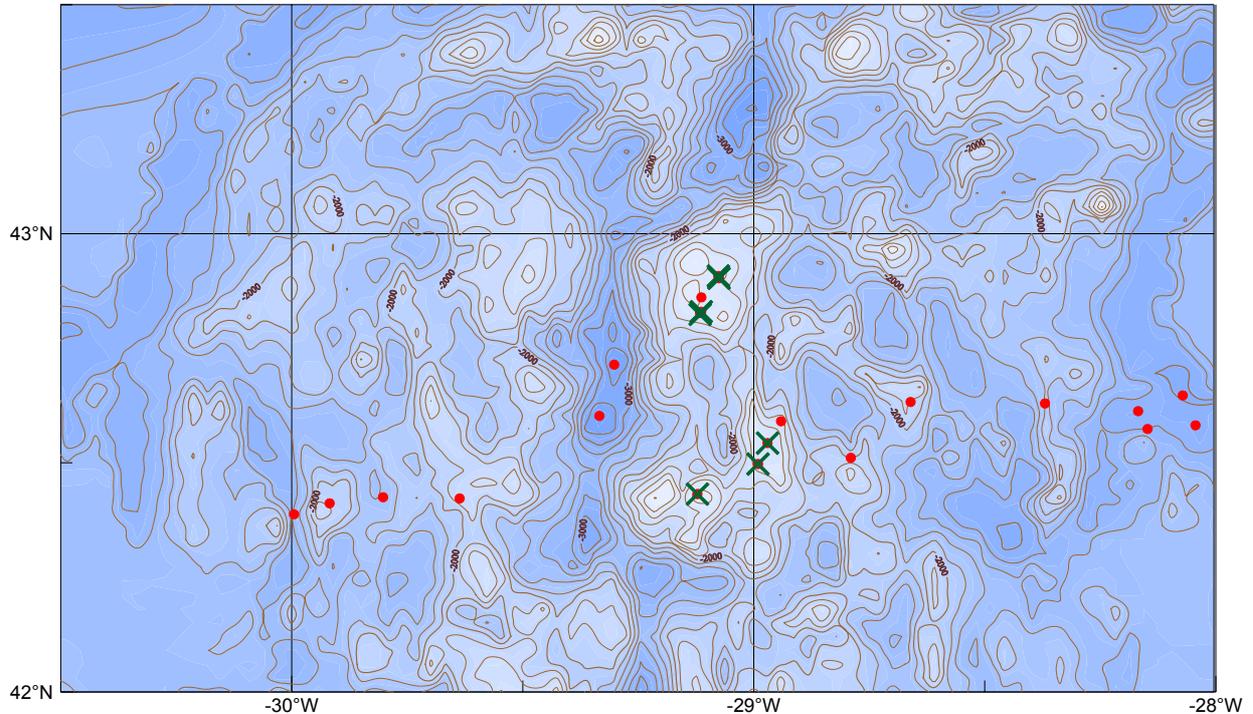


Figure 40 Distribution of *C. crepidater* in Area I. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.14 *Centroscymnus owstoni*

En: Roughskin dogfish

No: No name



Figure 41 Picture of a *C. owstoni* taken during the cruise.

A total of 12 *C. owstoni* was caught during the cruise. The total length distribution is given in Figure 42. The average weight was 3.00 kg (SD = 0.43 kg, n = 10). Only males occurred (n = 12).

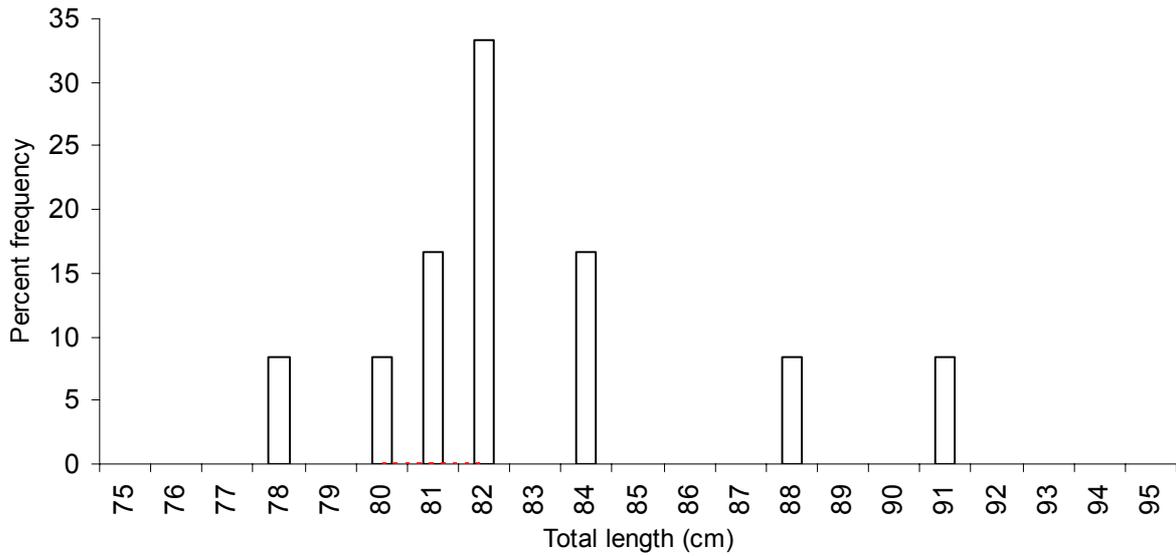


Figure 42 Length distribution of *C. owstoni* (n = 12).

C. owstoni was caught in Area I on the shallowest stations in the central part of the ridge. It occurred in depths less than 1 000 m (Figure 43).

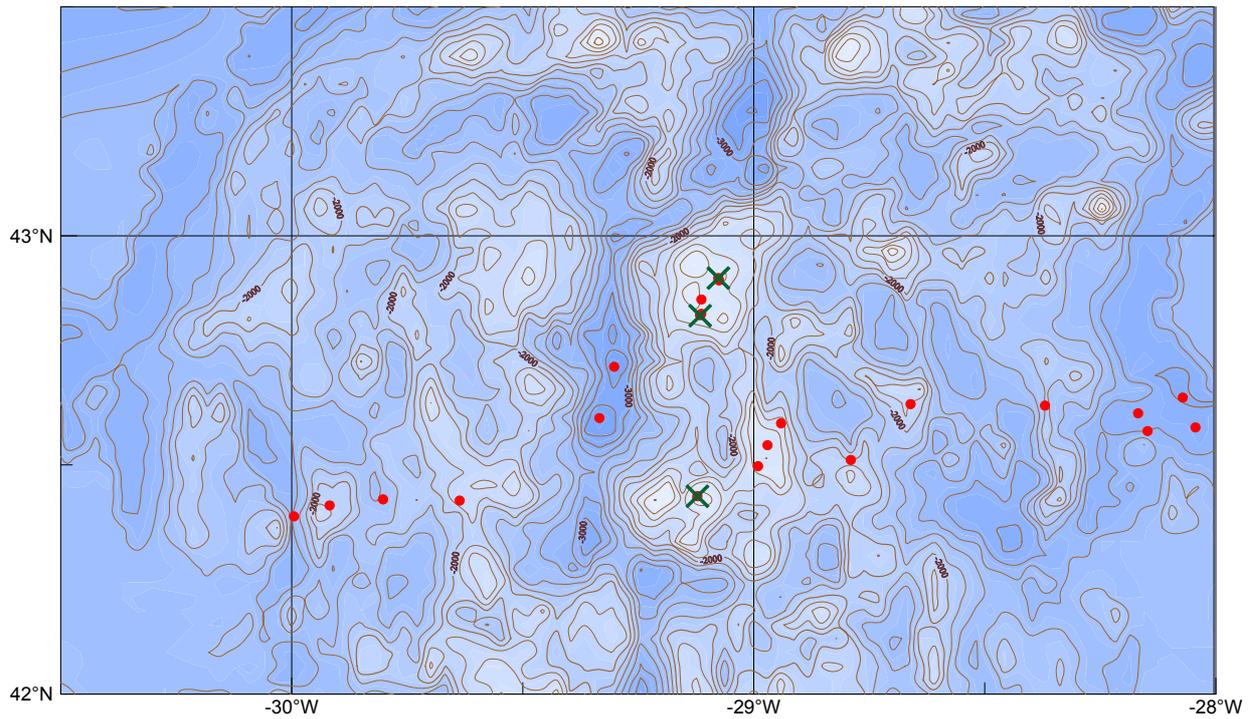


Figure 43 Distribution of *C. owstoni* in Area I. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.15 *Chimaera monstrosa*

En: Rabbit fish

No: Havmus

A single specimen of *C. monstrosa* was recorded. It was a female and occurred in Area I at 1 900 m depth (Figure 44). It was caught in a gillnet in the western part of the ridge. The post second dorsal fin length was 74 cm and the weight was 3.84 kg.

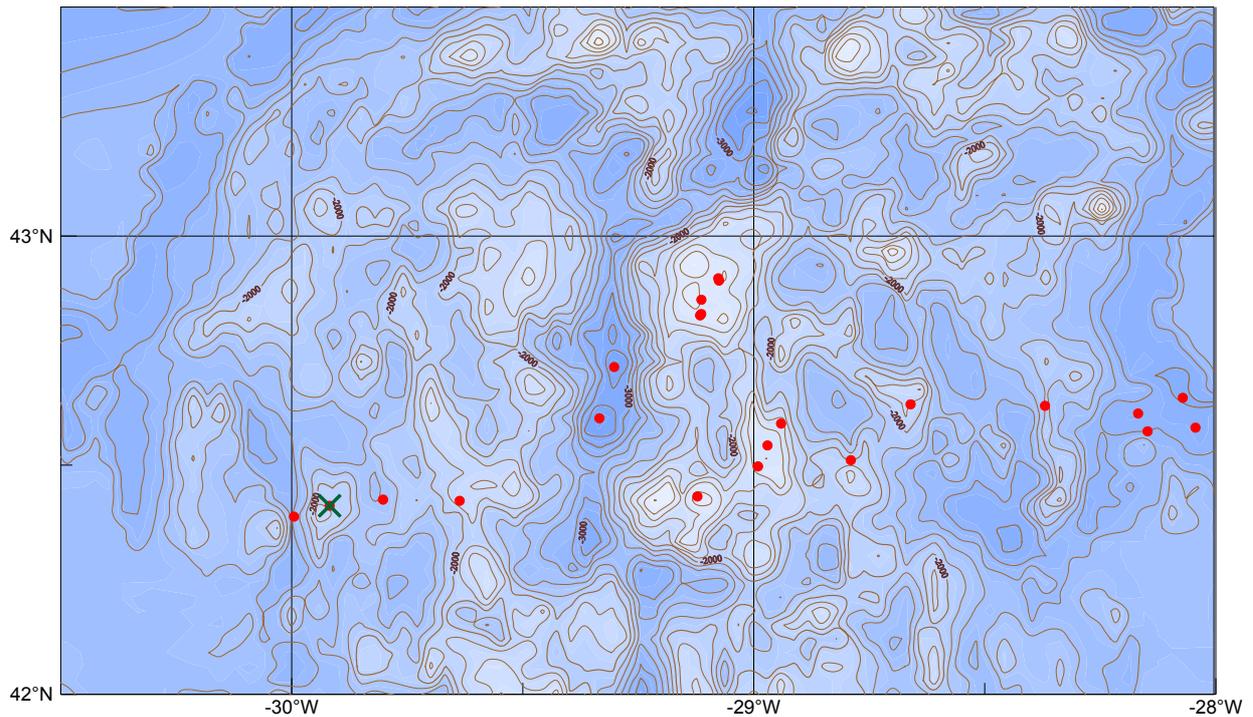


Figure 44 Distribution of *C. monstrosa* in Area I. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.16 *Coryphaenoides* 1

En: Grenadier

No: Grenader



Figure 45 A member of the genus *Coryphaenoides* taken during the cruise.

A total of 11 similar specimens of *Coryphaeonides* were recorded but these could not be identified to species. Four specimens were frozen for the Bergen Museum. The length distribution is given in Figure 46. The average weight was 0.61 kg (SD = 0.1 kg, n = 2).

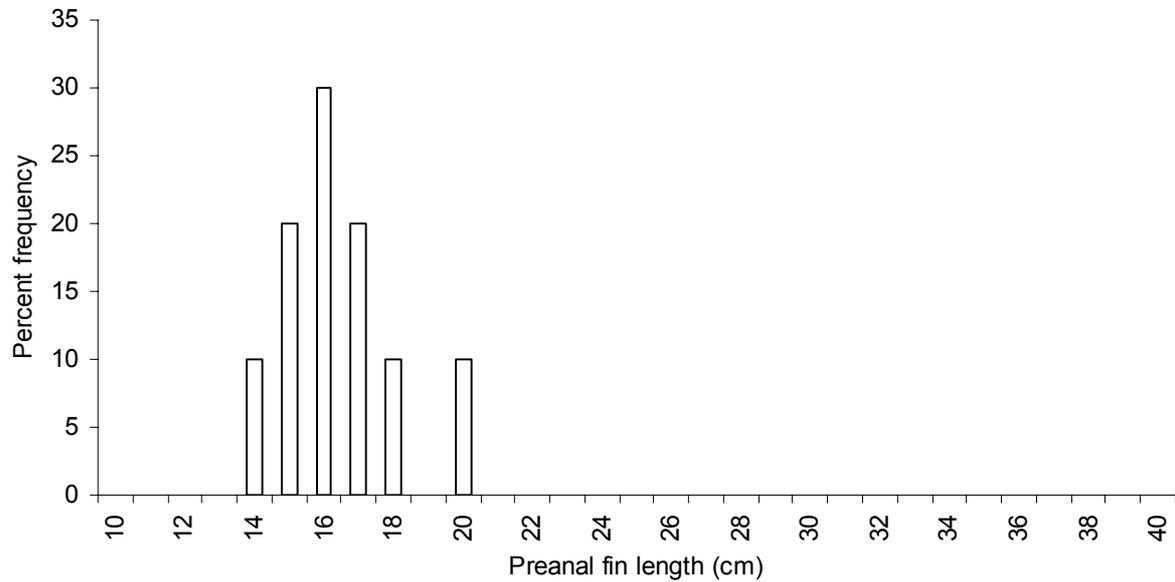


Figure 46 Length distribution of *Coryphaeonides 2*. (n = 10)

Coryphaeonides (1) was caught in all areas, but it only occurred in the eastern side of the ridge south of Charlie-Gibbs Fracture Zone. It was caught at depths between 2 200 and 3 000 m (Figure 47 - Figure 49),

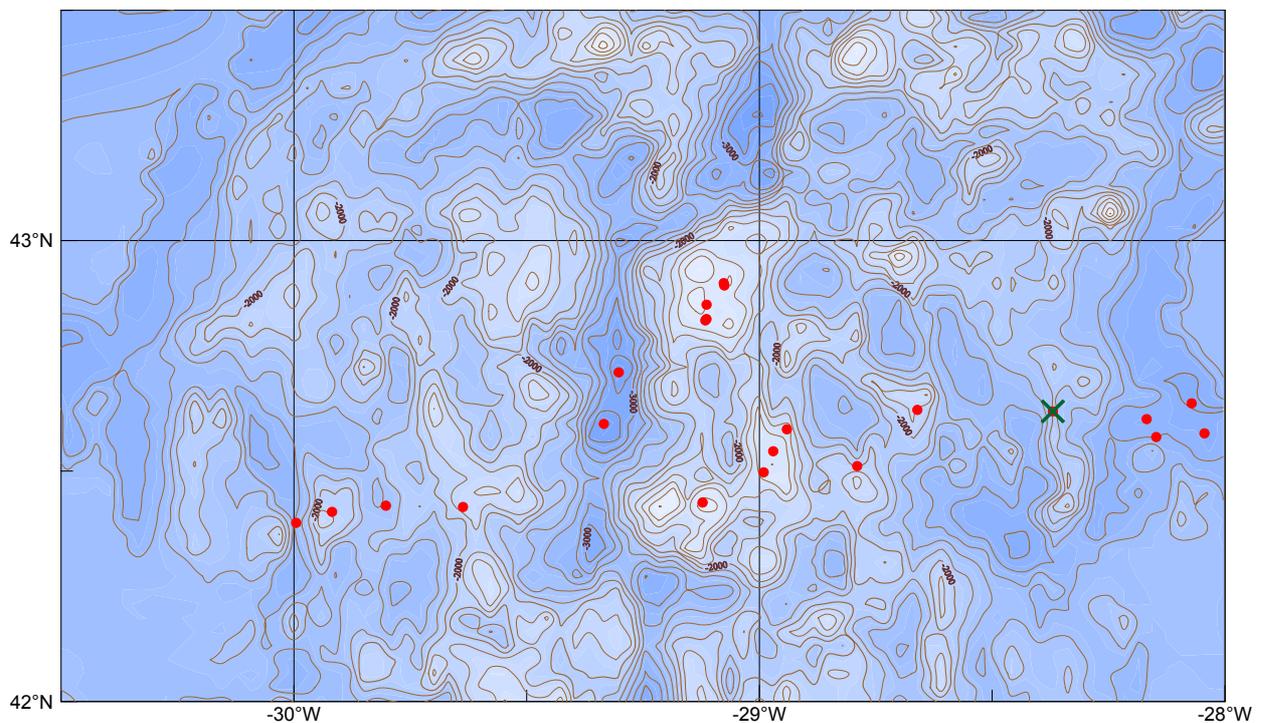


Figure 47 Distribution of *Coryphaeonides* (1) in Area I. Presence of the species on the stations is marked with a green X, and absence of the species are marked with a red dot.

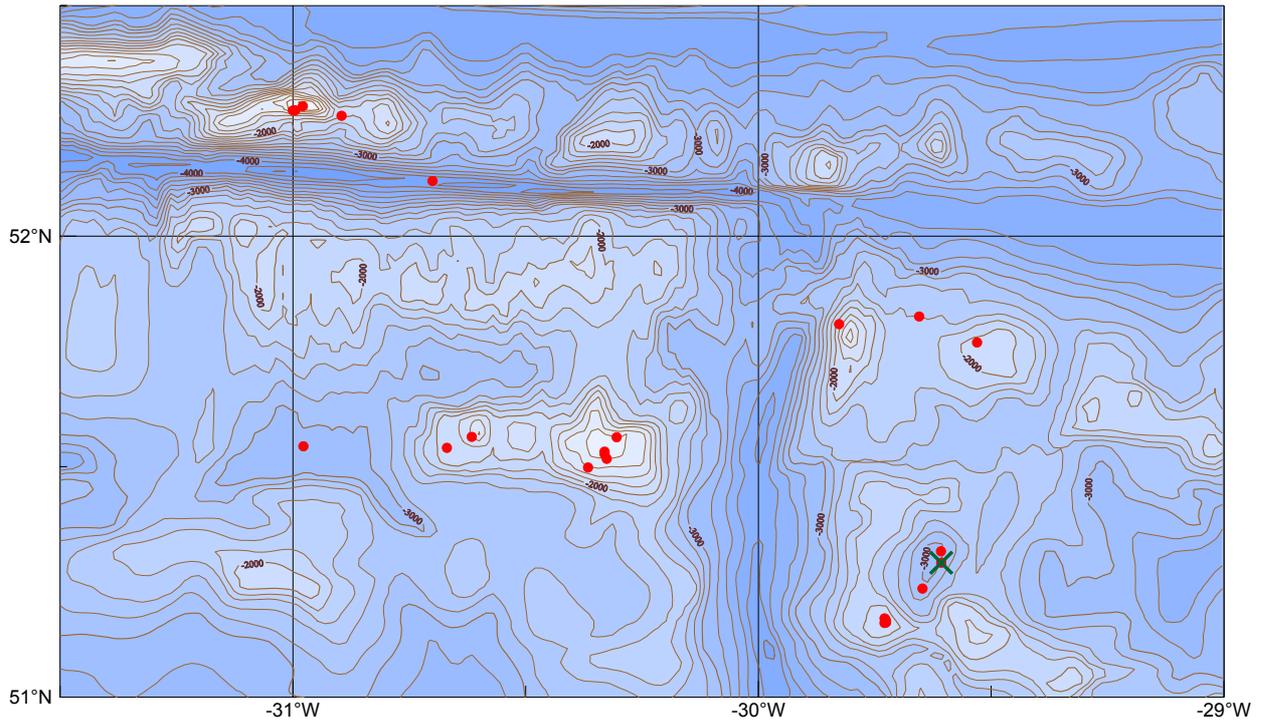


Figure 48 Distribution of *Coryphaeonides* (1) in Area II. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

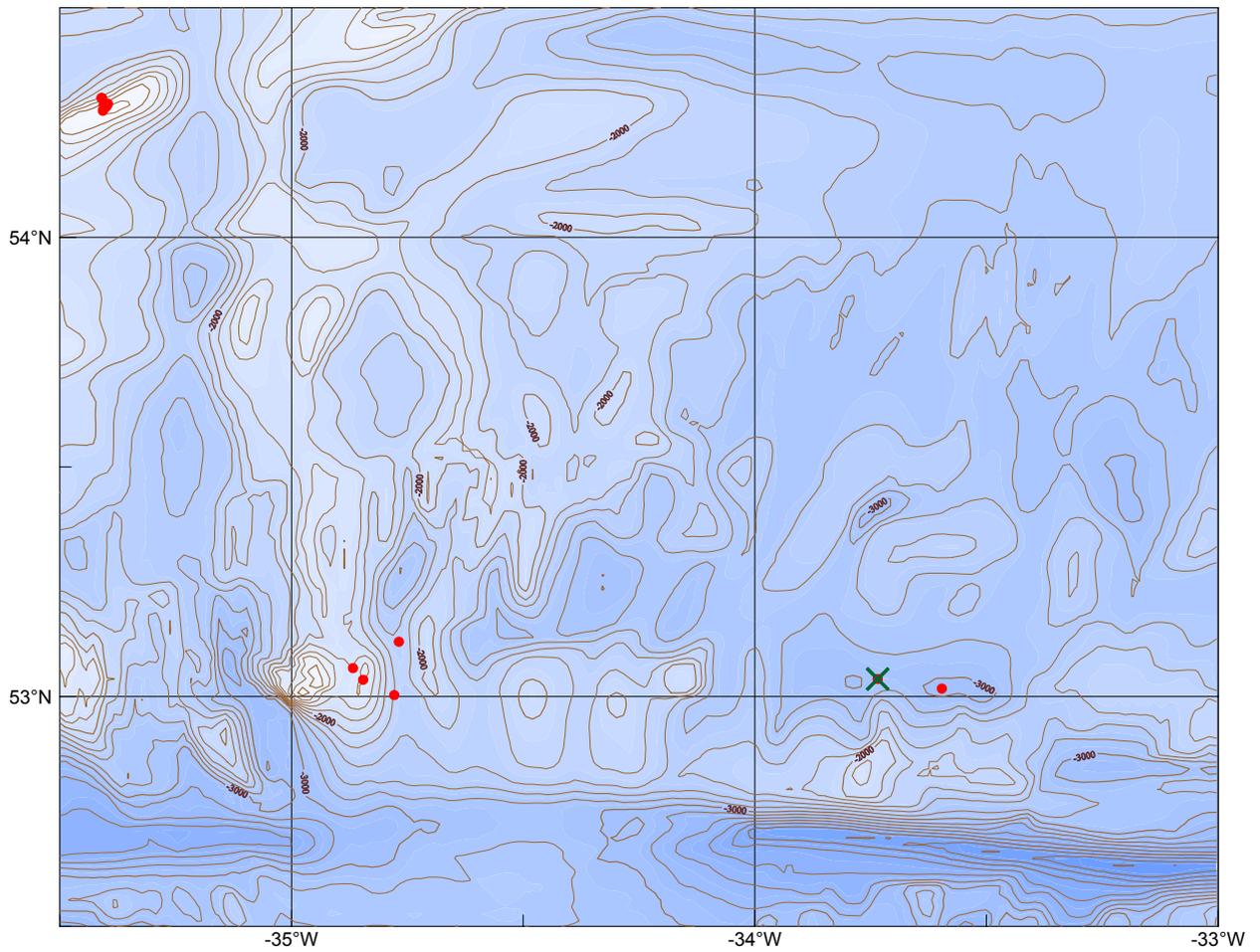


Figure 49 Distribution of *Coryphaeonides* (1) in Area III. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.17 *Coryphaenoides 2*

En: No name

No: No name



Figure 50 A member of the family *Coryphaenoides* taken during the cruise.

A total of 142 similar specimens of *Coryphaenoides* provisionally assigned to the species *striaturus* were recorded but these could not be identified with certainty to species. The length distribution is shown in Figure 51 and the range of the preanal fin length was 9 - 25 cm (mean = 18.1 cm, n = 126, SD = 3.2 cm). The average weight was 0.93 kg (SD = 0.45 kg, n = 95).

The females dominated the catches. 94 % of the individuals were females. Males were also smaller than females and the largest male was 15 cm (Figure 51).

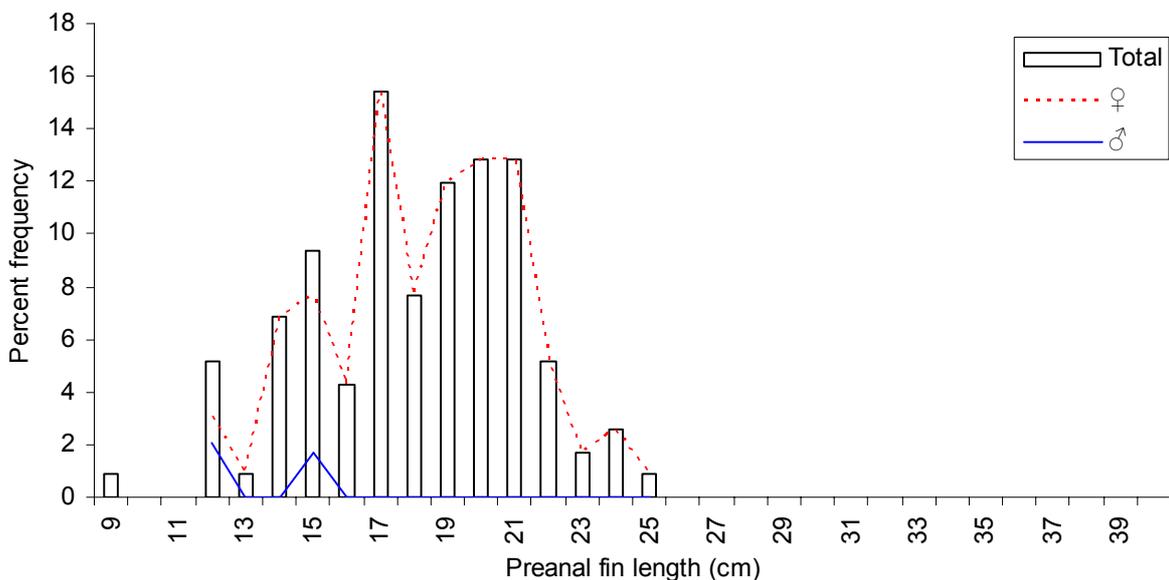


Figure 51 Length distribution of *Coryphaenoides* (2) (n = 126). The dotted line shows the portion of the females and the solid line shows the portion of males in each length group.

Coryphaenoides (2) was caught in all areas. It occurred on both sides of the ridge in depths between 900 and 3 500 meters (Figure 52 - Figure 54). 99 % was caught between 1 400 and 2 200.

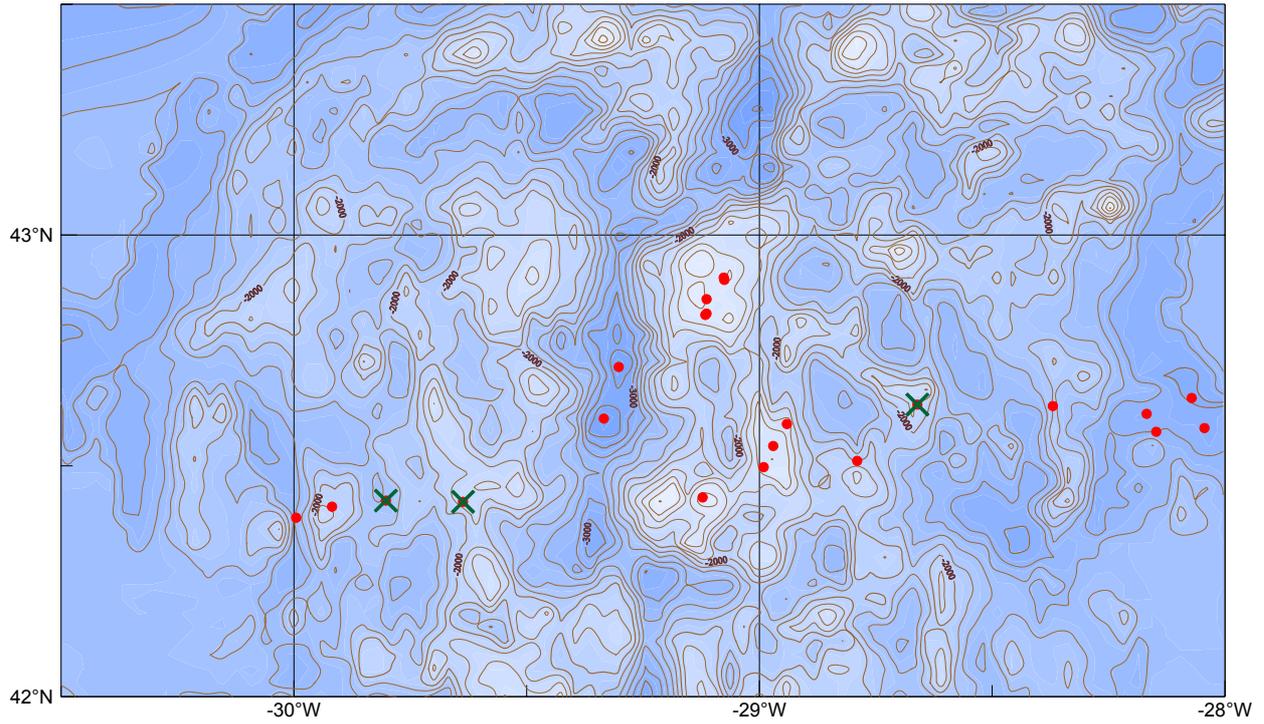


Figure 52 Distribution of *Coryphaenoides* (2) in Area I. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

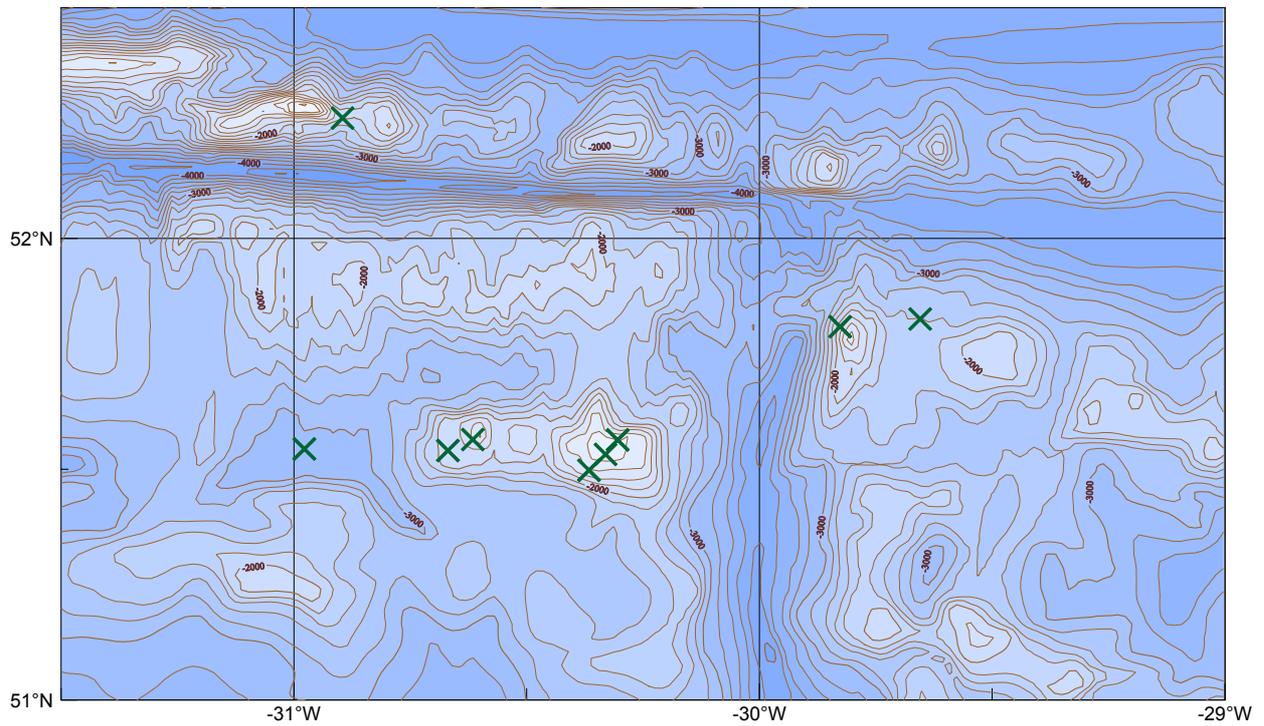


Figure 53 Distribution of *Coryphaenoides* (2) in Area II. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

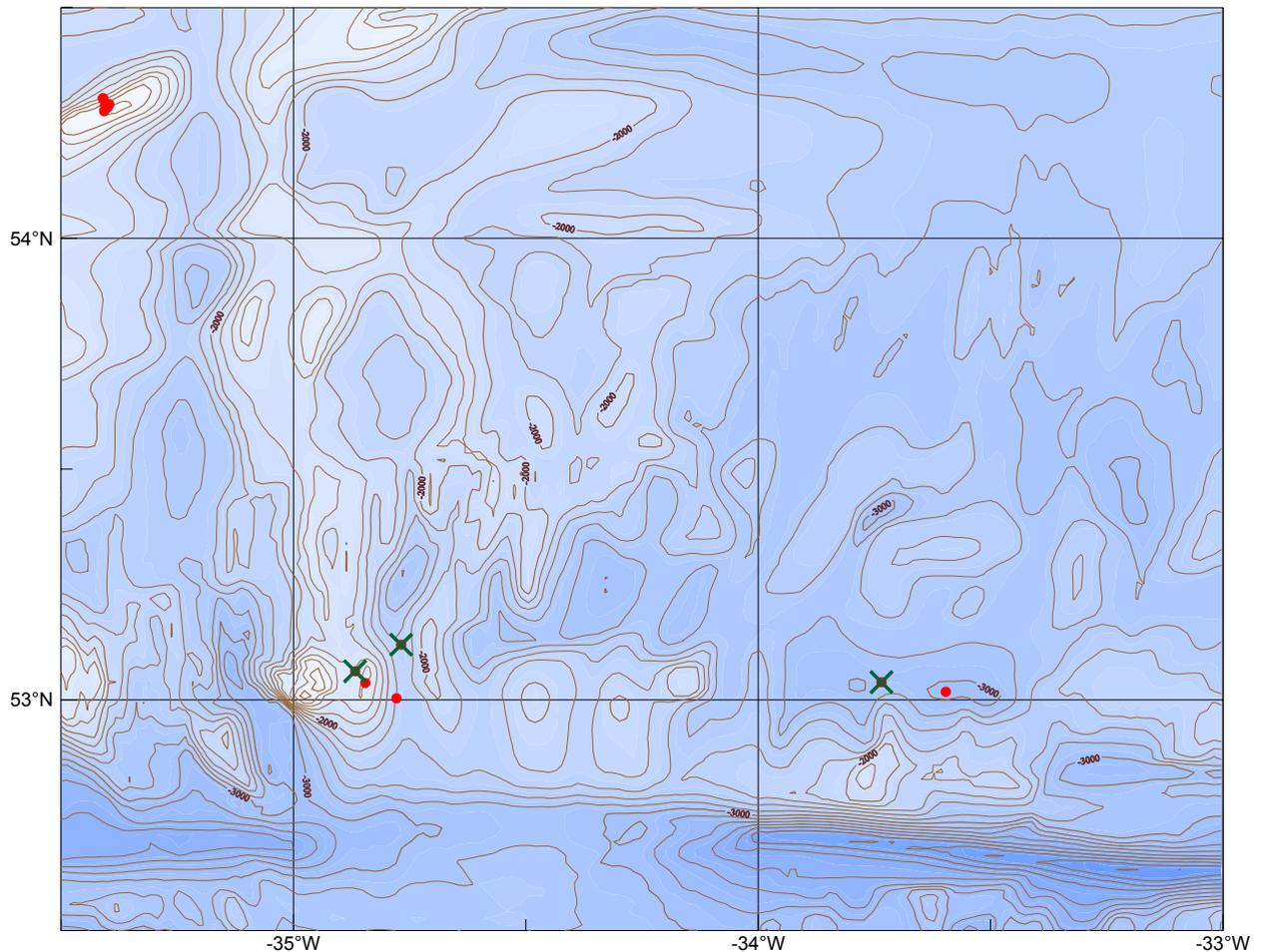


Figure 54 Distribution of *Coryphaenoides* (2) in Area III. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.18 *Coryphaenoides armatus*

En: Abyssal grenadier

No: Pansret skolest



Figure 55 Picture of a *C. armatus* taken during the cruise.

A total of 596 *C. armatus* was caught during the cruise. The length distribution is shown in Figure 56 and the range of the preanal fin length was 14.5 - 35 cm (mean = 20.9 cm, n = 585, SD = 3.4 cm). The average weight was 1.18 kg (SD = 0.72 kg, n = 401).

The females dominated the catches. 88 % of the individuals were females. Males were also smaller than females and the largest male was 27 cm (Figure 56).

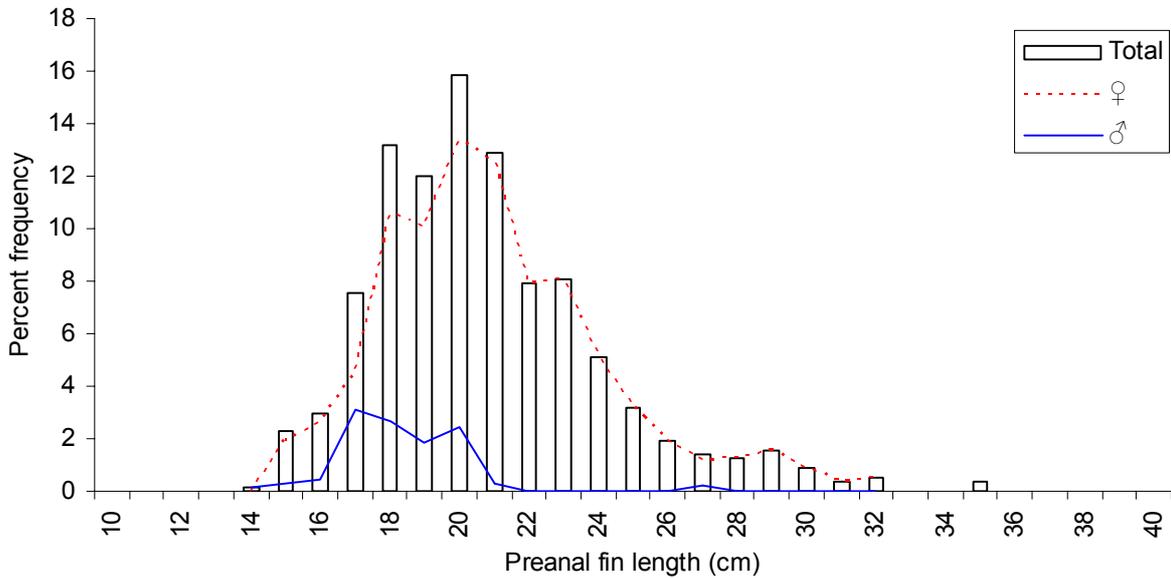


Figure 56 Length distribution of *C. armatus* (n = 585). The dotted line shows the portion of the females and the solid line shows the portion of males in each length group.

C. armatus was caught in all areas and occurred on the both sides of the ridge at depths between 1 700 and 4 200 meters (Figure 57 - Figure 59). 99 % was caught between 2 600 and 4 200 m and the largest catches were in Area I at the deepest stations in the east.

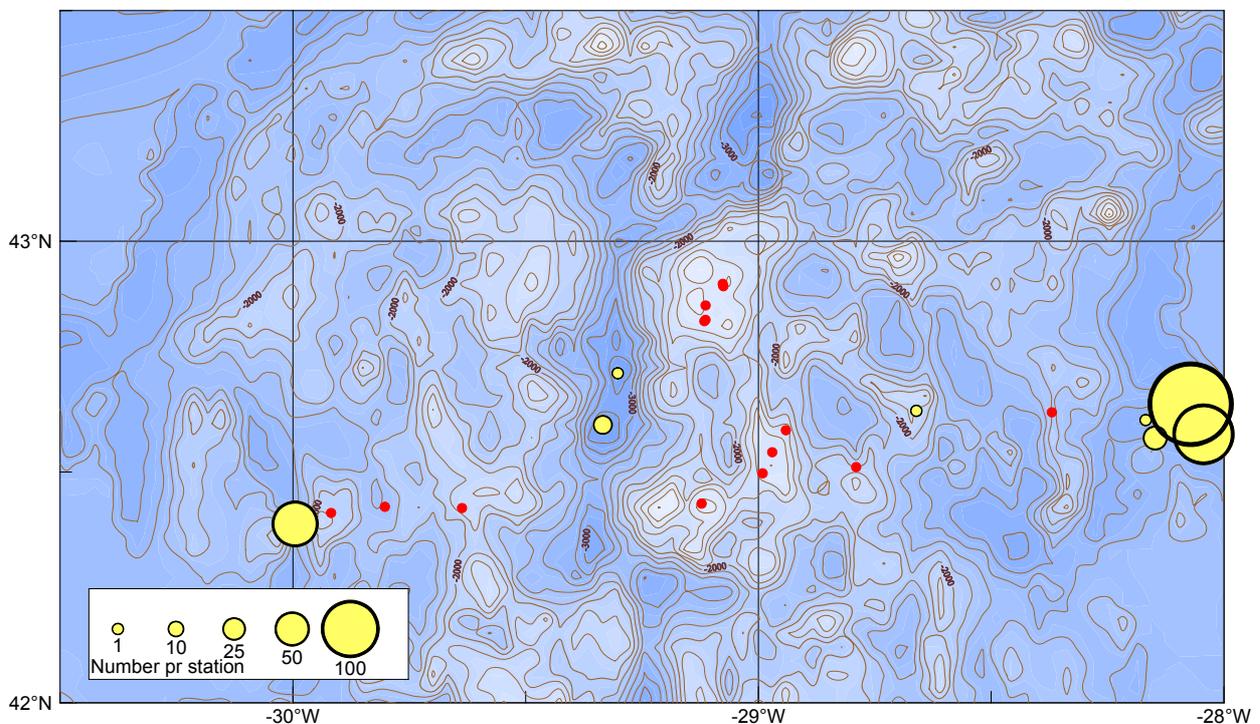


Figure 57 Distribution of *C. armatus* in Area I. Presence of the species on the stations is marked with a yellow circle where the size is proportional with abundance. Dots are stations with no catch of the taxon.

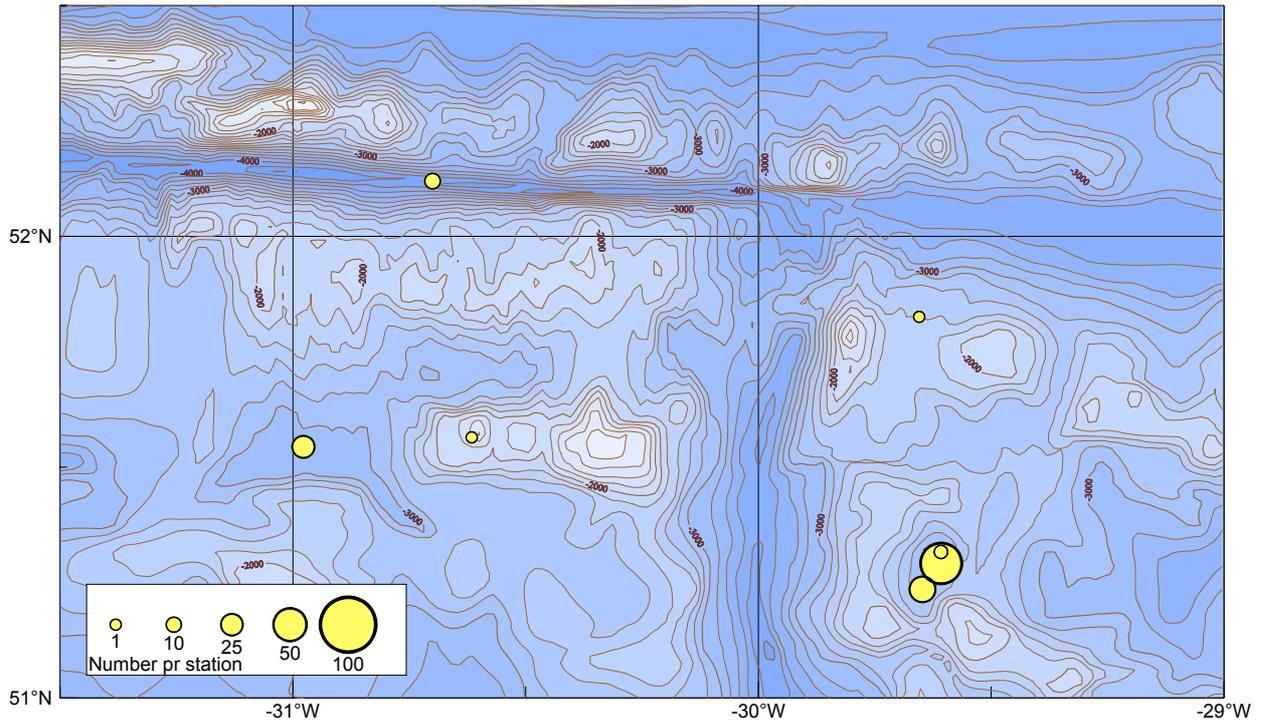


Figure 58 Distribution of *C. armatus* in Area II. Presence of the species on the stations is marked with a yellow circle where the size is proportional with abundance. Dots are stations with no catch of the taxon.

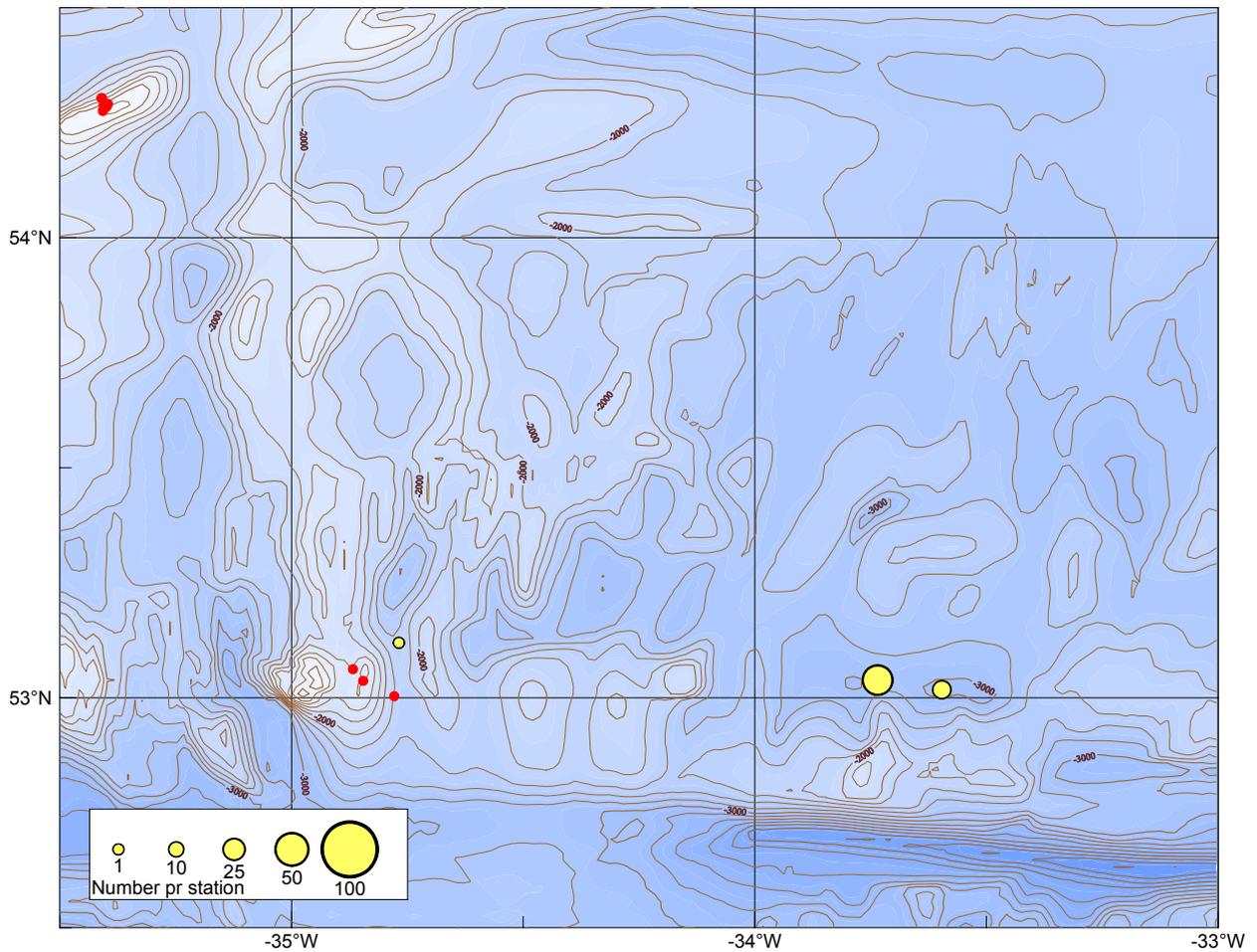


Figure 59 Distribution of *C. armatus* in Area III. Presence of the species on the stations is marked with a yellow circle where the size is proportional with abundance. Dots are stations with no catch of the taxon.

3.1.19 *Coryphaenoides rupestris*

En: Roundnose grenadier

No: Skolest



Figure 60 Picture of a *C. rupestris* taken during the cruise.

A total of 38 *C. rupestris* was caught during the cruise. The length distribution is shown in Figure 61 and the range of the preanal fin length was 15 - 22.5 cm (mean = 18.1 cm, $n = 29$, $SD = 2.2$ cm). The average weight was 1.04 kg ($SD = 0.29$ kg, $n = 25$).

44 % of the specimens were females. The largest male had a preanal fin length of 19 cm (Figure 61).

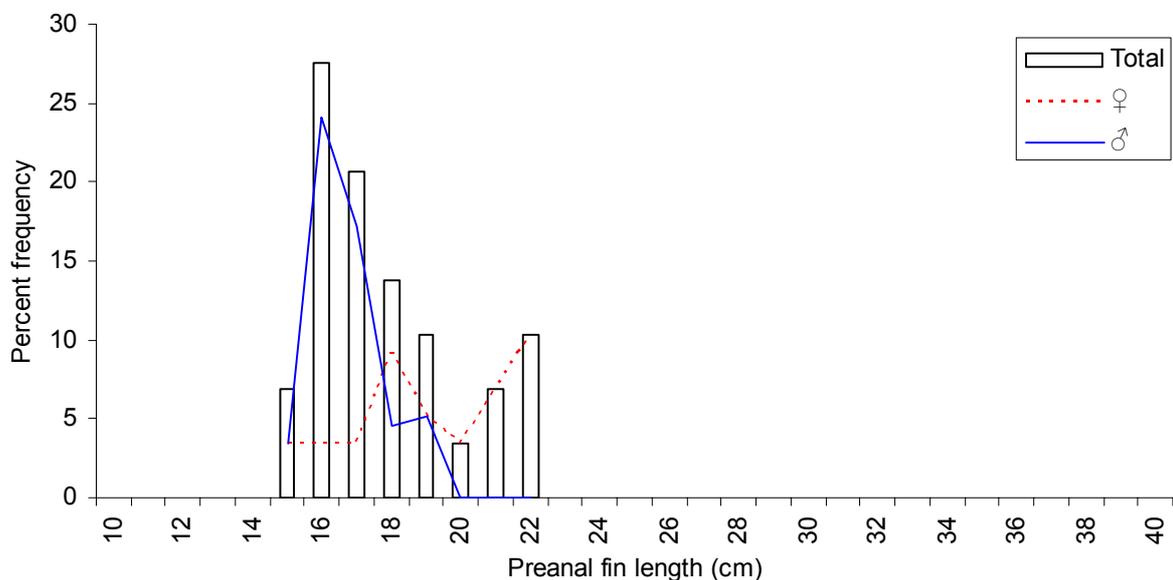


Figure 61 Length distribution of *C. rupestris* ($n = 29$). The dotted line shows the portion of the females and the solid line shows the portion of males in each length group.

C. rupestris was caught in the northern areas both north and south of Charlie-Gibbs Fracture Zone and it occurred at depths between 600 and 1 600 meters (Figure 62 and Figure 63). It was found in two distinct areas, the southernmost stations in Area II and in the southwest of Area III.

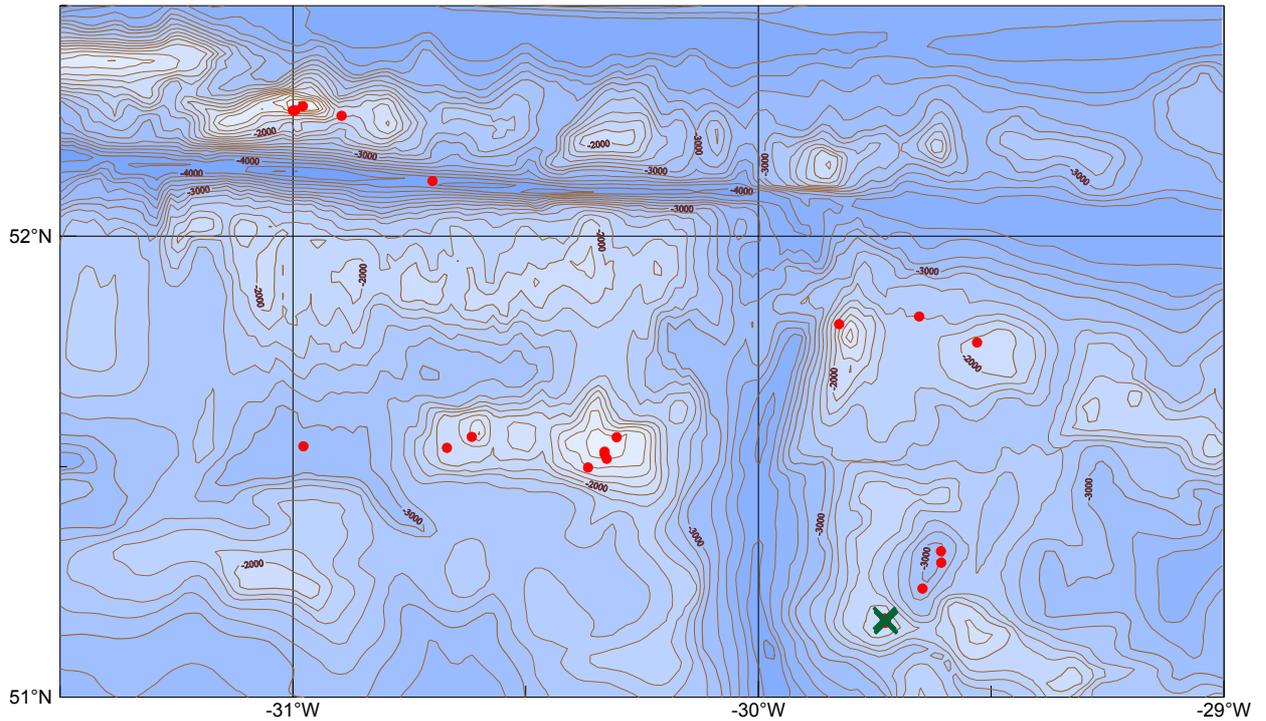


Figure 62 Distribution of *C. rupestris* in Area II. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

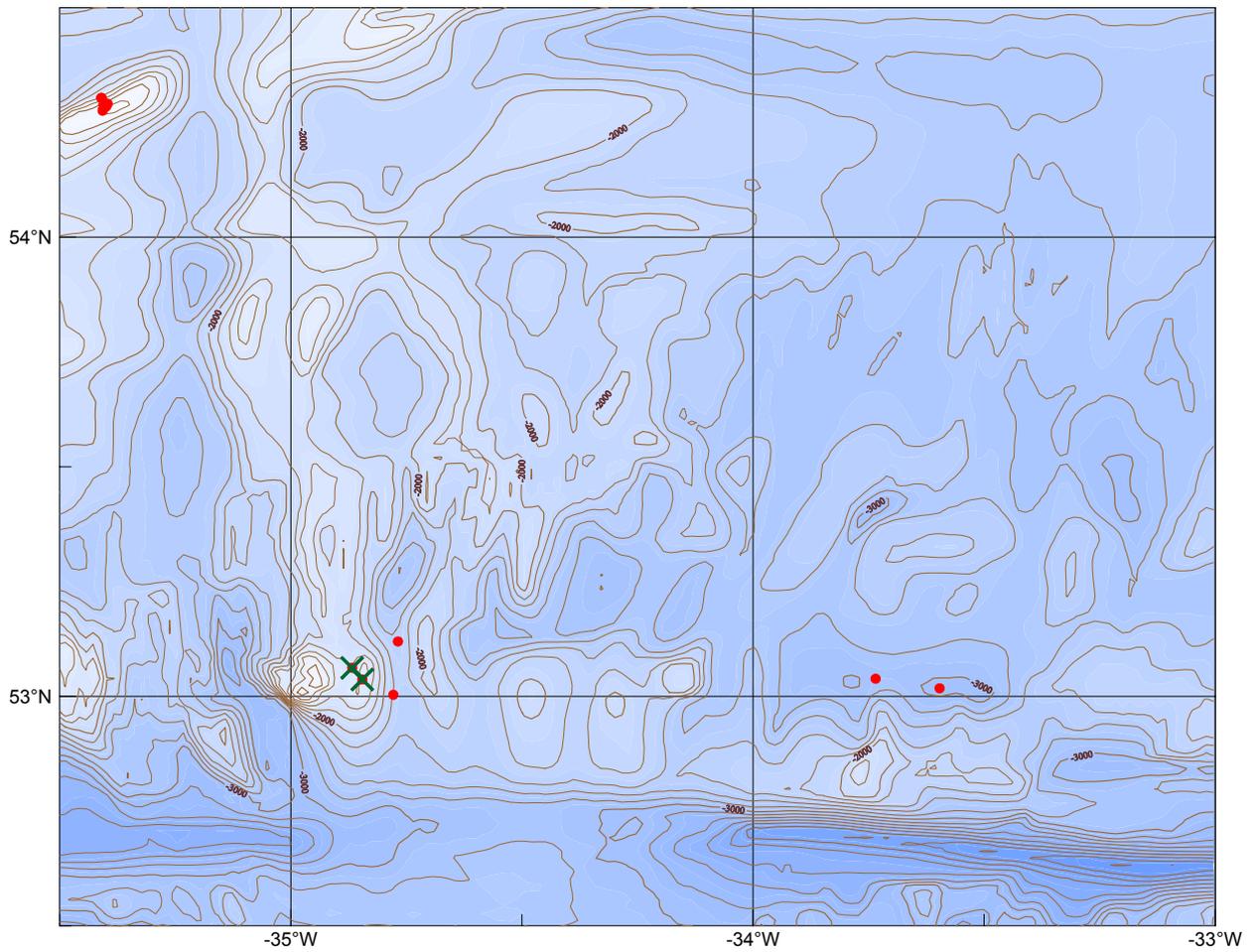


Figure 63 Distribution of *C. rupestris* in Area III. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.20 *Deania calcea*

En: Birdbeak dogfish

No: Gråhå



Figure 64 Picture of an *D. calcea* taken during the cruise.

A total of 19 *D. calcea* was caught during the cruise. The length distribution is shown in Figure 65 and the length range was 81 - 102 cm (mean = 93.7 cm, $n = 18$, $SD = 6.4$ cm). The average weight was 3.13 kg ($SD = 0.87$ kg, $n = 17$).

Only one male with a length of 81 cm was recorded ($n = 17$).

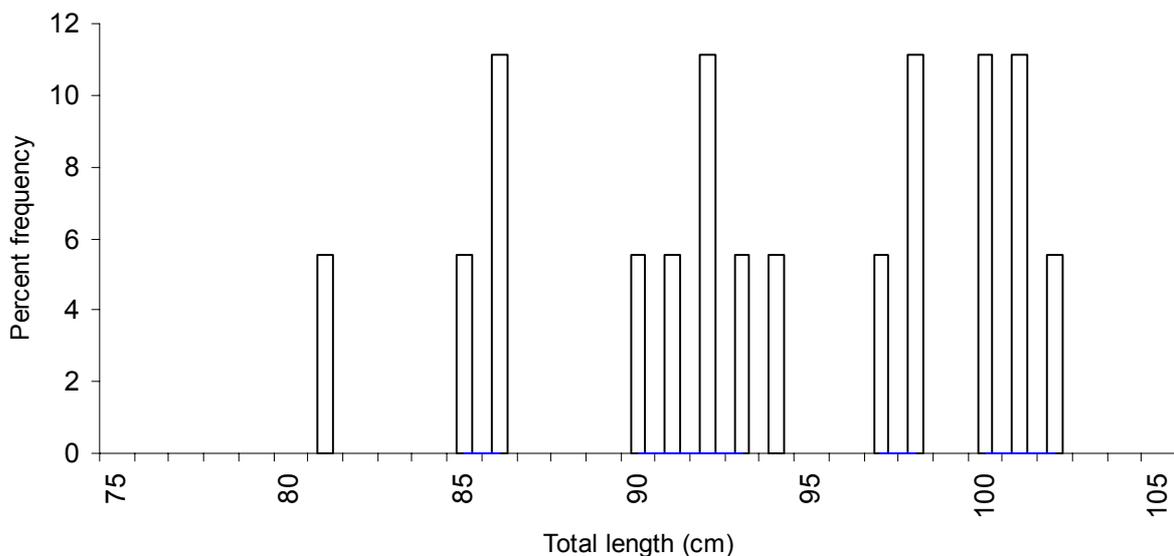


Figure 65 Length distribution of *D. calcea* ($n = 18$)

D. calcea was caught in Area I in the middle and shallowest part of the ridge. It occurred at depths between 1 000 and 3 300 meters, but most were caught between 800 and 1 300 m (Figure 66).

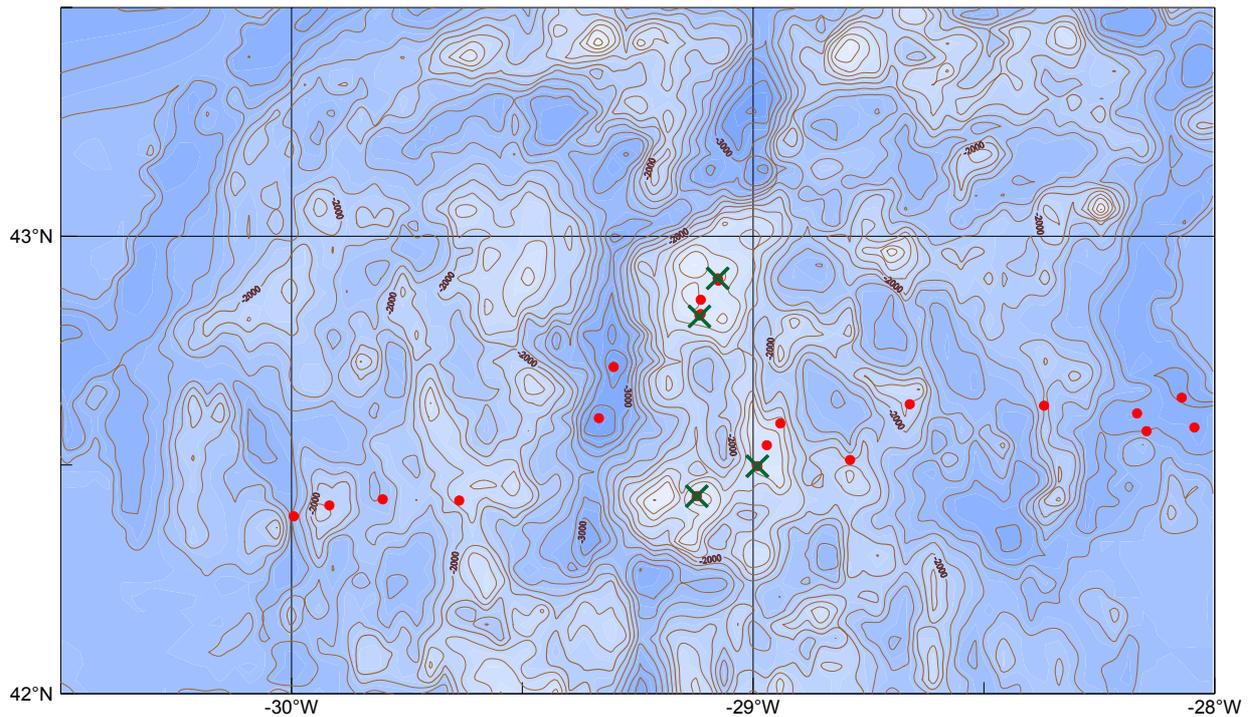


Figure 66 Distribution of *D. calcea* in Area I. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.21 *Etmopterus princeps*

En: Great lanternshark

No: Stor svarthå



Figure 67 Picture of an *E. princeps* taken during the cruise.

A total of 4 440 *E. princeps* was caught during the cruise. The length distribution is shown in Figure 68 and the length range was 27 - 96 cm (mean = 60.6 cm, $n = 1\ 549$, $SD = 9.0$ cm). The average weight was 1.30 kg ($SD = 0.55$ kg, $n = 413$).

The sex distribution was almost equal, but the length distribution was different between the sexes (Figure 68). Males were smaller when females and largest male was 71 cm.

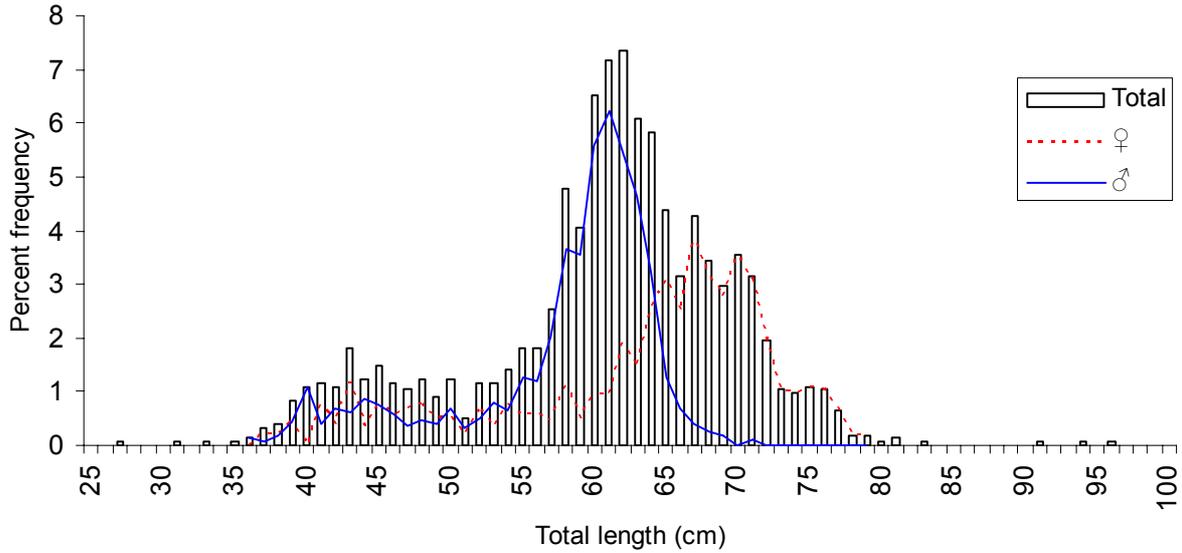


Figure 68 Length distribution of *E. princeps* (n = 1 549). The dotted line shows the portion of the females and the solid line shows the portion of males in each length group.

E. princeps was caught in all areas and occurred on both sides of the ridge in depths between 400 and 2 900 m (Figure 69 - Figure 71), but more rarely in depth below 2000 m. The highest concentrations were found in Area I on the central part of the ridge.

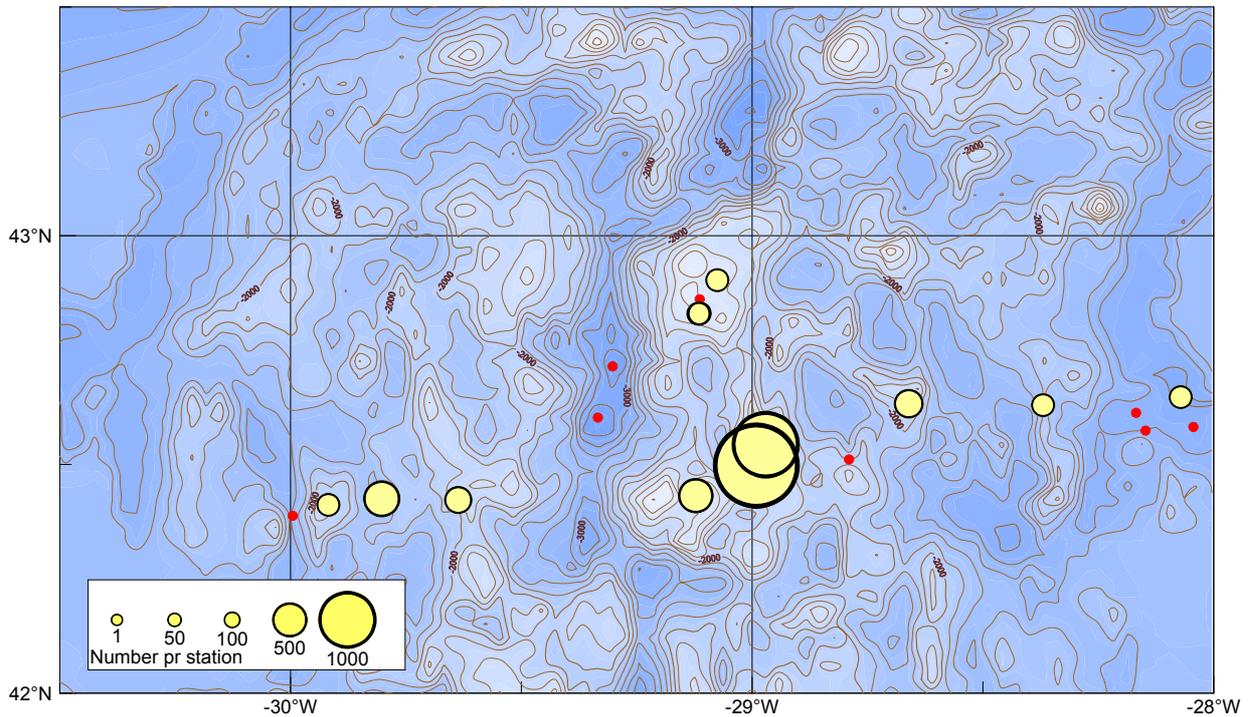


Figure 69 Distribution of *E. princeps* in Area I. Presence of the species on the stations is marked with a yellow circle where the size is proportional with abundance. Dots are stations with no catch of the taxon.

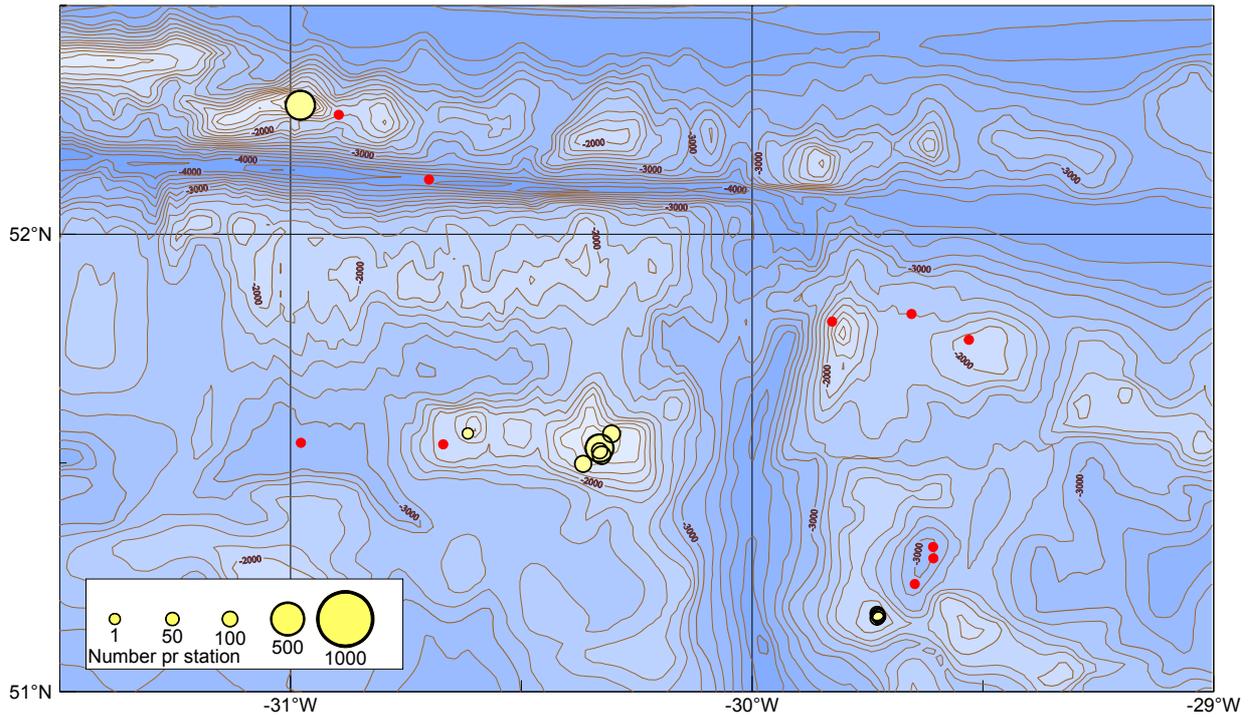


Figure 70 Distribution of *E. princeps* in Area II. Presence of the species on the stations is marked with a yellow circle where the size is proportional with abundance. Dots are stations with no catch of the taxon.

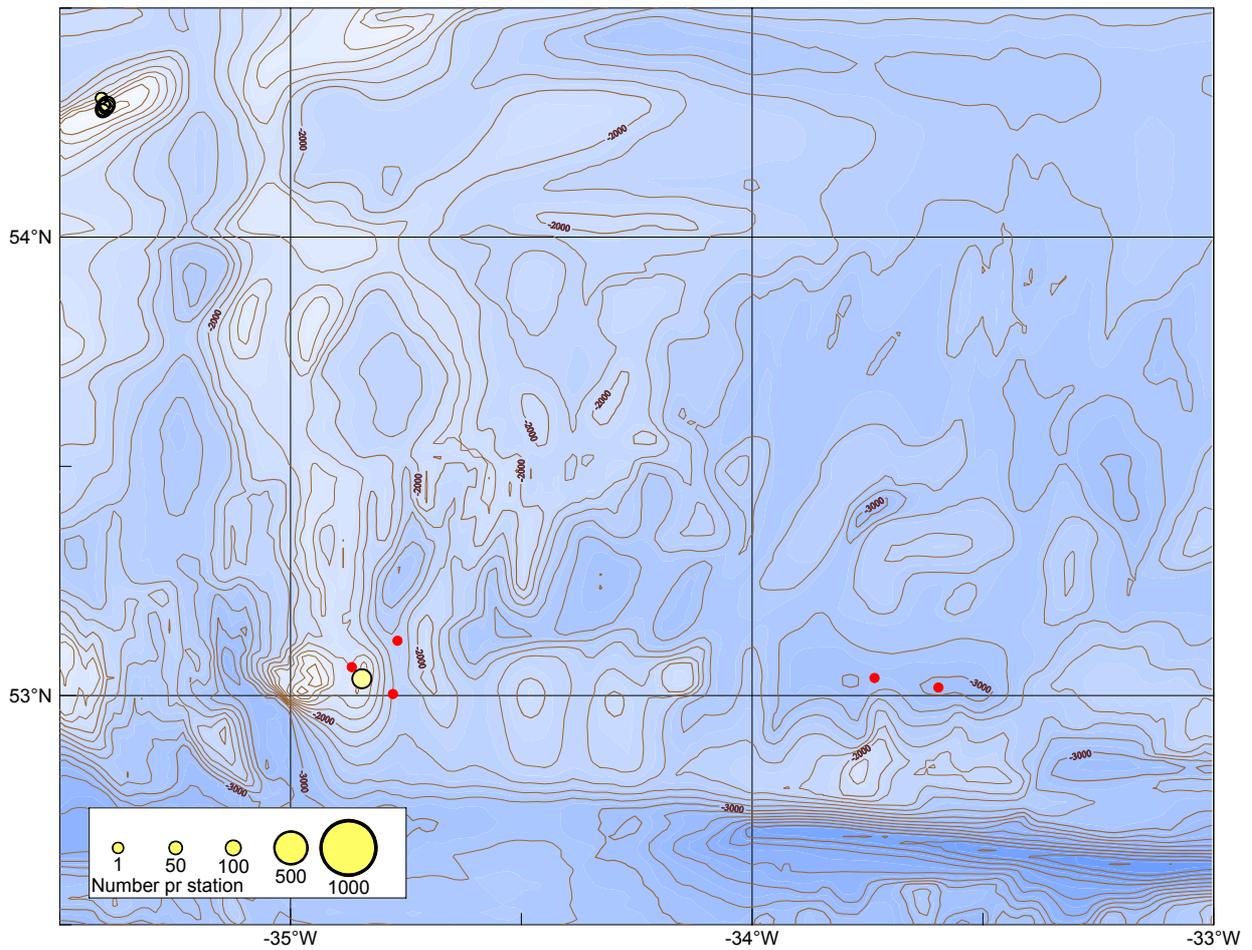


Figure 71 Distribution of *E. princeps* in Area III. Presence of the species on the stations is marked with a yellow circle where the size is proportional with abundance. Dots are stations with no catch of the taxon.

3.1.22 *Galeus murinus*

En: Mouse catshark

No: No name



Figure 72 Picture of an *G. murinus* taken during the cruise.

A total of 4 *G. murinus* was caught during the cruise, two of each sex. The total lengths of these were 47 cm (two), 49 and 51 cm. The average weight was 0.42 kg (SD = 0.03 kg, n = 3).

G. murinus was caught in Area I in the central and shallowest part of the ridge and occurred at depths between 900 and 1 300 m (Figure 73).

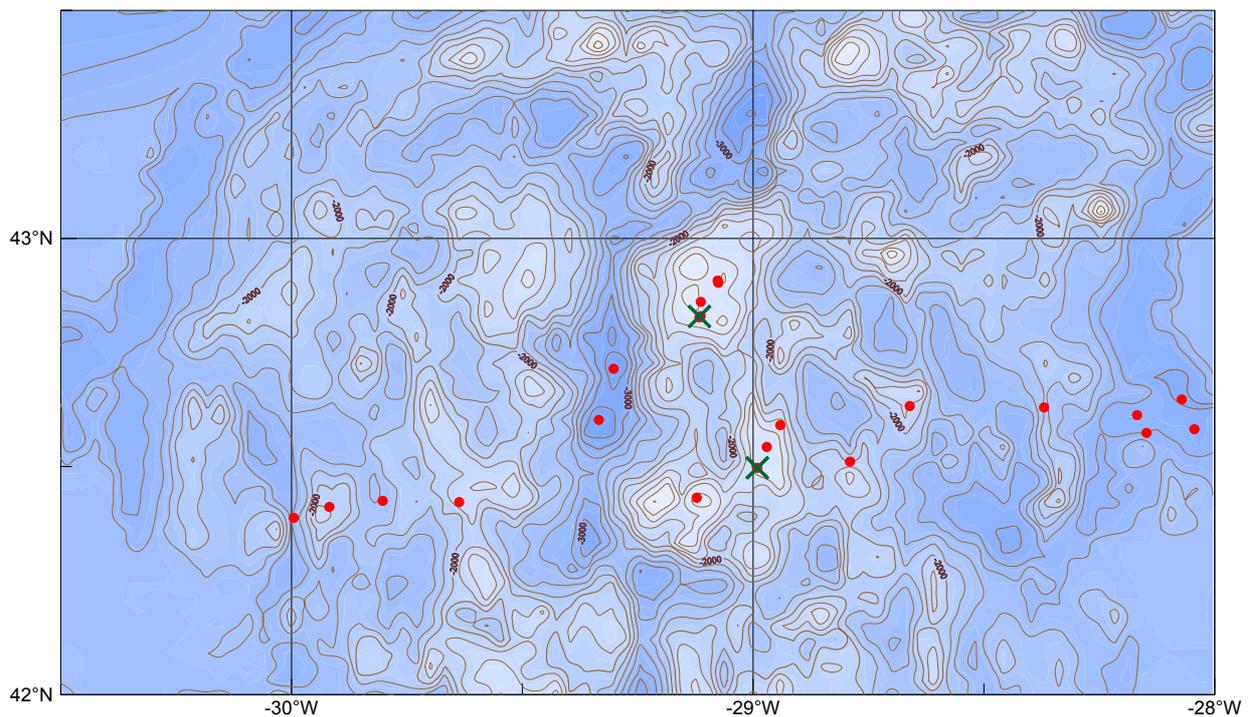


Figure 73 Distribution of *G. murinus* in Area I. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.23 *Histiobranchus bathybius*

En: Deepwater arrowtooth eel

No: Dyphavsål



Figure 74 Picture of an *H. bathybius* taken during the cruise.

A total of 52 *H. bathybius* was caught during the cruise. The length distribution is shown in Figure 75 and the total length range was 37 - 93 cm (mean = 75.0 cm, $n = 51$, $SD = 10.9$ cm). The average weight was 0.90 kg ($SD = 0.34$ kg, $n = 41$). The sex distribution was almost equal.

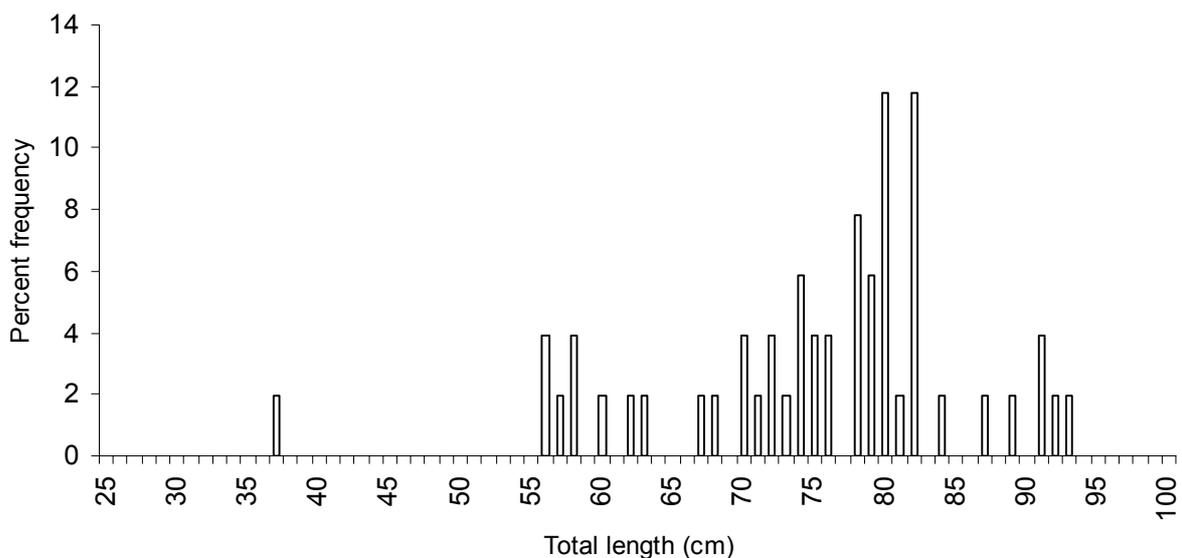


Figure 75 Length distribution of *H. bathybius* ($n = 51$)

H. bathybius was caught in all areas and widely distributed at depths between 800 and 3 300 m. In Area I it was only caught in the central part and eastern side of the ridge. In Area II and III it was caught on both sides of the ridge and on both sides of the Charlie-Gibbs Fracture Zone (Figure 76 - Figure 78).

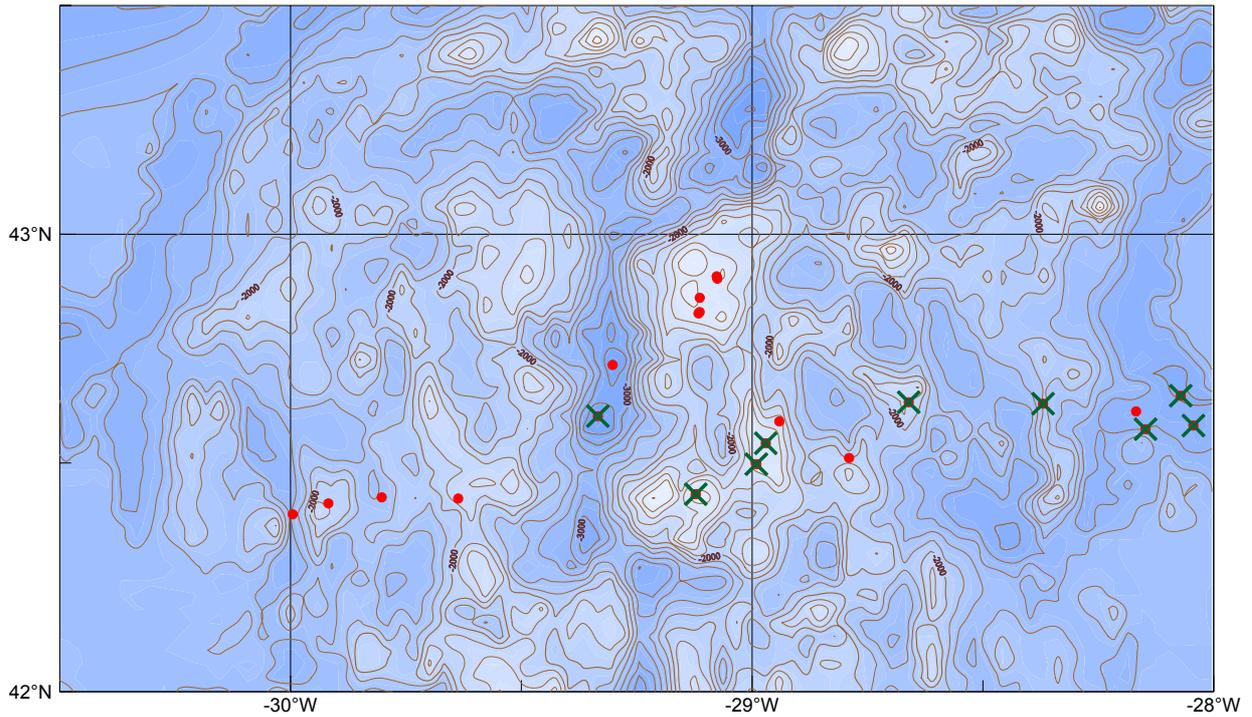


Figure 76 Distribution of *H. bathybius* in Area I. Presence at a station is indicated by a X. Dots are stations with no catch of the taxon.

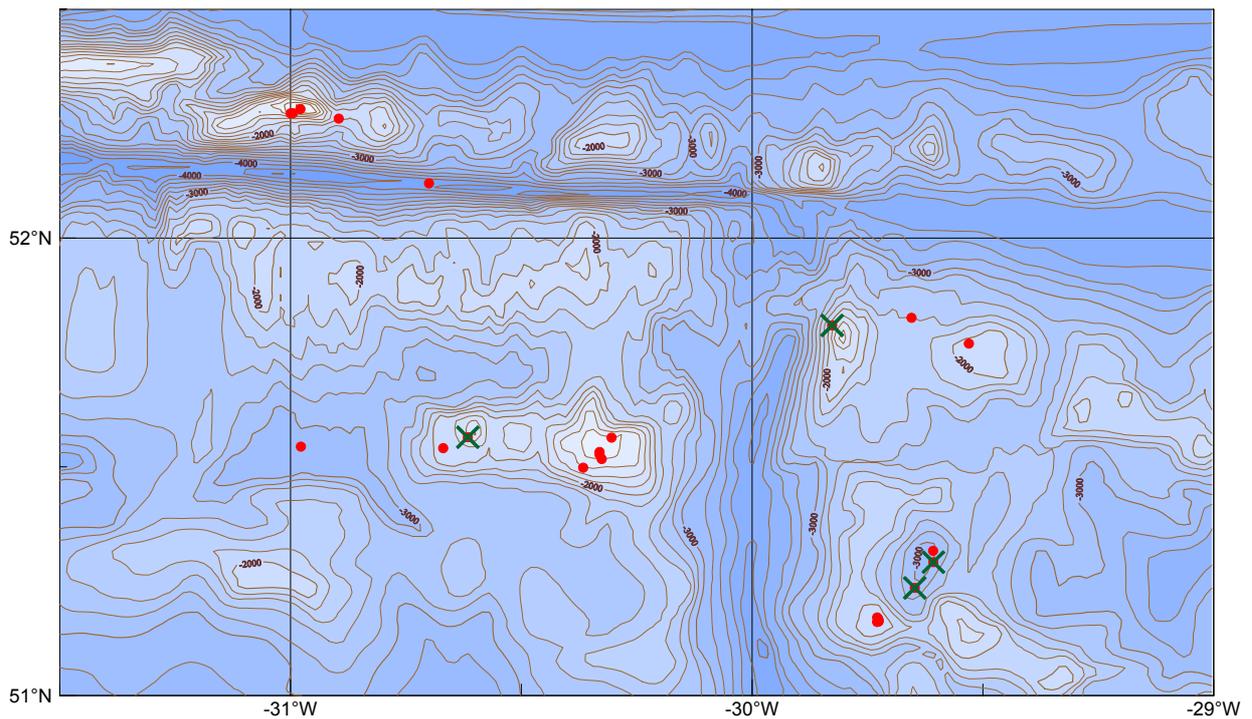


Figure 77 Distribution of *H. bathybius* in Area II. Presence at a station is indicated by a X. Dots are stations with no catch of the taxon.

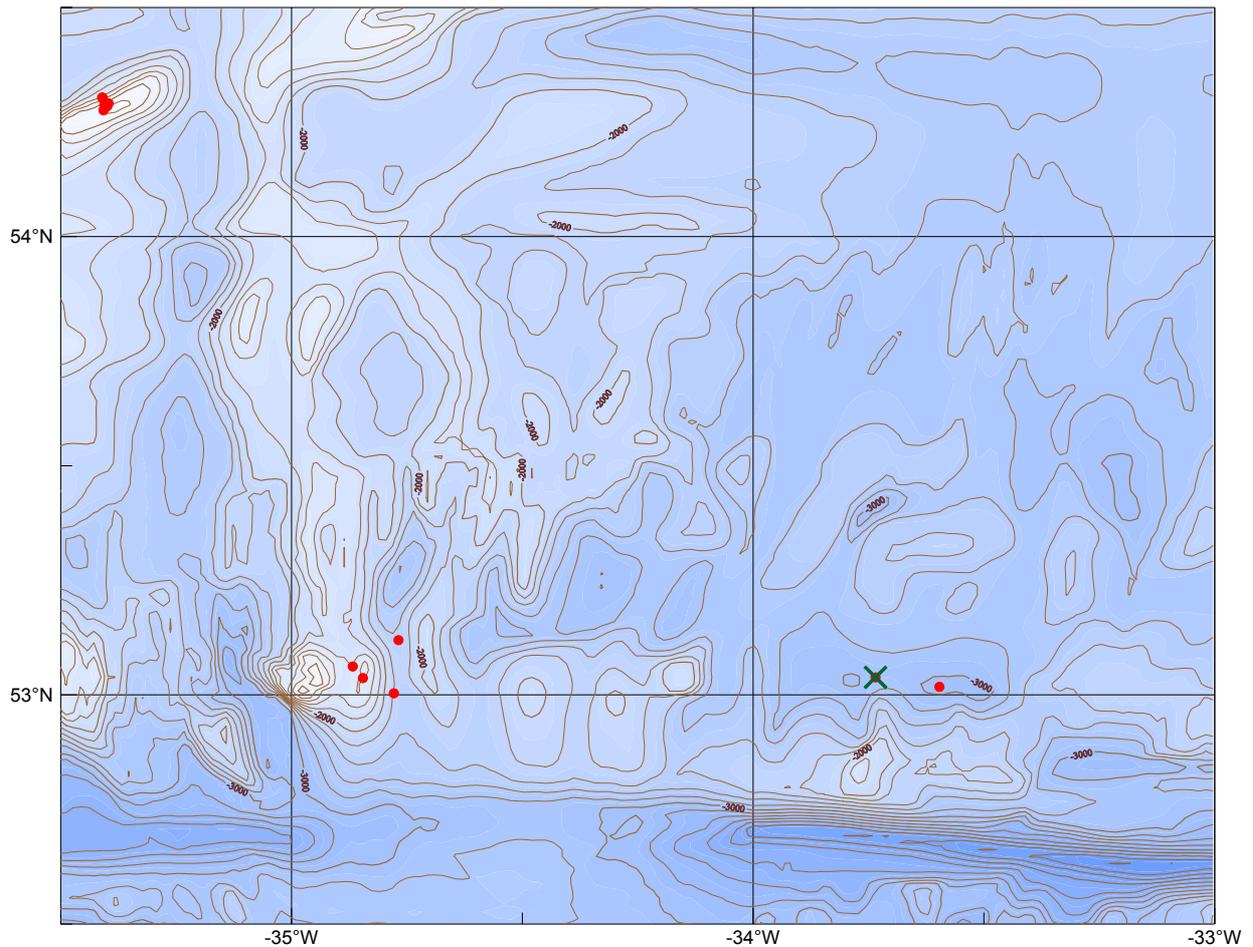


Figure 78 Distribution of *H. bathybius* in Area III. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.24 *Hoplostethus atlanticus*

En: Orange roughy

No: Orange roughy



Figure 79 Picture of two *H. atlanticus* taken during the cruise.

Three *H. atlanticus* was found in the stomach of a *Somniosus microcephalus* (Greenland shark) in the northernmost stations in Area III (Figure 80). The total lengths were 50, 55 and 56 cm.

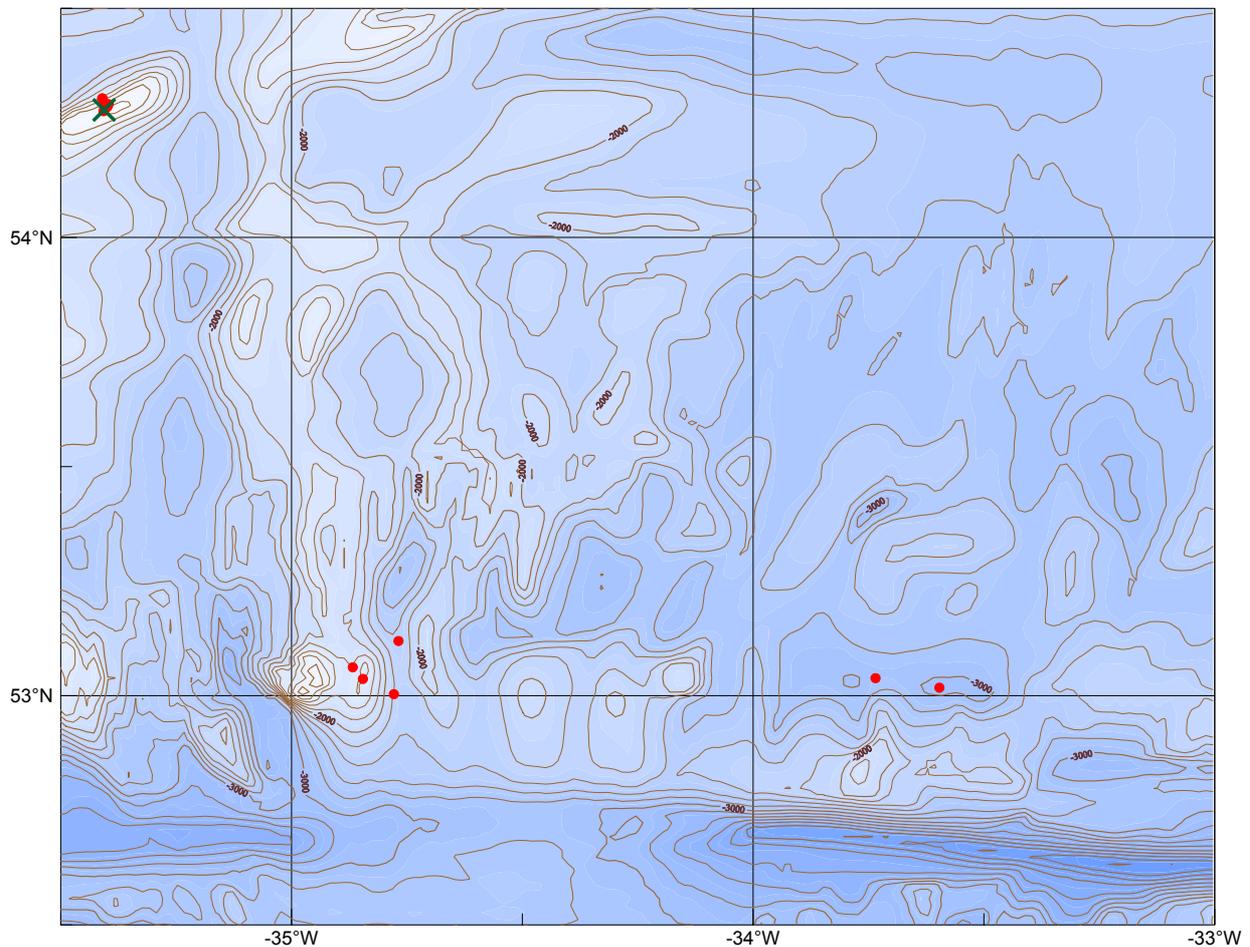


Figure 80 The station where *H. atlanticus* where found in the stomach of a *S. microcephalus* in Area III. Presence at a station is indicates by an X. Dots are stations with no catch of the taxon.

3.1.25 *Hydrolagus affinis*

En: Smalleyed rabbitfish

No: Brun havmus

A total of 122 *H. affinis* was caught during the cruise. The length distribution is shown in Figure 81 and the range of the post second dorsal fin length was 58 - 128 cm (mean = 101.8 cm, n = 120, SD = 15.5 cm). The average weight was 11.73 kg (SD = 4.82 kg, n = 105).

The majority of the *H. affinis* was females (67 %). Males were also smaller then females and the largest male had a post second dorsal fin length of 110 cm (Figure 81).

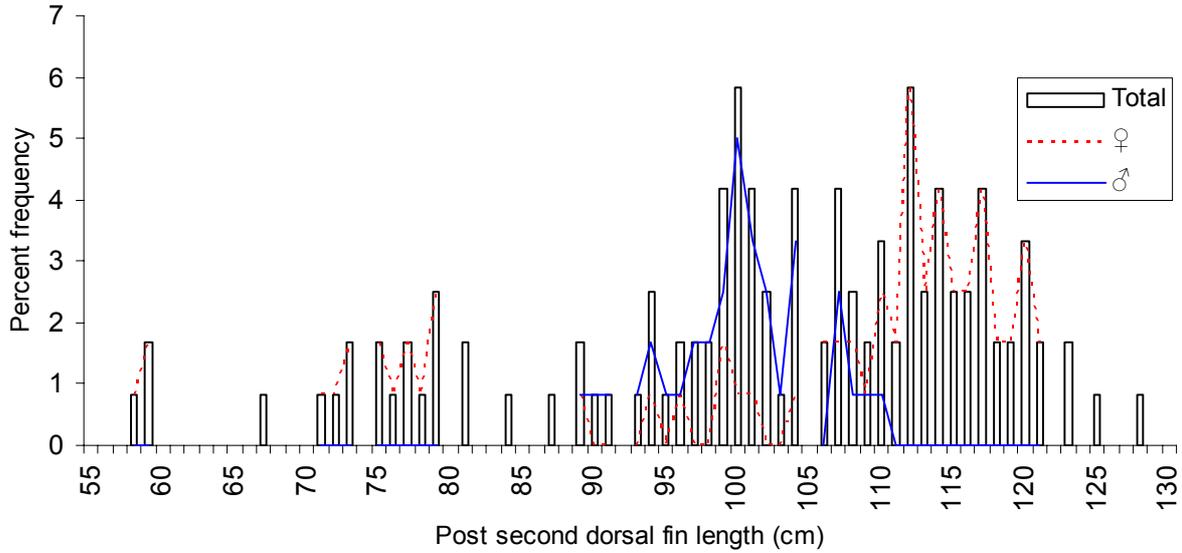


Figure 81 Length distribution of *H. affinis* (n = 120). The dotted line shows the portion of the females and the solid line shows the portion of males in each length group.

H. affinis was caught in all areas and it occurred on both sides of the ridge (Figure 82 - Figure 84). It was caught at depths between 1 300 and 3 000 m, but mostly shallower than 2 000 m.

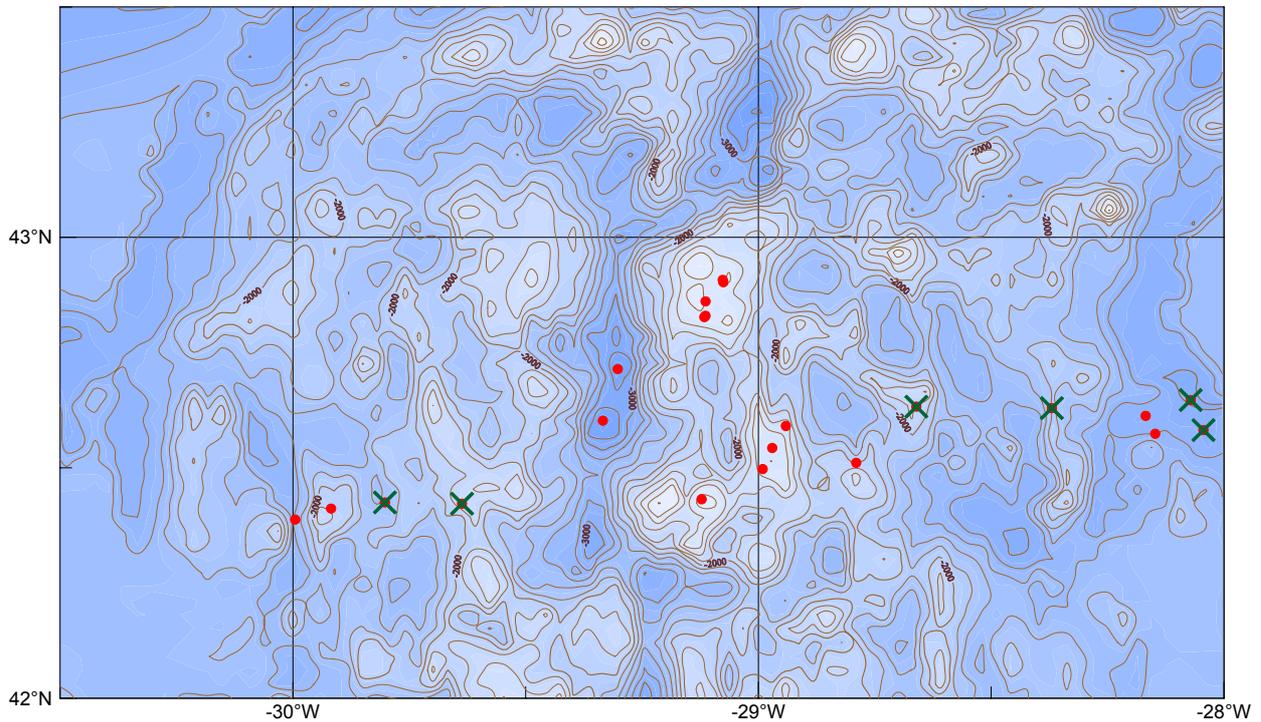


Figure 82 Distribution of *H. affinis* in Area I. Presence at a station is indicated by a X. Dots are stations with no catch of the taxon.

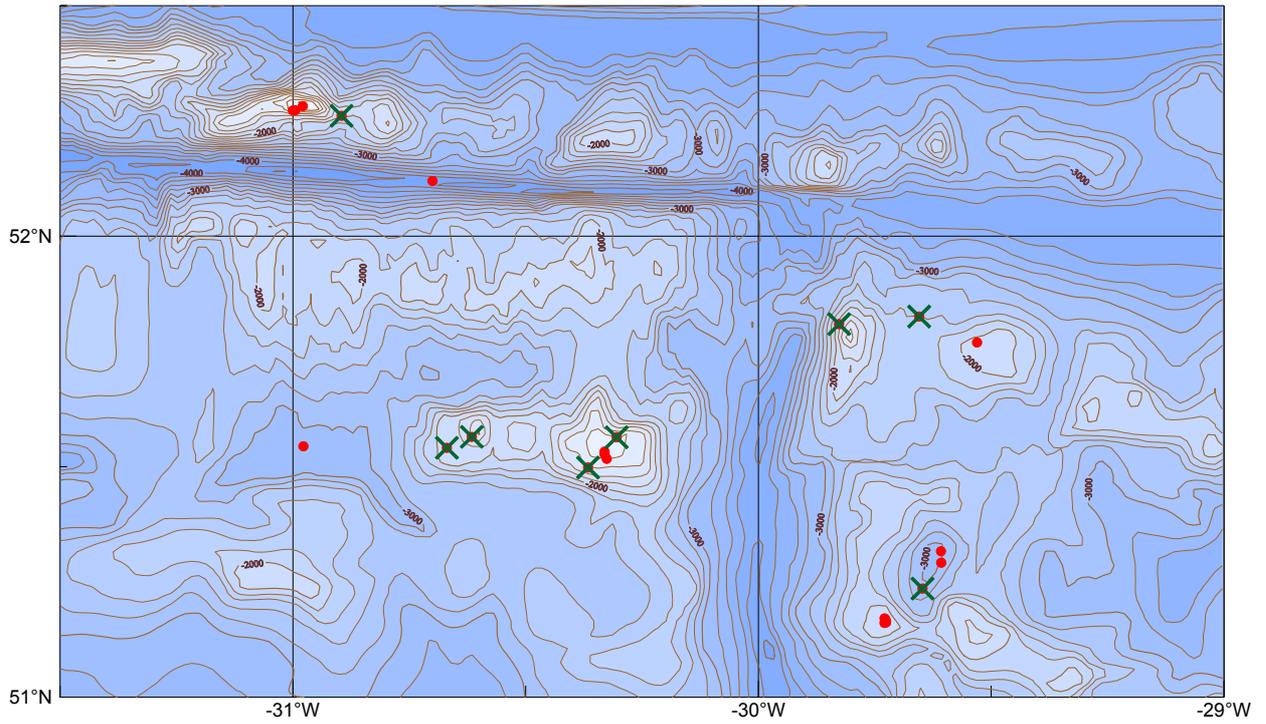


Figure 83 Distribution of *H. affinis* in Area II. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

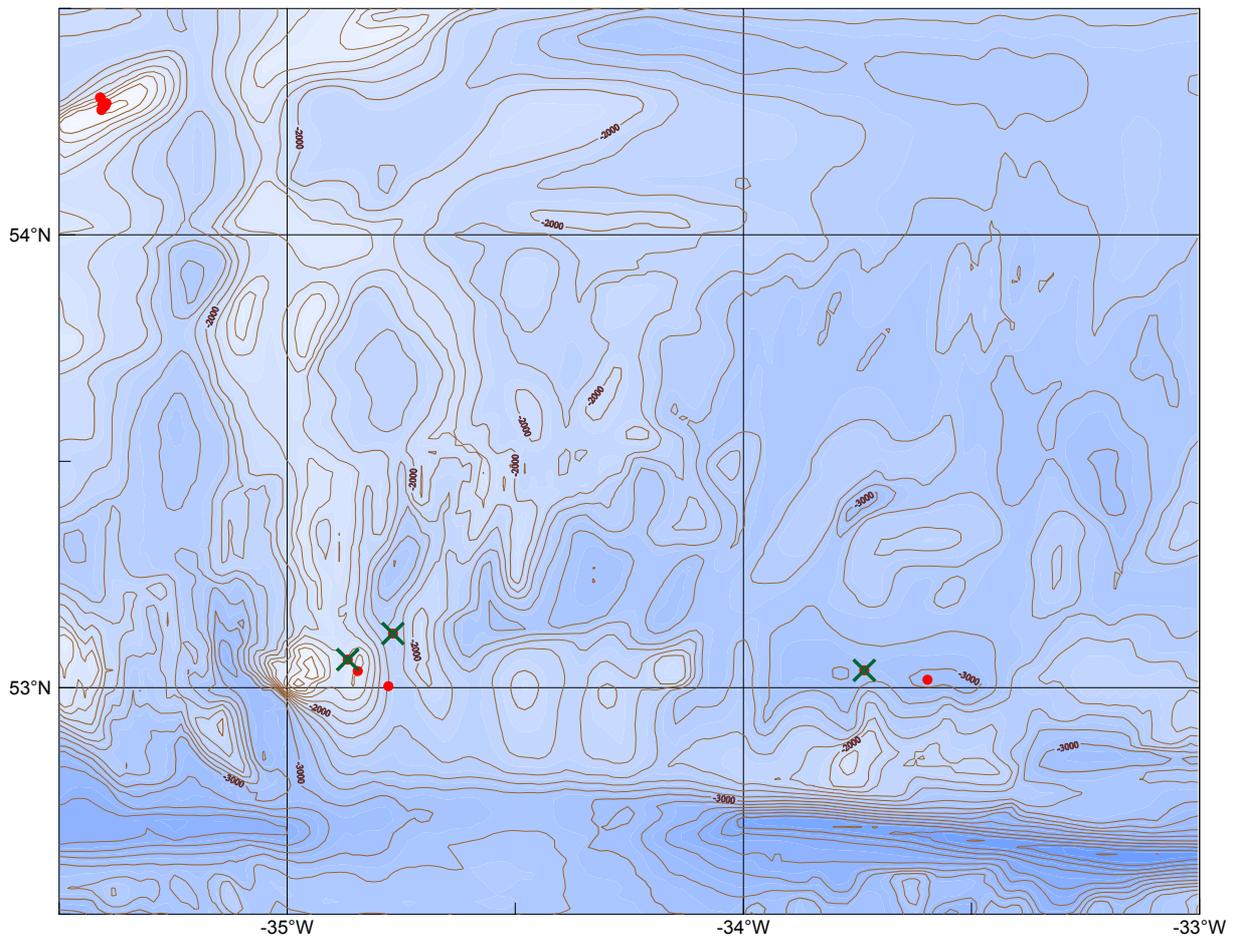


Figure 84 Distribution of *H. affinis* in Area III. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.26 *Hydrolagus pallidus*

En: Bigeyed rabbitfish

No: Hvit havmus

A total of 63 *H. pallidus* was caught during the cruise. The length distribution is shown in Figure 85 and the range of the post second dorsal fin length was 58 - 120 cm (mean = 94.1 cm, n = 61, SD = 13.5 cm). The average weight was 9.00 kg (SD = 3.45 kg, n = 61).

The majority of the recorded *H. pallidus* was females (80 %). There was no size difference between the sexes.

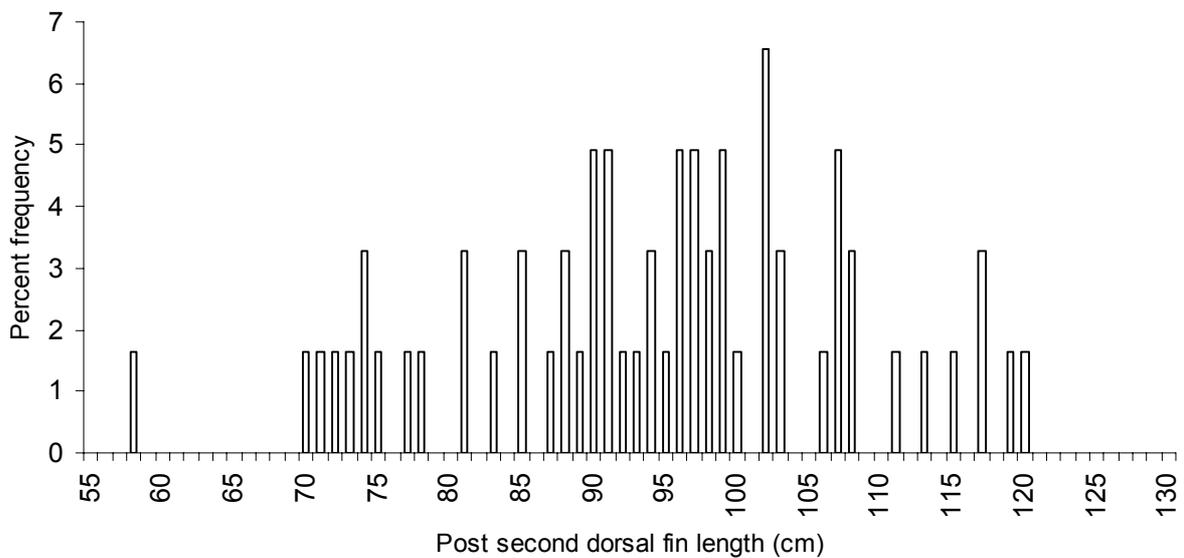


Figure 85 Length distribution of *H. pallidus* (n = 61)

H. pallidus was caught in all areas and on both sides of the ridge (Figure 86 - Figure 88). It occurred more or less evenly distributed at depths between 800 and 2 700 m.

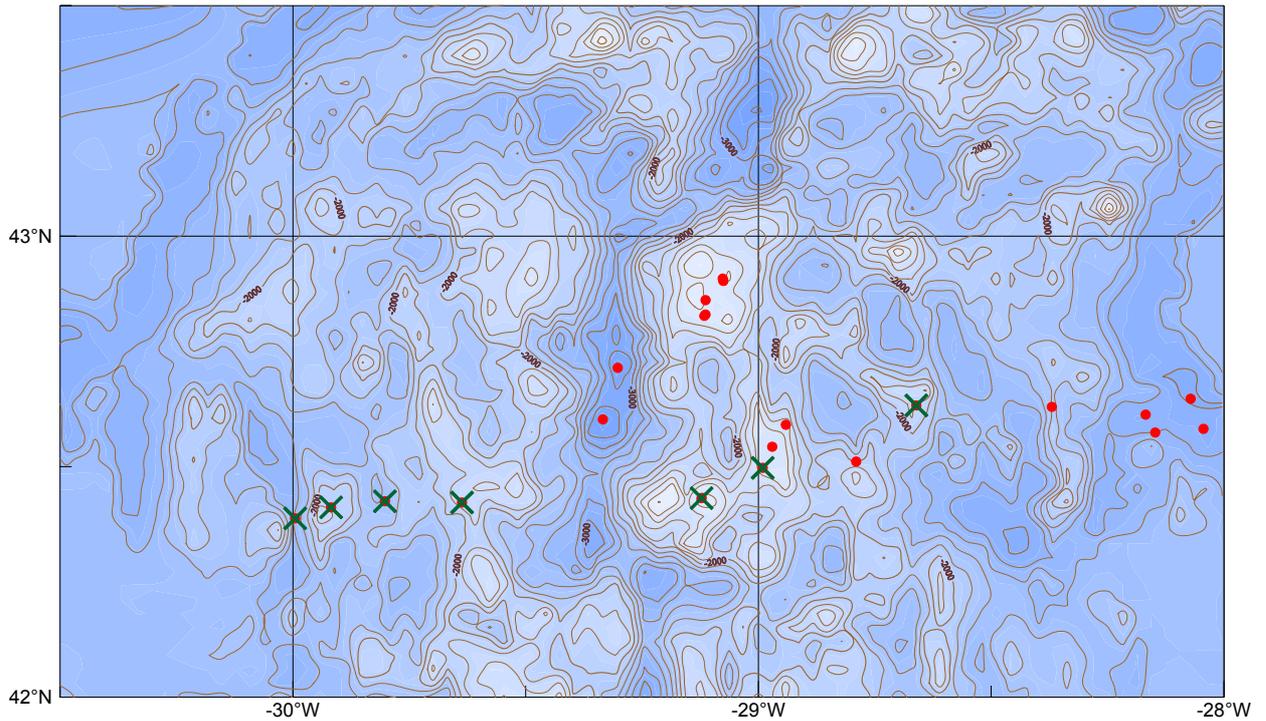


Figure 86 Distribution of *H. pallidus* in Area I. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

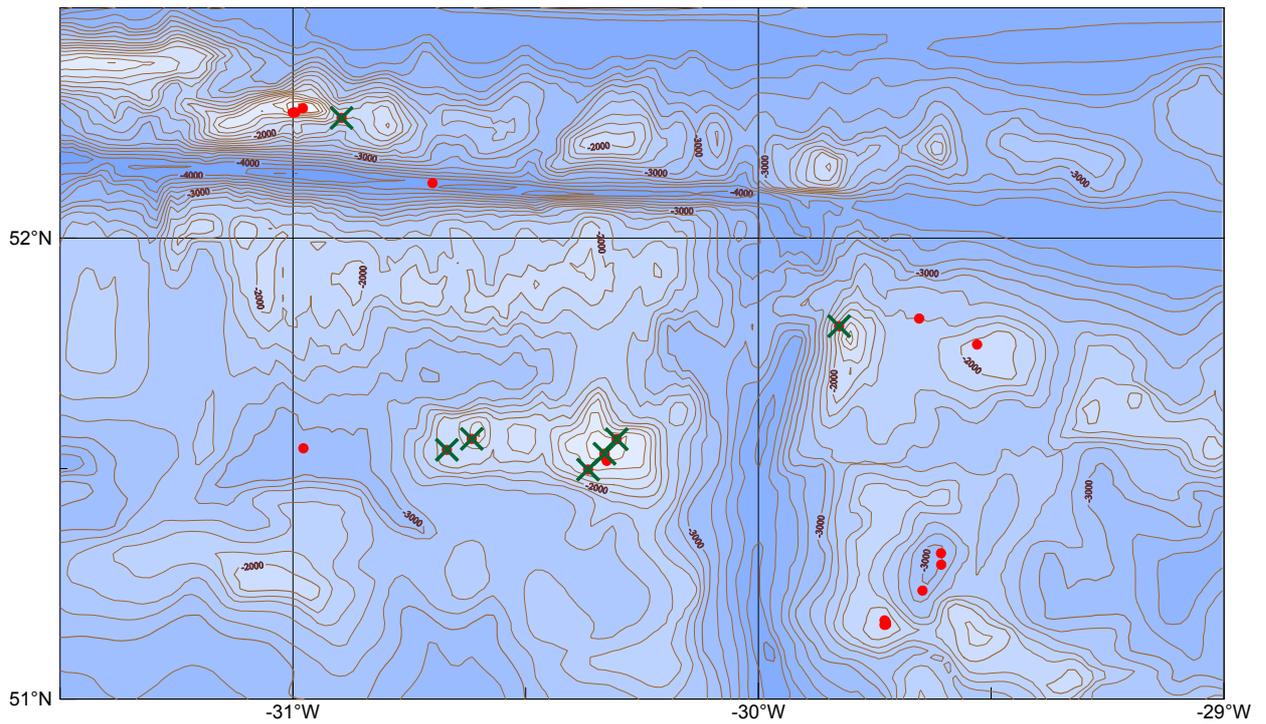


Figure 87 Distribution of *H. pallidus* in Area II. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

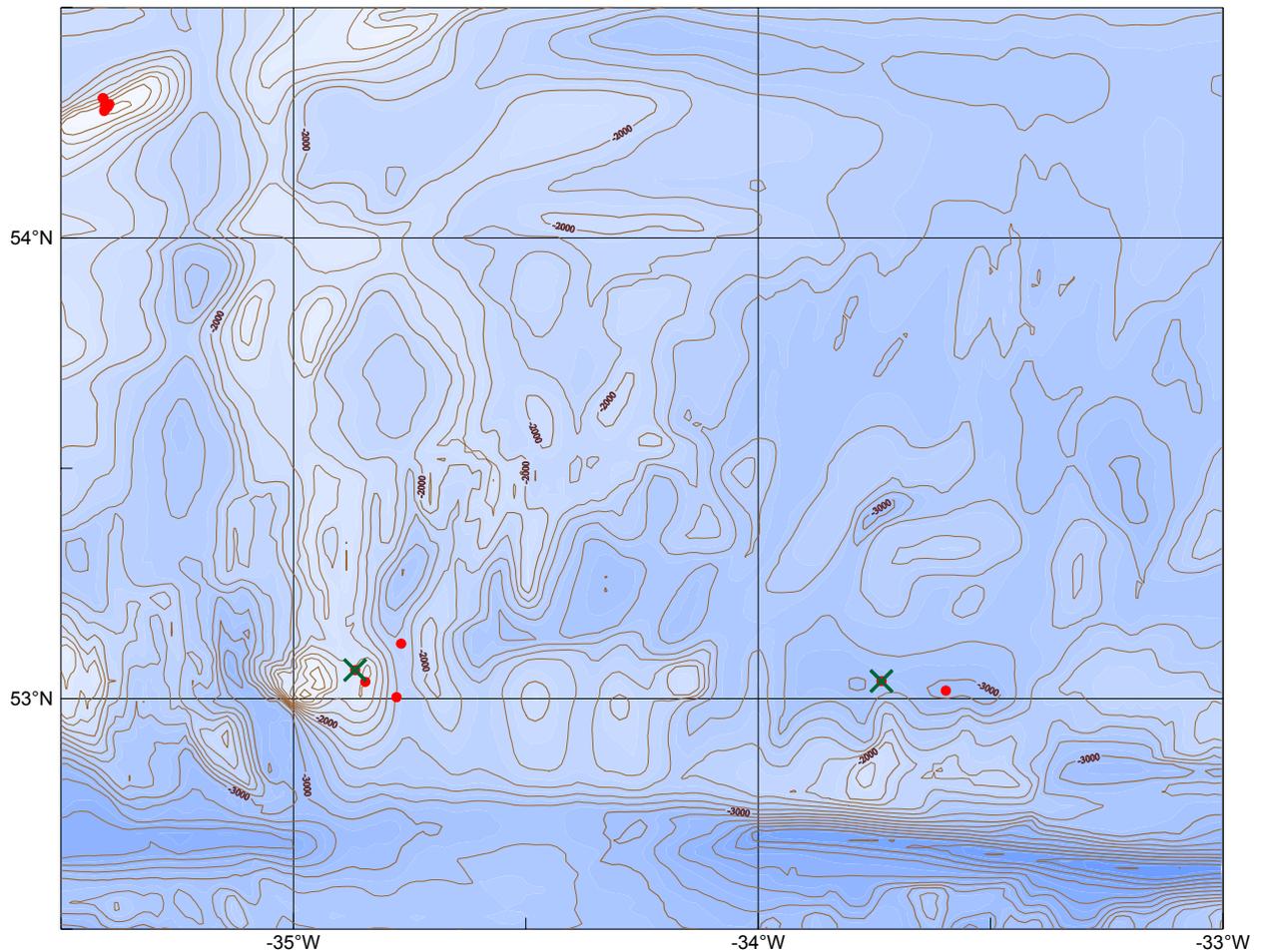


Figure 88 Distribution of *H. pallidus* in Area III. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.27 *Lepidion eques*

En: North Atlantic Codling

No: Dyphavsmoride

A total of 25 *L. eques* was caught during the cruise. The length distribution is shown in Figure 89 and the range of the total length was 31 - 47 cm (mean = 37.8 cm, n = 25, SD = 4.0 cm). The average weight was 0.37 kg (SD = 0.10 kg, n = 24). 41 % of the specimens were females (n = 19).

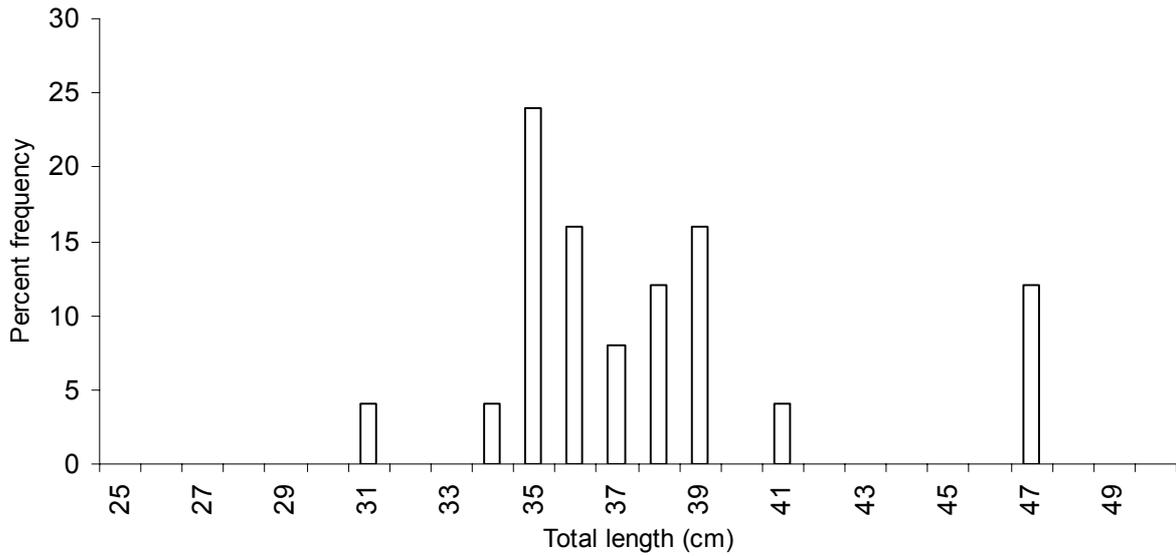


Figure 89 Length distribution of *L. eques* (n = 25).

L. eques was caught in all areas and at depths between 500 and 1 500 meters (Figure 90 - Figure 92). In Area I it occurred on the central part of the ridge, while in Area II and III it was recorded on most of the investigated hills.

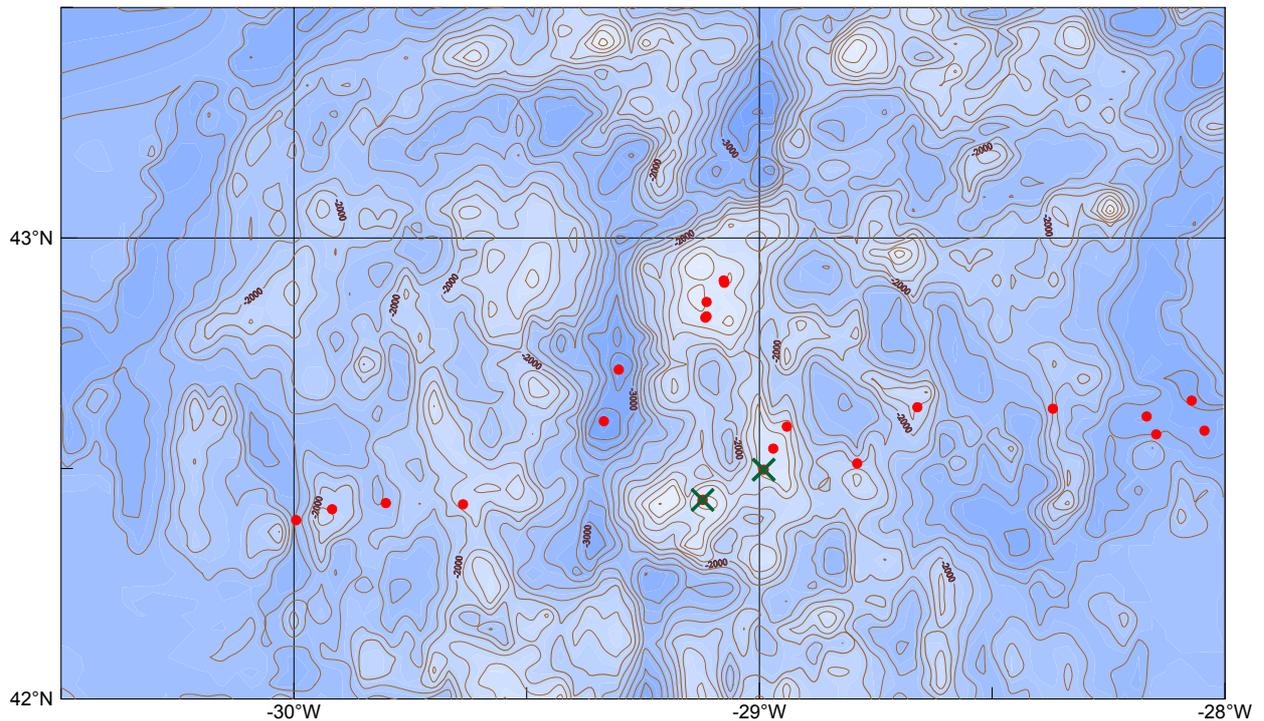


Figure 90 Distribution of *L. eques* in Area I. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

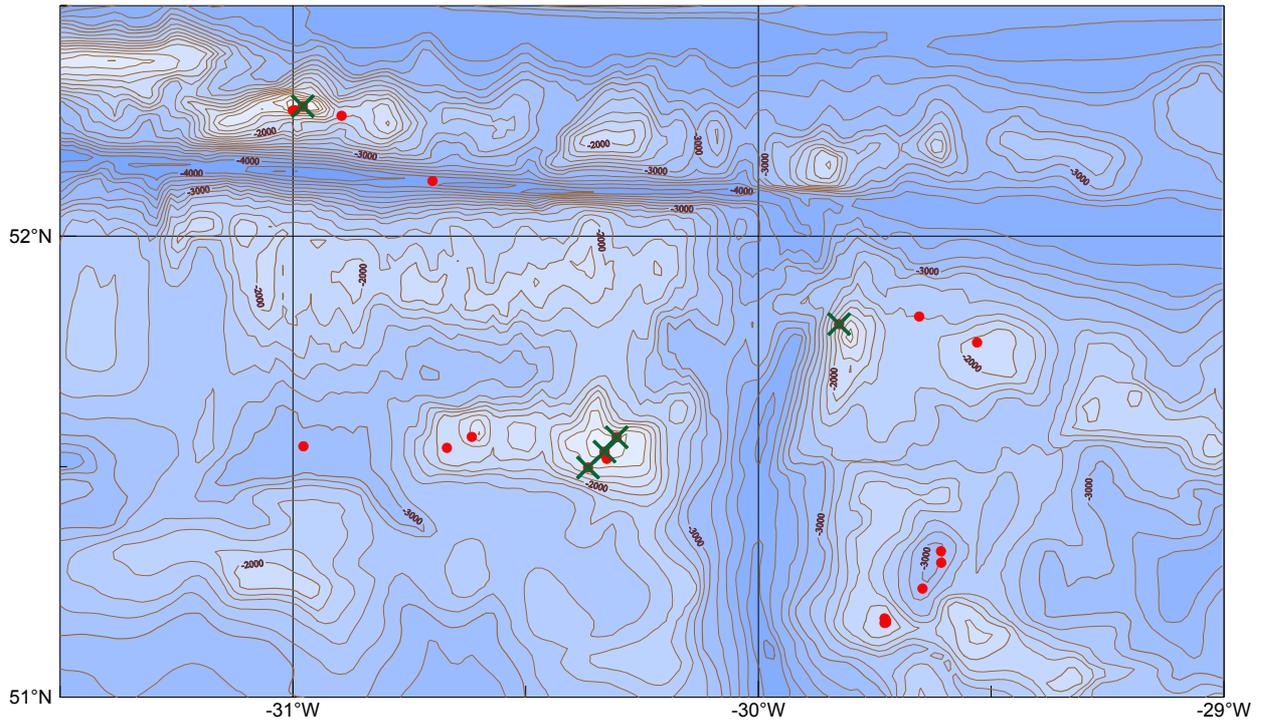


Figure 91 Distribution of *L. eques* in Area II. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

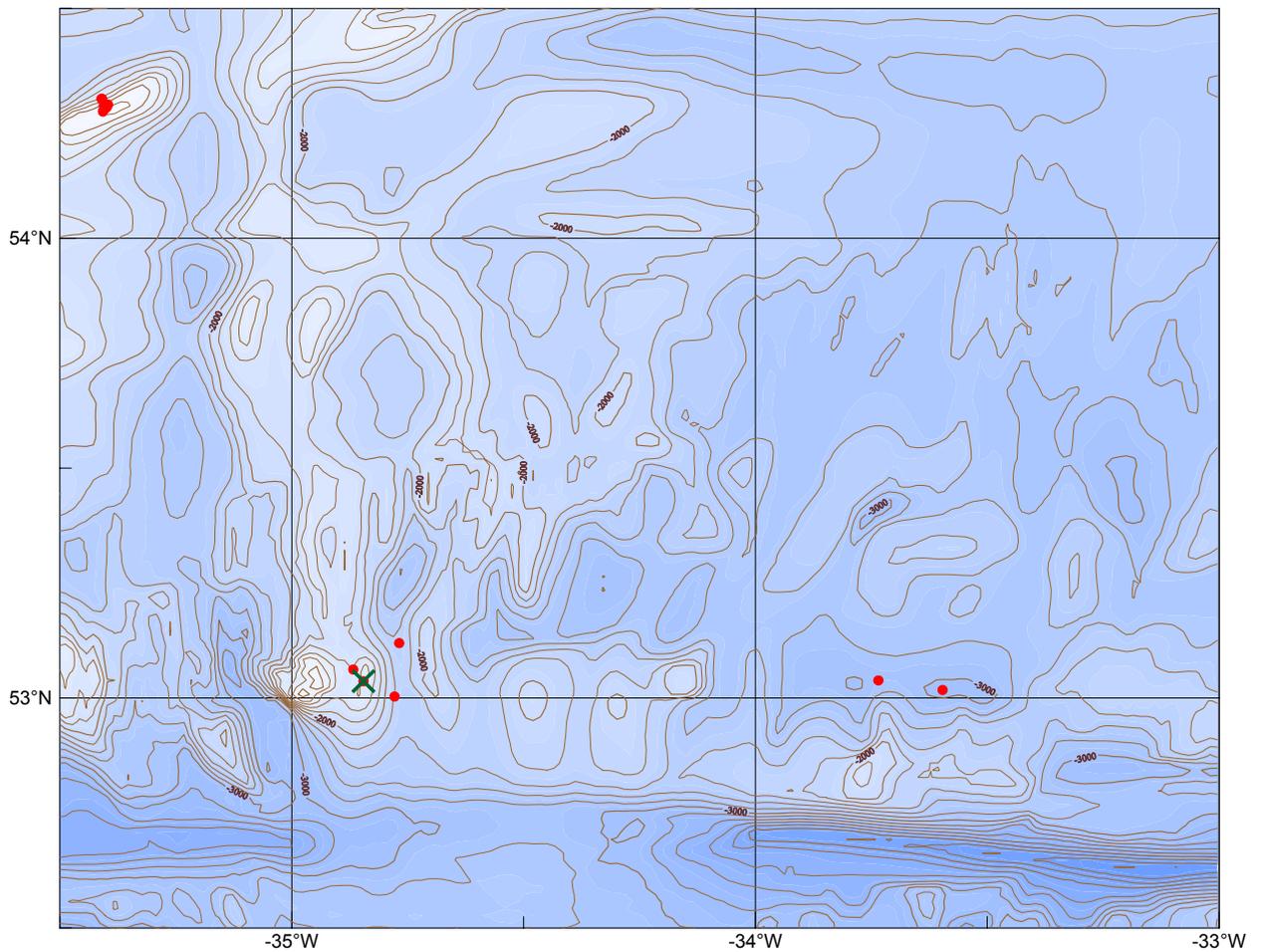


Figure 92 Distribution of *L. eques* in Area III. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.28 *Lepidion guentheri*

En: No name

No: No name



Figure 93 Picture of an *L. guentheri* taken during the cruise.

A total of 19 *L. guentheri* was caught during the cruise. The length distribution is given in Figure 94. The average weight was 1.85 kg (SD = 1.08 kg, n = 14).

Six out of nine specimens that were sexed were females. The largest male had a total length of 57 cm.

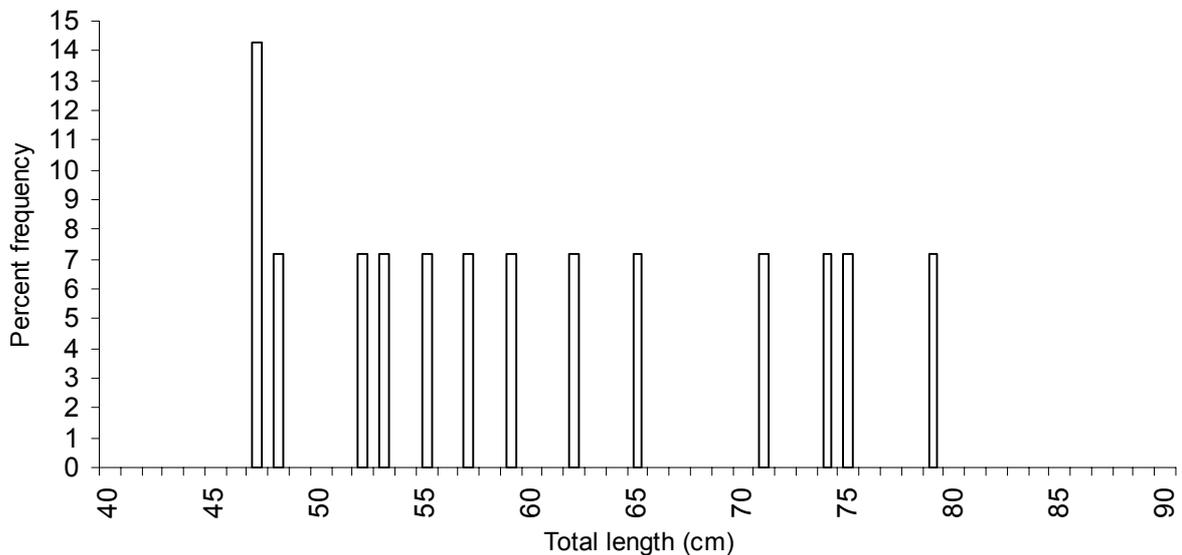


Figure 94 Length distribution of *L. guentheri* (n = 14)

L. guentheri was caught in the Area I, in the central and on the eastern side of the ridge at depths between 800 and 2300 m (Figure 95).

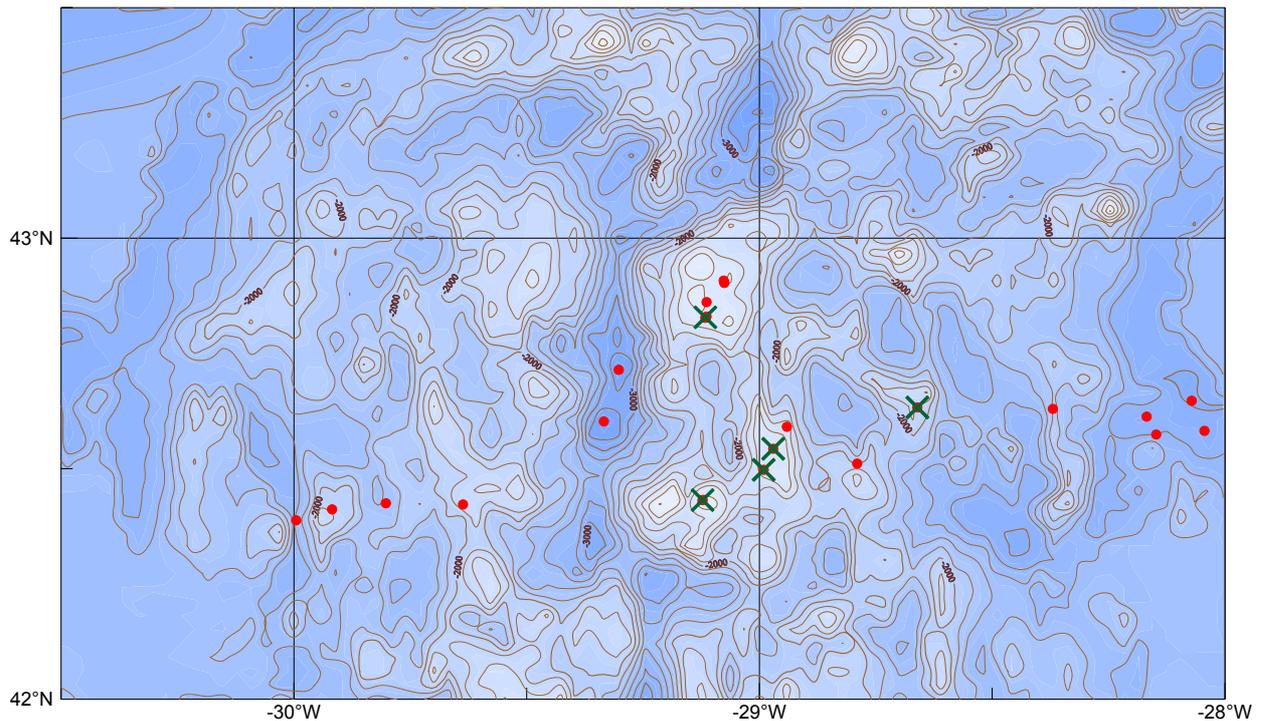


Figure 95 Distribution of *L. guentheri* in Area I. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.29 *Lepidion schmidti*

En: No name
No: No name



Figure 96 Picture of a *Lepidion schmidti* taken during the cruise.

A total of 47 *L. schmidti* was caught during the cruise. The length distribution is shown in Figure 97 and the range was 46 - 138 cm (mean = 91.5 cm, n = 44, SD = 19.5 cm). The average weight was 7.58 kg (SD = 5.51 kg, n = 42). 41 % of the sexed *L. schmidti* was females (n = 40).

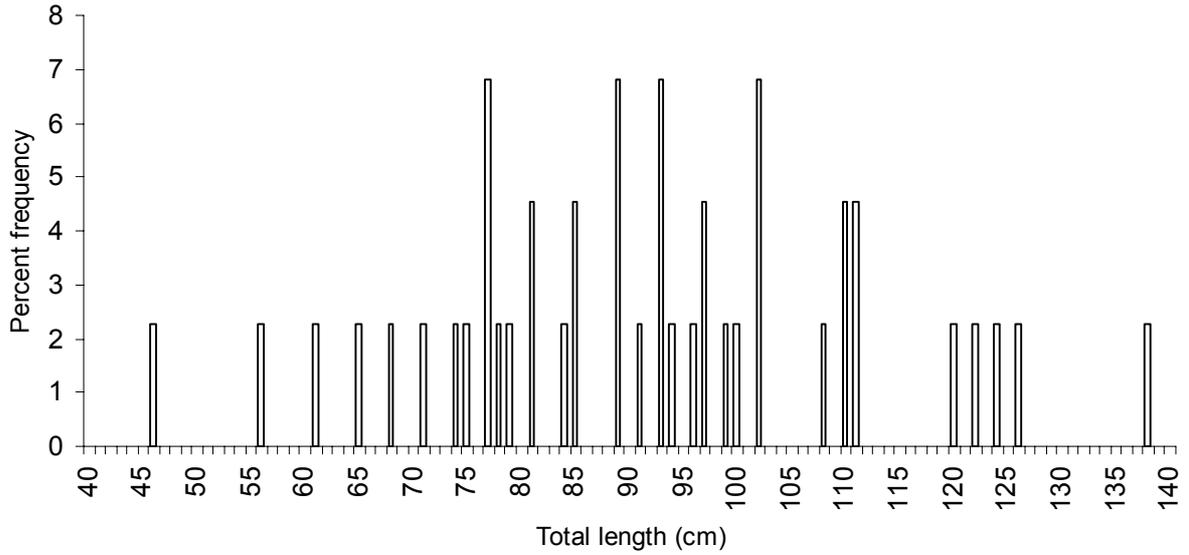


Figure 97 Length distribution of *L. schmidti* (n = 44)

L. schmidti was caught in Area I and Area II and it occurred on both sides of the ridge and north of Charlie-Gibbs Fracture Zone. The depth range was 1 300 to 2 400 m (Figure 98 and Figure 99).

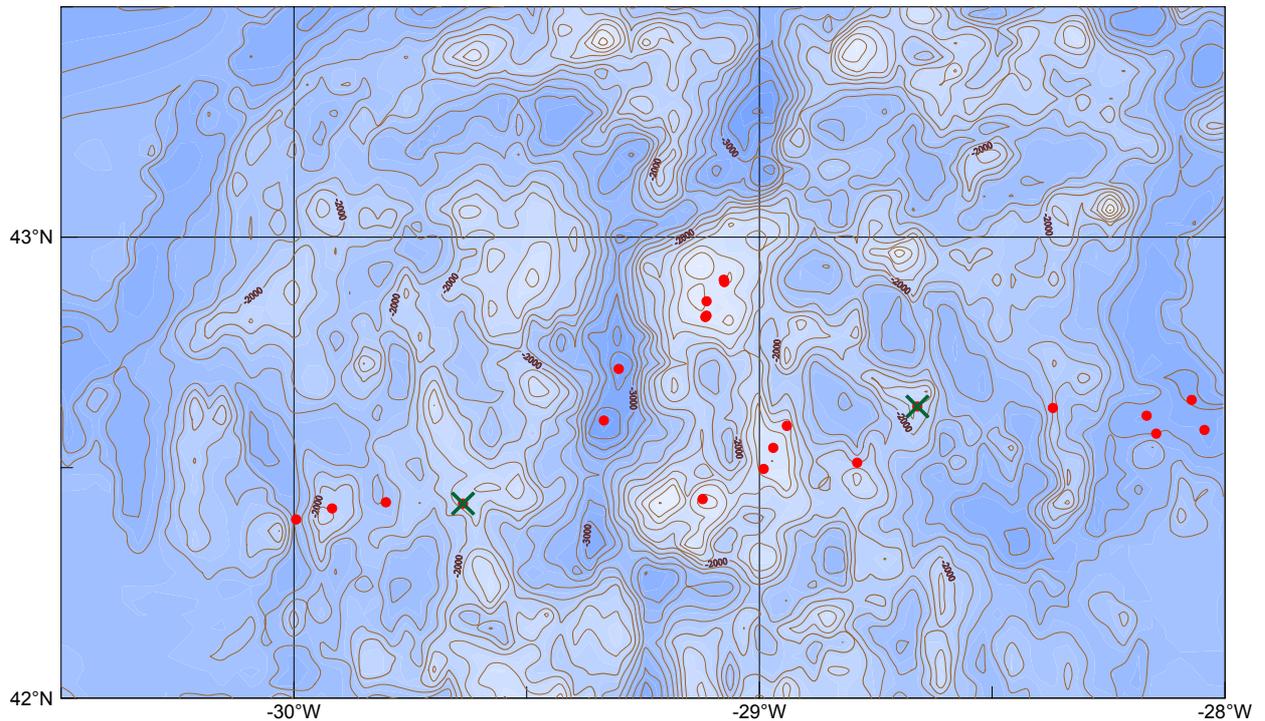


Figure 98 Distribution of *L. schmidti* in Area I. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

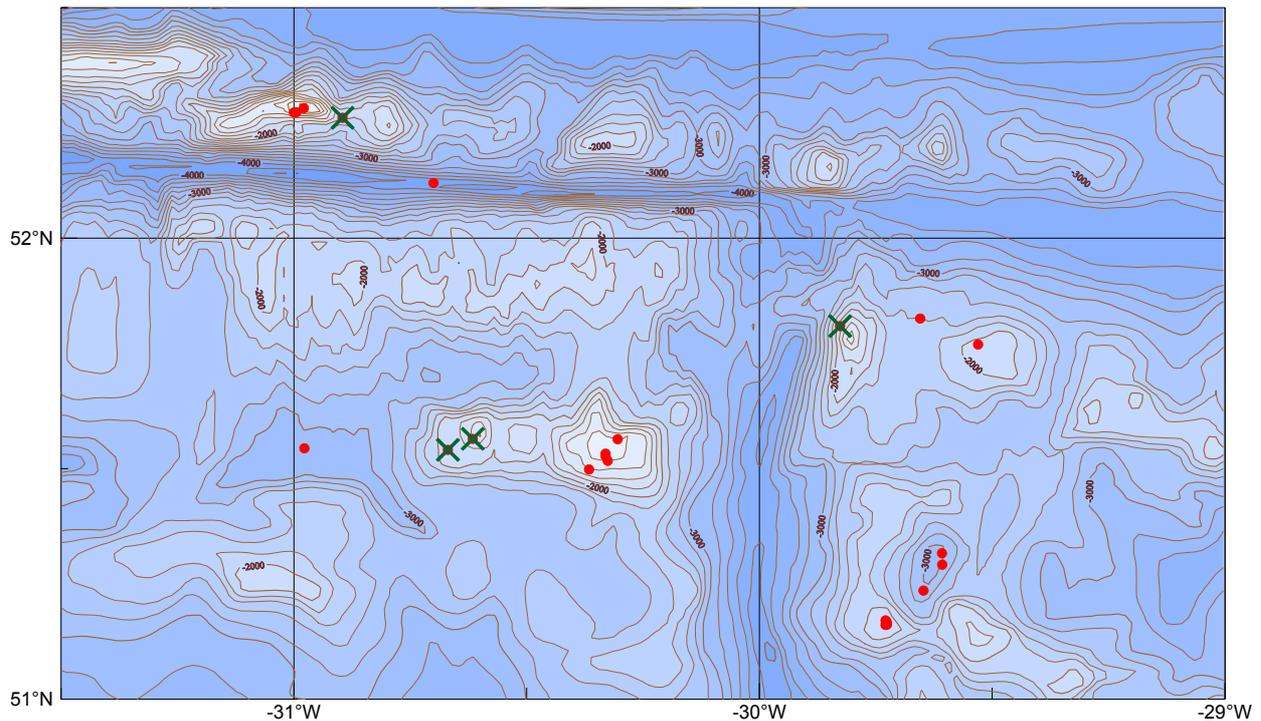


Figure 99 Distribution of *L. schmidti* in Area II. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.30 *Macrourus berglax*

En: Onion-eye grenadier (Roughhead grenadier)

No: Isgalt

A total of 281 *M. berglax* was caught during the cruise. The length distribution is shown in Figure 100 and the range of the preanal fin length was 14.5 - 49 cm (mean = 26.4 cm, n = 278, SD = 8.3 cm). The average weight was 2.27 kg (SD = 2.33 kg).

62 % of the *M. berglax* were females. Males were smaller than females and the largest male had a preanal fin length of 26 cm (Figure 100).

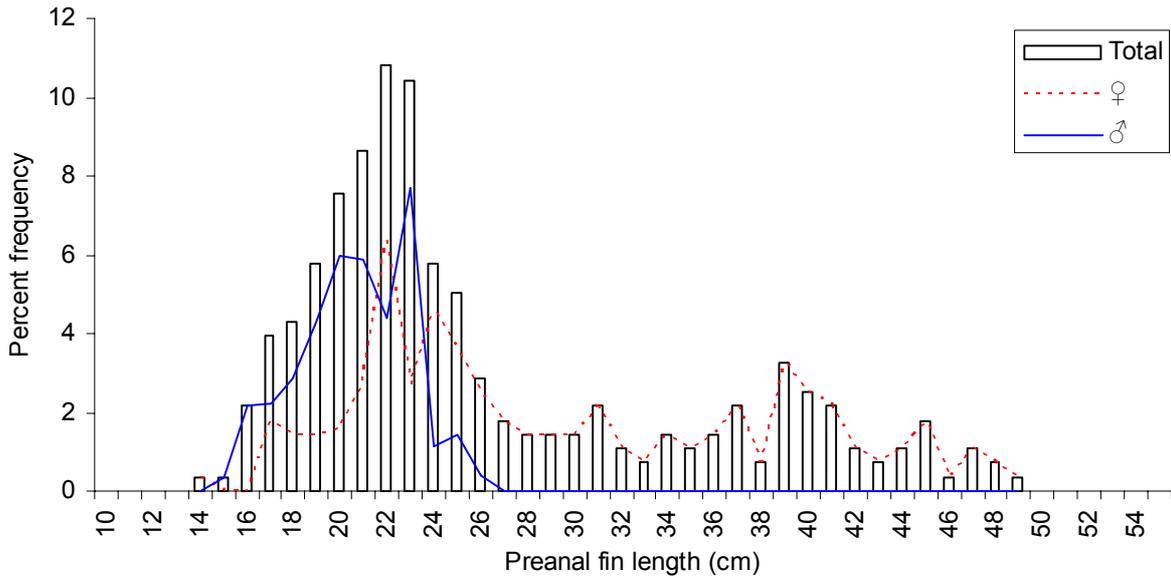


Figure 100 Length distribution of *M. berglax* (n = 278). The dotted line shows the portion of the females and the solid line shows the portion of males in each length group.

M. berglax was caught in the two northernmost areas, both north and south of Charlie-Gibbs Fracture zone and on both sides of the ridge at depths between 500 and 2 100 meters (Figure 101 - Figure 102). The highest catches were made in Area II in the east-central part of ridge.

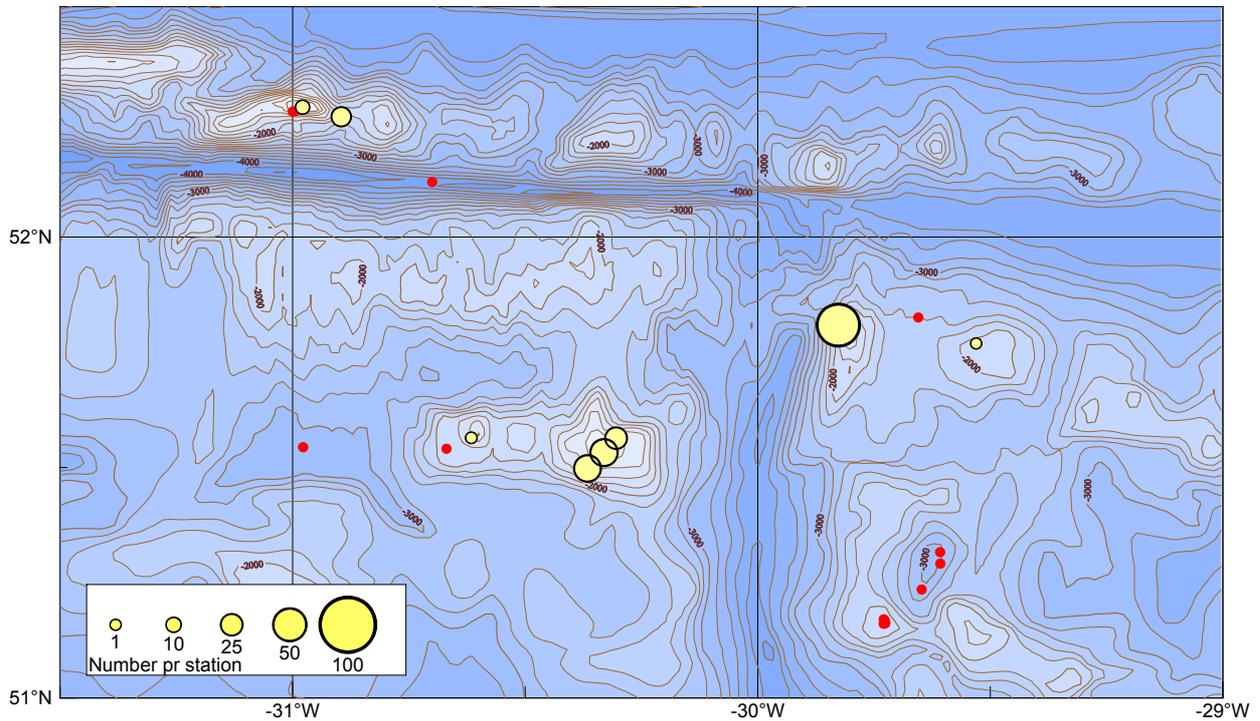


Figure 101 Distribution of *M. berglax* in Area II. Presence of the species on the stations is marked with a yellow circle where the size is proportional with abundance. Dots are stations with no catch of the taxon.

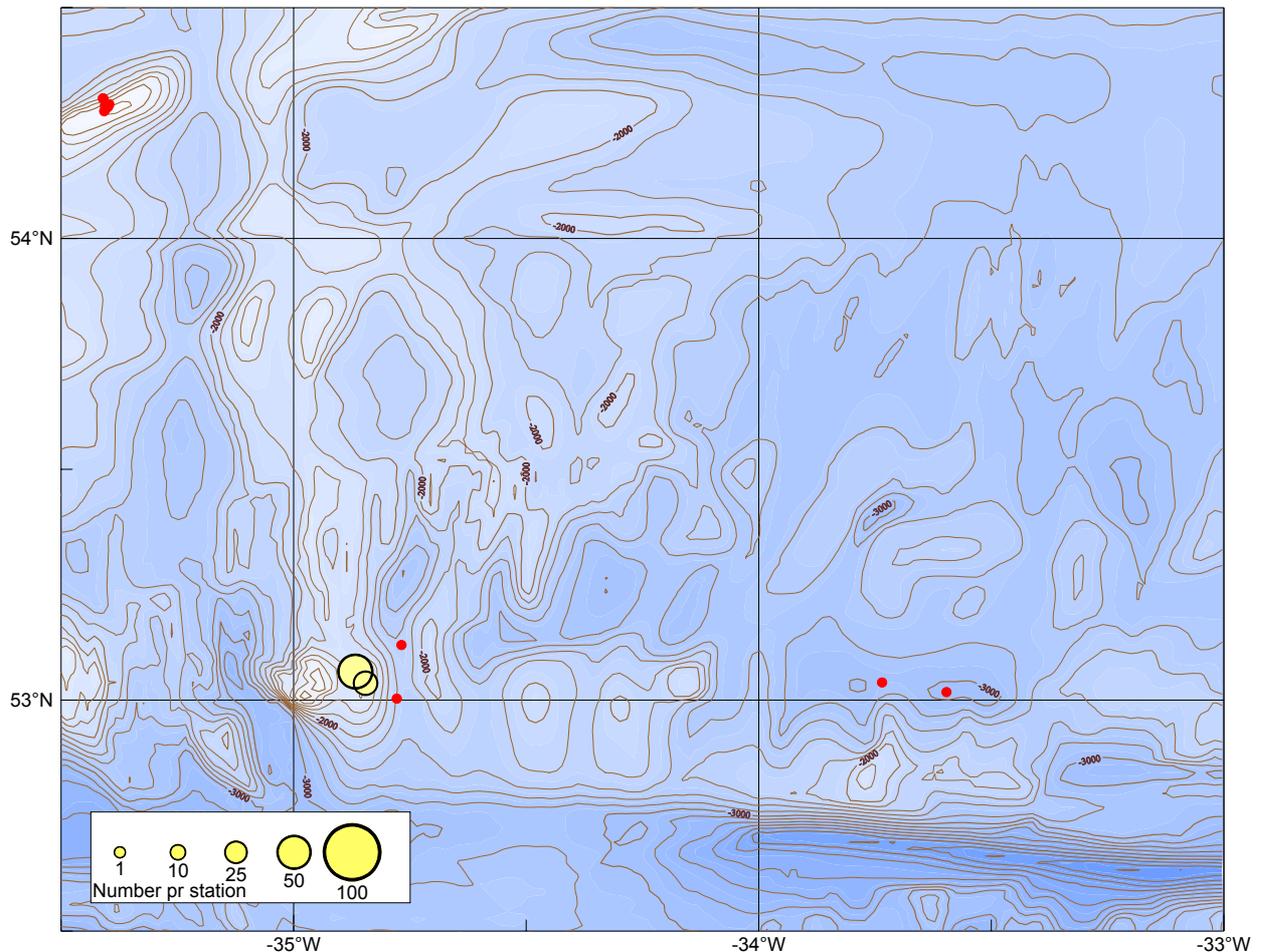


Figure 102 Distribution of *M. berglax* in Area III. Presence of the species on the stations is marked with a yellow circle where the size is proportional with abundance. Dots are stations with no catch of the taxon.

3.1.31 *Mola mola*

En: Ocean sunfish

No: Månefisk

One *Mola mola* with the weight of 26.7 kg was caught during the cruise. The specimen was taken on a long gaff at the surface while hauling the line. It was caught at the southernmost stations in Area I

3.1.32 *Mora moro*

En: Common mora

No: Mora

A total of four *M. moro* was recorded during the cruise. The lengths of these were 59, 63, 72 and 76 cm. The average weight was 3.17 kg (SD = 1.55 kg, n = 3).

All the specimens occurred at the same station in Area I just east of the central valley at depths between 900 and 1 150 m (Figure 103).

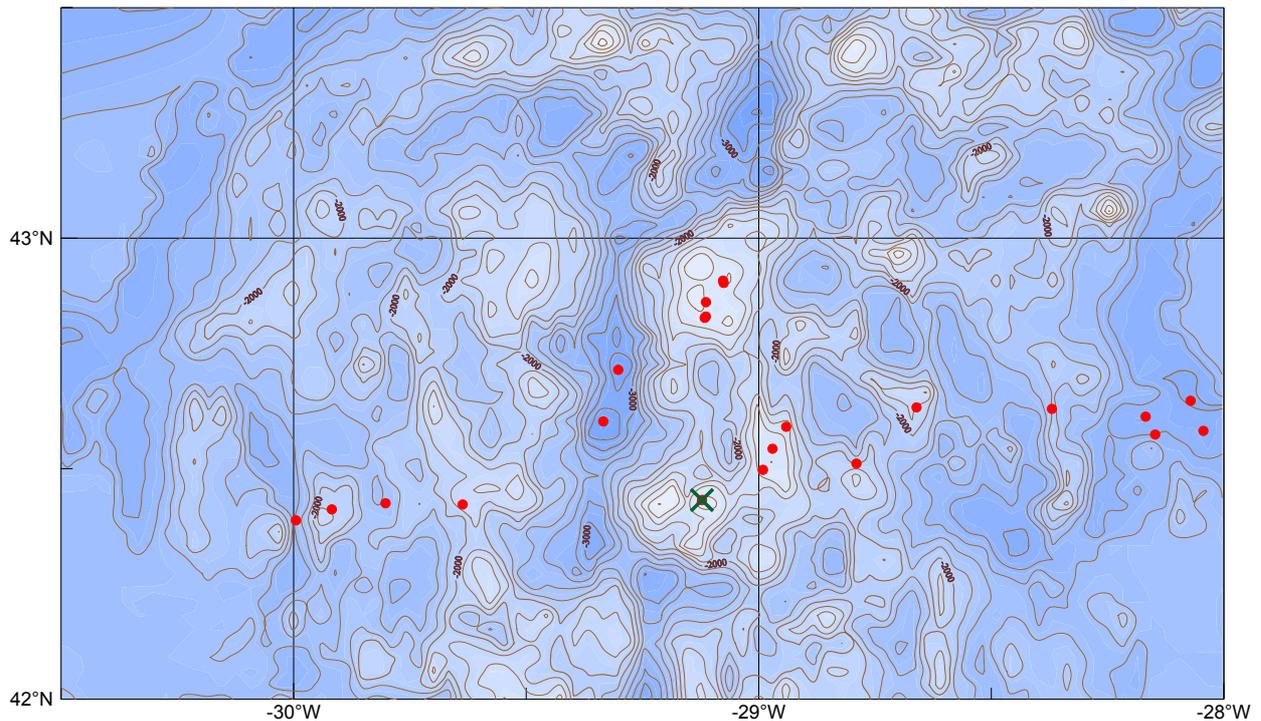


Figure 103 Distribution of *M. moro* in Area I. Presence at a station is indicated by a X. Dots are stations with no catch of the taxon.

3.1.33 *Phycis blennoides*

En: Greater forkbeard

No: Skjellbrosme

A total of 12 *P. blennoides* was caught during the cruise. The length distribution is given in Figure 104. The average weight was 3.20 kg (SD = 0.52 kg, n = 12). All the 11 sexed specimens were females.

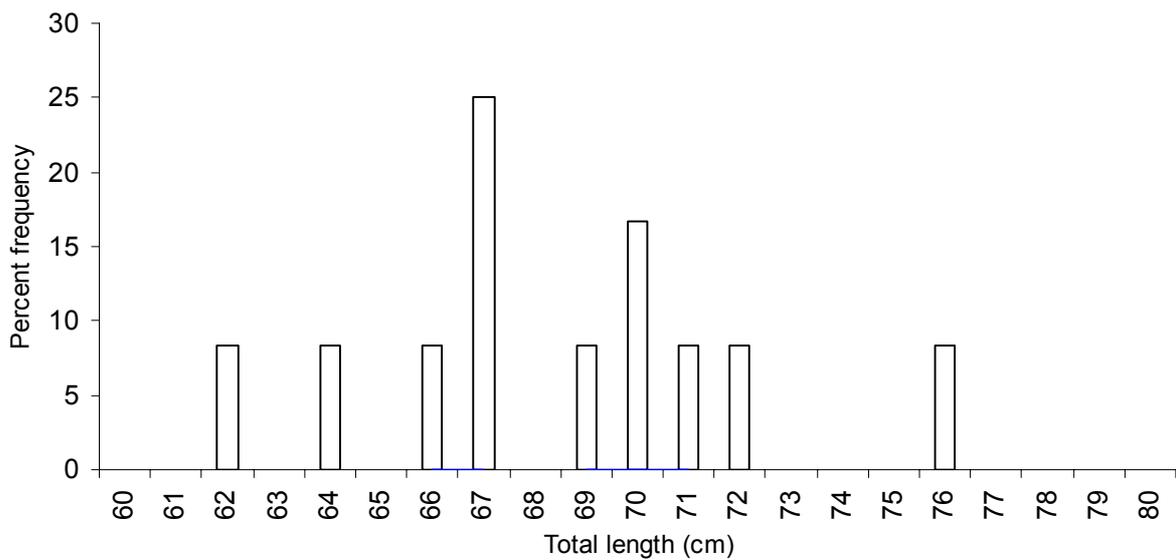


Figure 104 Length distribution of *P. blennoides* (n = 12).

P. blennoides was caught in the northernmost and shallowest part of Area III, and it occurred at depths between 400 and 600 meters (Figure 105).

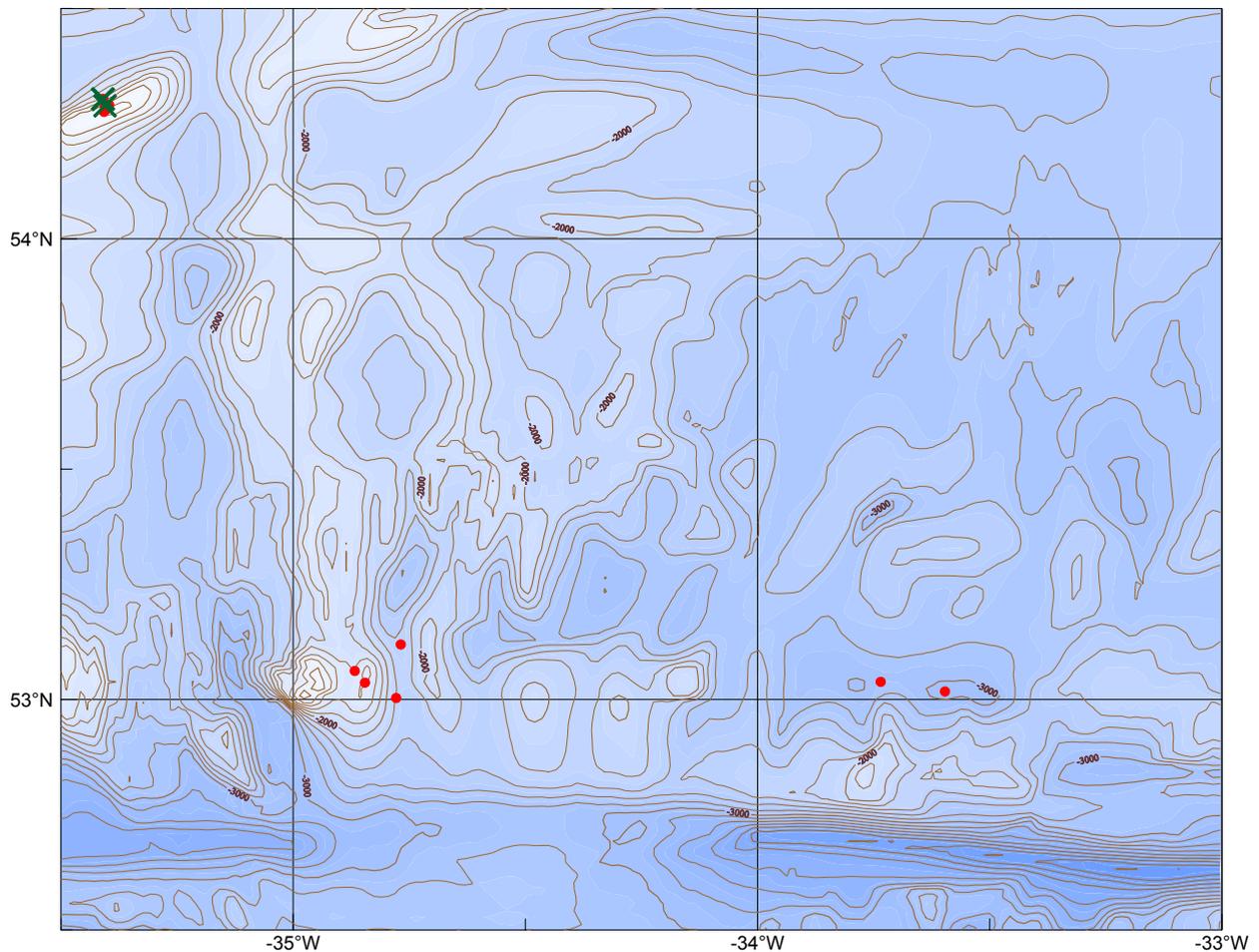


Figure 105 Distribution of *P. blennoides* in Area III. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.34 *Polyprion americanus*

En: Wreckfish

No: Vrakfisk

Three juvenile *P. americanus* was caught during the cruise. The specimens were caught with a net at the surface from underneath a drifting buoy in the eastern part of Area I.

3.1.35 *Prionace glauca*

En: Blue shark

No: Blåhai

A juvenile *P. glauca* was caught during the cruise. The specimen was taken on a long gaff at the surface while hauling the line. It was taken at night in the central part of Area I near Station 17. The length of the female specimen was 62 cm and it weighed 0.70 kg.

3.1.36 *Pseudotriakis microdon*

En: False catshark

No: Kattehai



Figure 106 Picture of a *P. microdon* taken during the cruise.

A total of four *P. microdon* were caught during the cruise. The total lengths were 204, 231, 260 and 262 cm. Their weights exceeded the capacity of available balances. The two smallest individuals were mature males, while the two others were females. The *P. microdon*s were caught in Area I at the central ridge, at depths between 800 and 1 300 m (Figure 107).

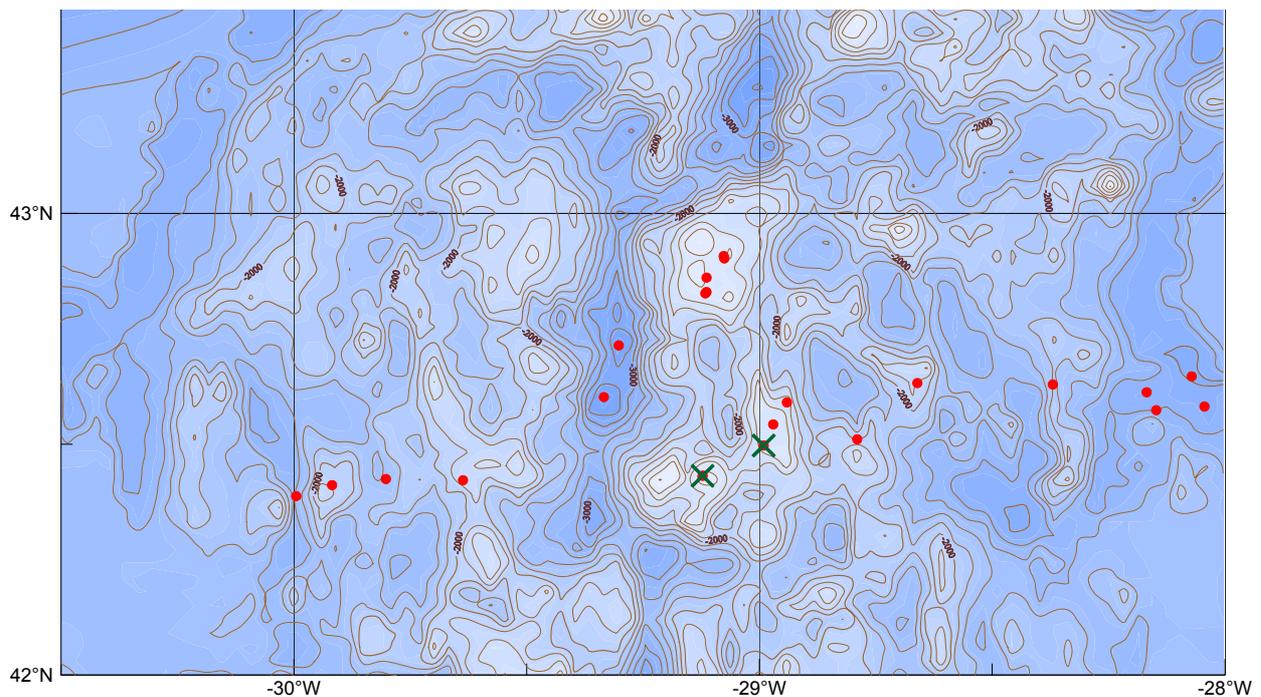


Figure 107 Distribution of *P. microdon* in Area I. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.37 *Raja batis*

En: No name
No: Storskate

Three *R. batis* was recorded during the cruise. The disk widths were 90, 101 and 106 cm. The individual weights exceeded the capacity of available balances. The smallest and biggest ones were females, and the third specimen was a mature male. *R. batis* occurred at a single station in the eastern part of Area III, at depths between 2 600 and 2 700 m (Figure 108).

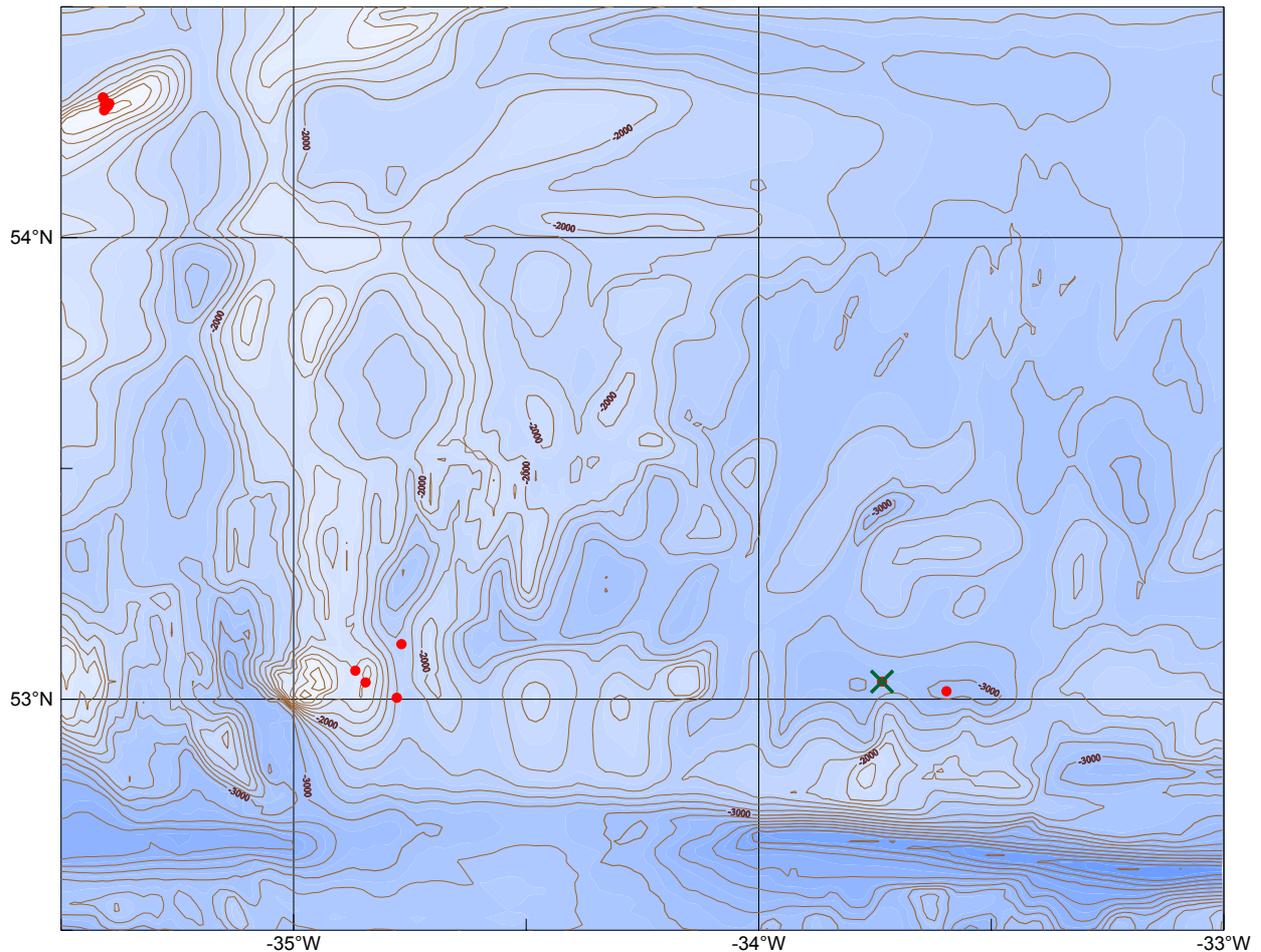


Figure 108 Distribution of *R. batis* in Area III. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.38 *Raja bathyphila*

En: No name
No: No name



Figure 109 Picture of an *R. bathyphila* taken during the cruise.

A total of 13 *R. bathyphila* was caught during the cruise. The length distribution is given in Figure 110. The average weight was 8.01 kg (SD = 3.88 kg).

Five out of thirteen sexed specimens were females. The largest specimen was a male.

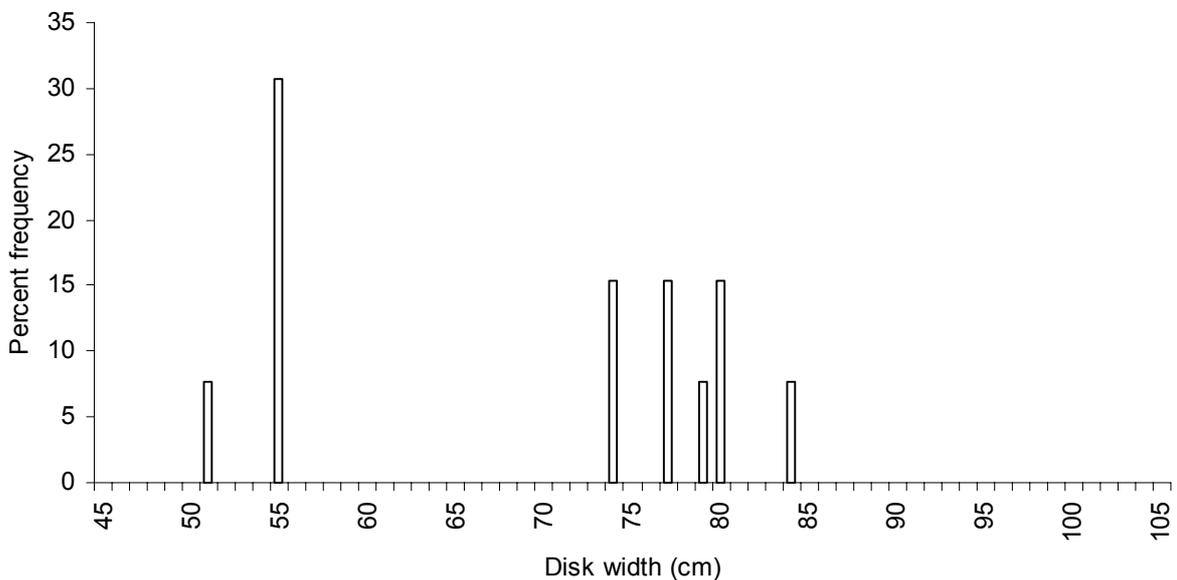


Figure 110 Length distribution of *R. bathyphila* (n = 13)

R. bathyphila was caught in the northern areas both north and south of Charlie-Gibbs Fracture zone and on both sides on the ridge. It occurred at depths between 900 and 2 400 m, but rarely shallower than 1 500 m (Figure 111 and Figure 112).

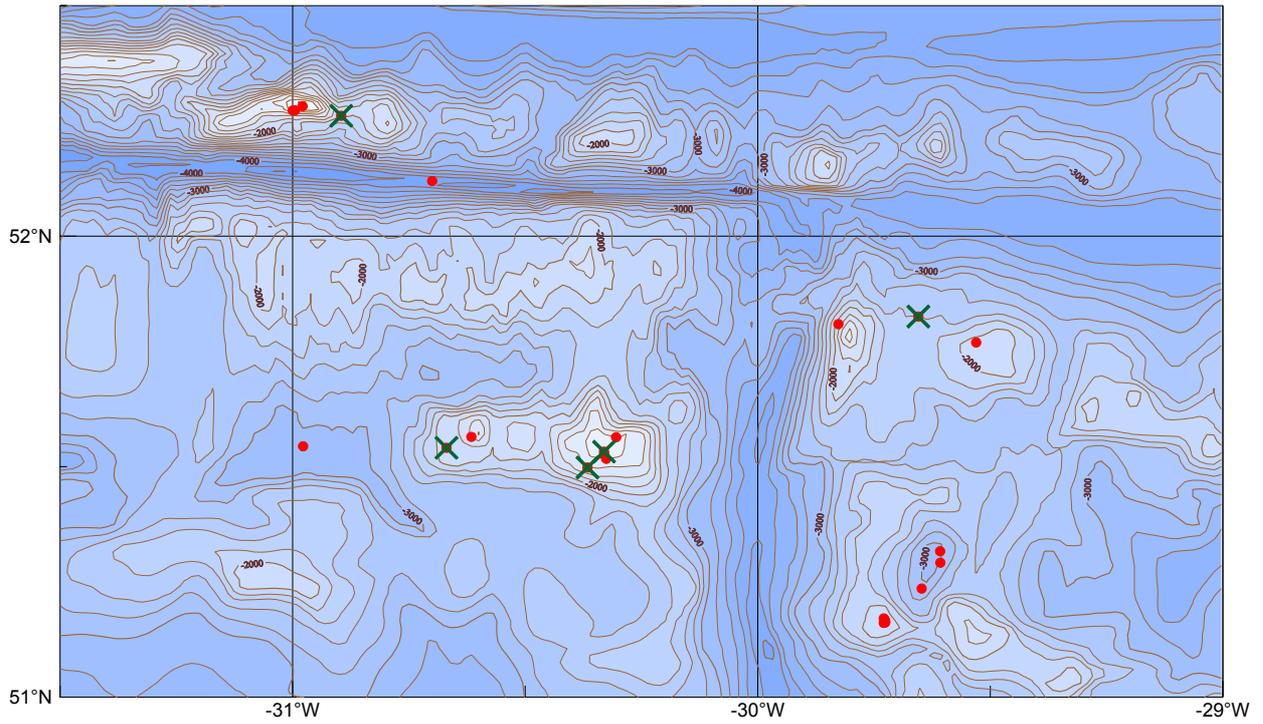


Figure 111 Distribution of *R. bathyphila* in Area II. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

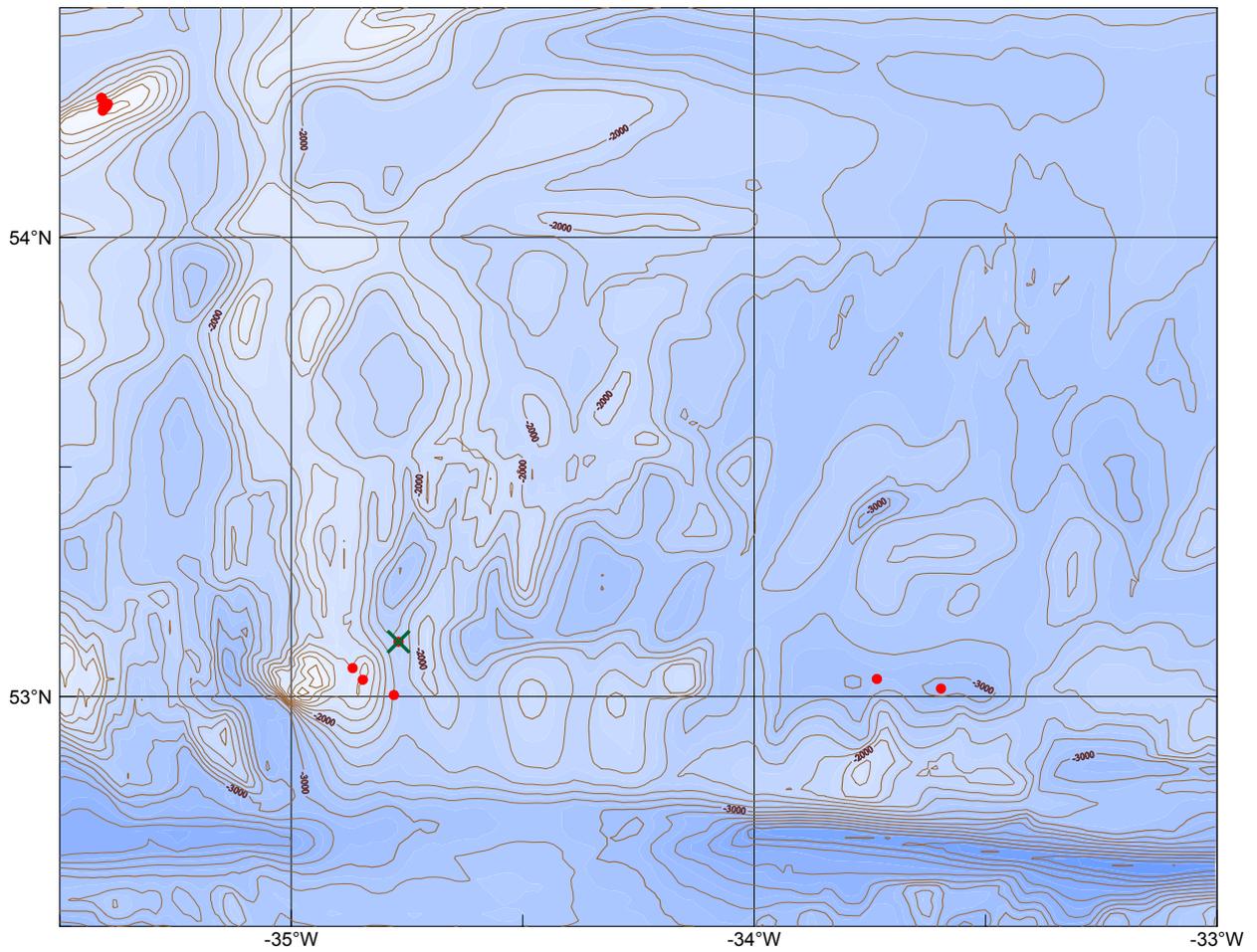


Figure 112 Distribution of *R. bathyphila* in Area III. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.39 *Sebastes marinus*

En: Redfish

No: Vanlig uer



Figure 113 Picture of n *S. marinus* taken during the cruise.

A total of 39 *S. marinus* was caught during the cruise. The length distribution is shown in Figure 114 and the total length range was 34 - 76 cm (mean = 42.2 cm, n = 37, SD = 8.1 cm). The average weight was 1.28 kg (SD = 1.34 kg, n = 37).

One third of the sexed specimens were females. The largest male had a total length of 46 cm.

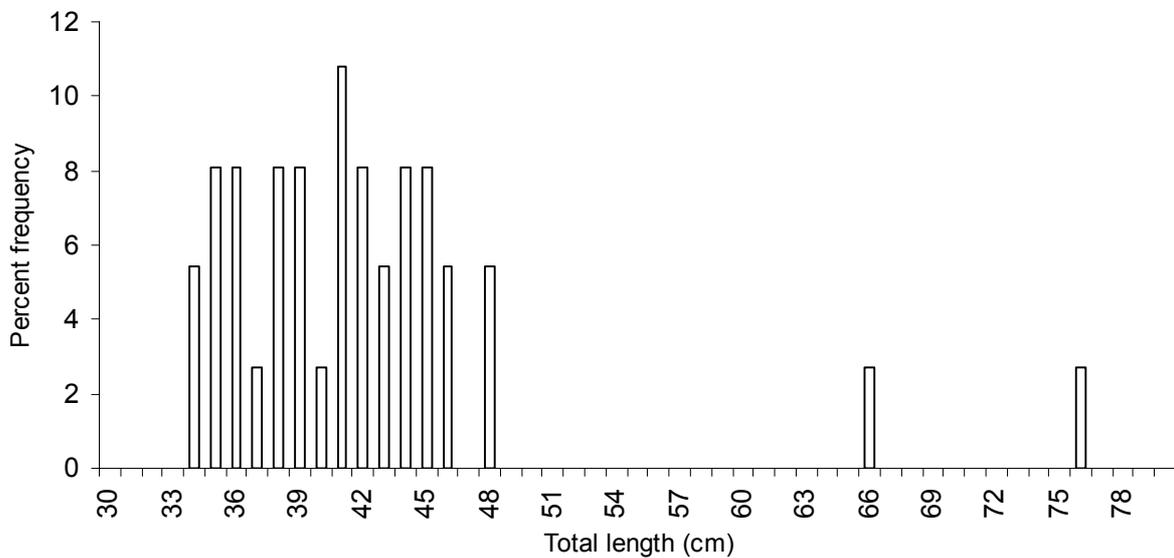


Figure 114 Length distribution of *S. marinus* (n = 37)

S. marinus was caught in the northern areas (II and III), but only north of Charlie-Gibbs Fracture zone on the shallowest stations down to 600 m (Figure 115 and Figure 116).

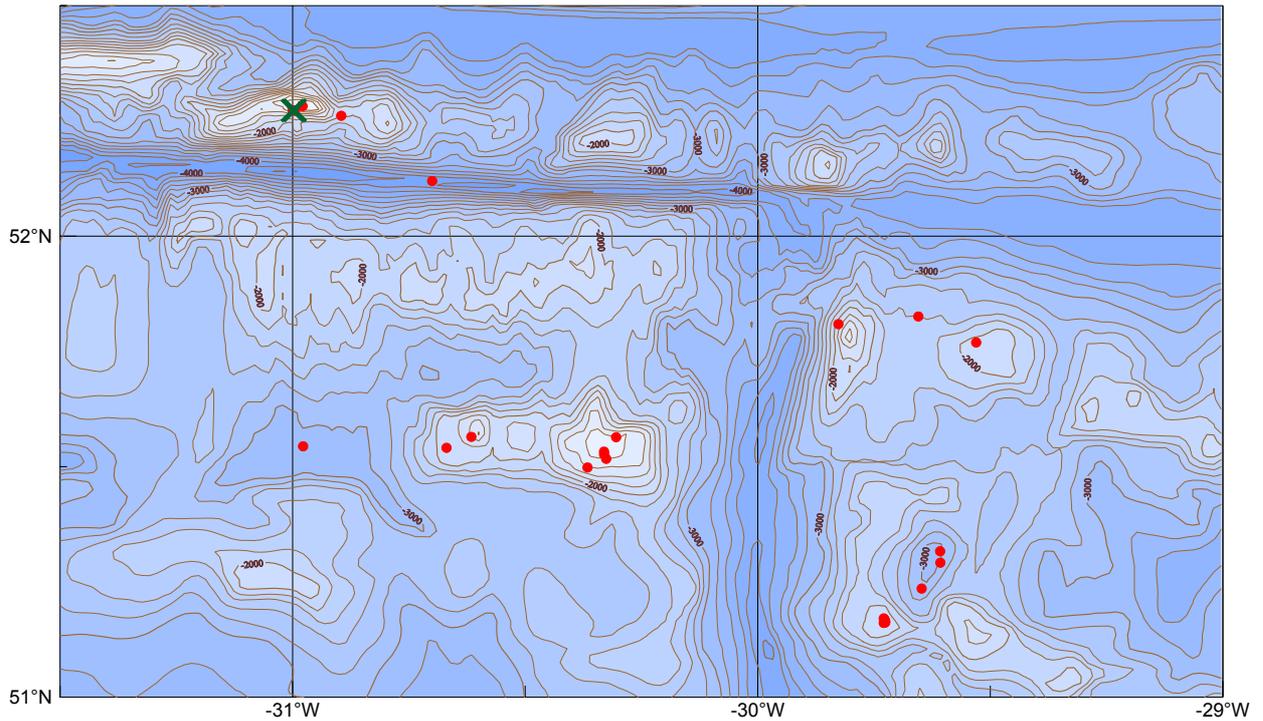


Figure 115 Distribution of *S. marinus* in Area II. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

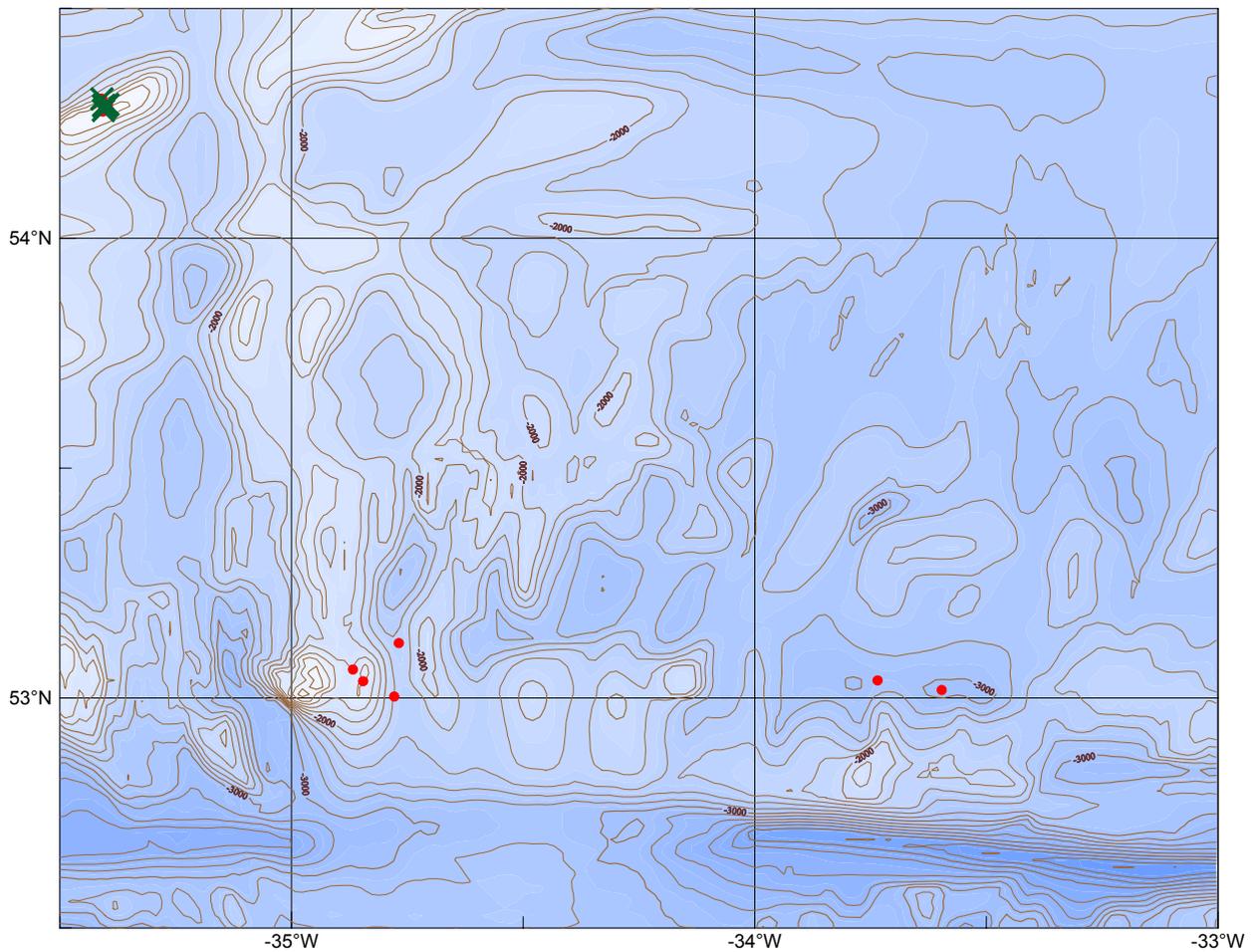


Figure 116 Distribution of *S. marinus* in Area III. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.40 *Seriola dumerili*

En: Greater amberjack

No: No name

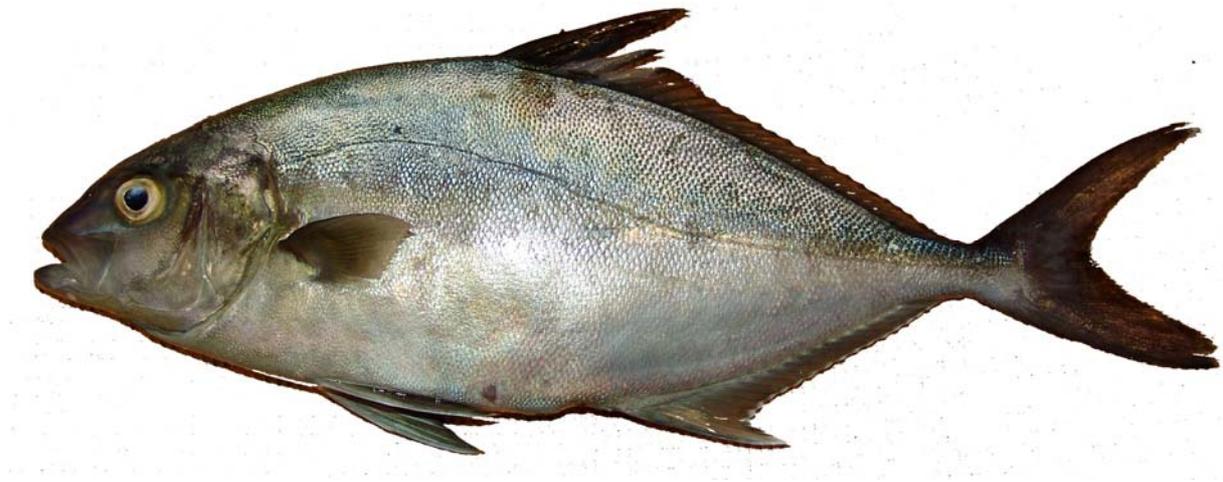


Figure 117 Picture of a *S. dumerili* taken during the cruise.

One *S. dumerili* was caught during the cruise. The specimen was caught on a trolling line at the surface. The specimen was first observed under a drifting buoy in the eastern part of Area.

3.1.41 *Somniosus microcephalus*

En: Greenland shark

No: Håkjering

One *S. microcephalus* was caught in Area III in the northernmost part (Figure 118) at 500 m depth. It was a female and the total length was 441 cm. The weight exceeded the capacity of available balances.



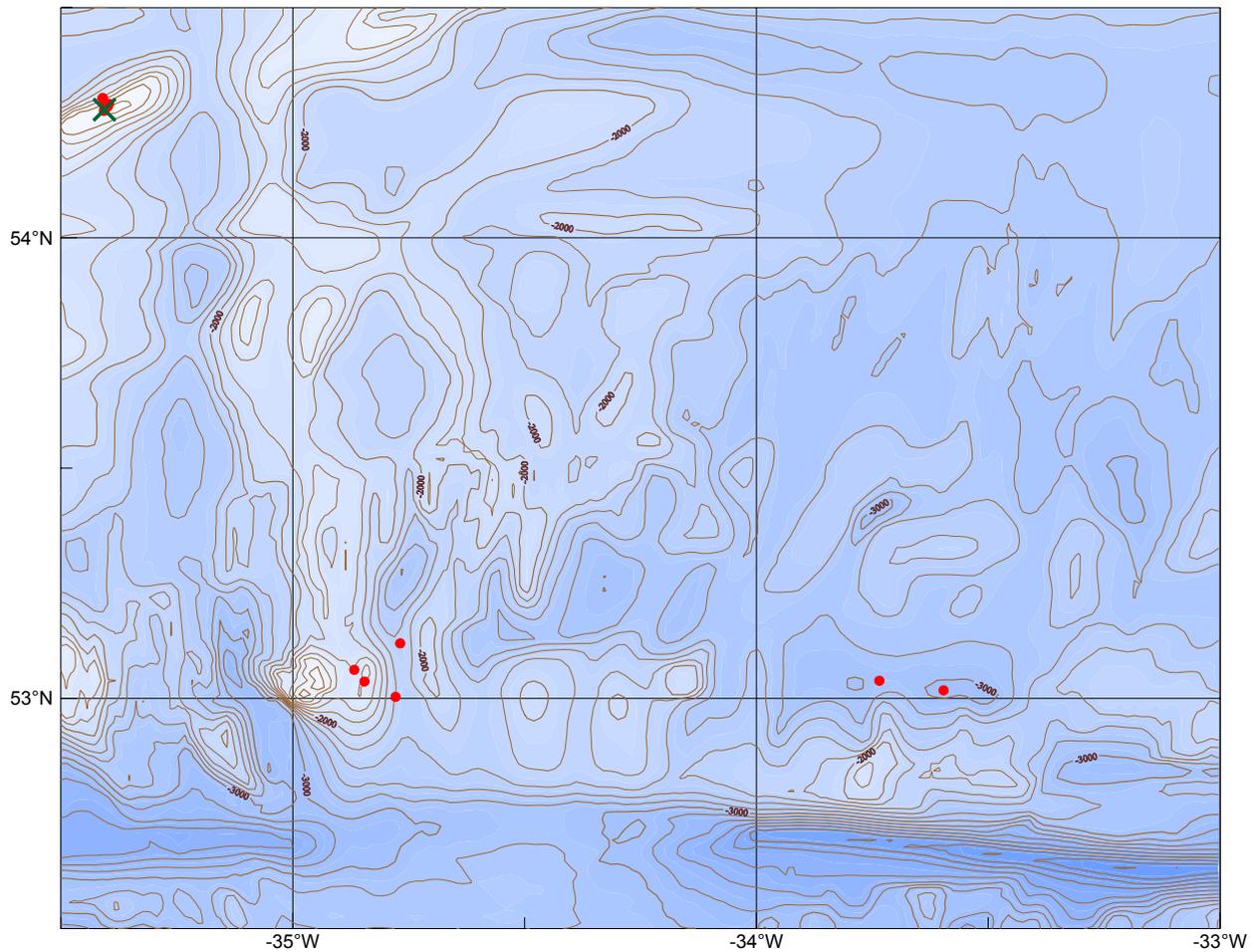


Figure 118 The presence of the *S. microcephalus* in Area III is marked with a green X, and the other stations are marked with a red dot.

3.1.42 *Somniosus rostratus*

En: Little sleeper shark

No: No name

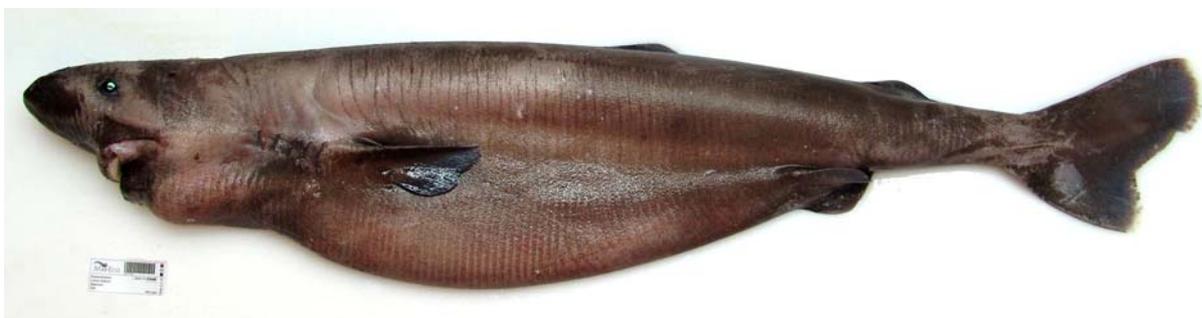


Figure 119 Picture of a *S. rostratus* taken during the cruise.

One *S. rostratus* was caught in Area I in the eastern part of the ridge at 1 600 m depth (Figure 120). It was a female with a total length of 142 cm and a weight of 16 kg.

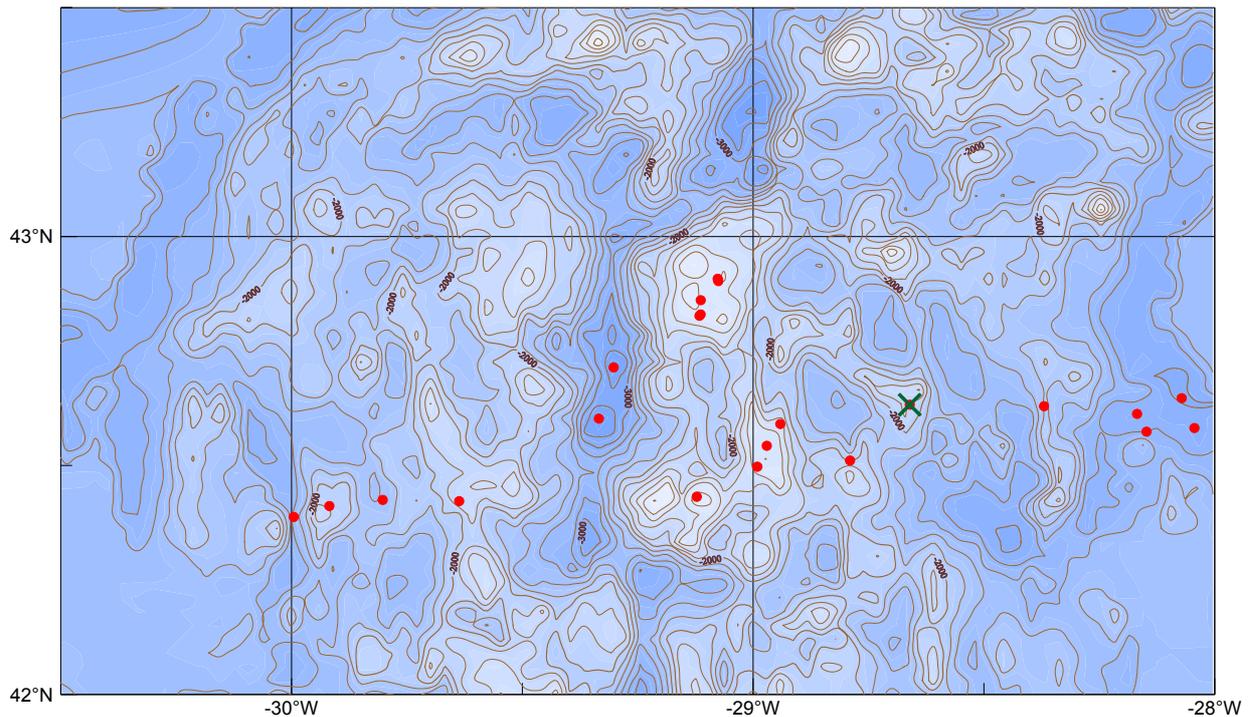


Figure 120 The station where *S. rostratus* was found in Area I are marked with a green X, and negative stations are marked with red dots.

3.1.43 *Spectrunculus grandis*

En: Pudgy cuskeel

No: No name



Figure 121 Picture of an *S. grandis* taken during the cruise.

A total of 308 *S. grandis* were caught during the cruise. The length distribution is shown in Figure 122 and the range was 49 - 131 cm (mean = 95.2 cm, $n = 293$, $SD = 16.2$ cm). The average weight was 6.64 kg ($SD = 2.88$ kg).

Females were a little more frequent than males (61 %, $n = 242$), but size distributions were equal (Figure 122).

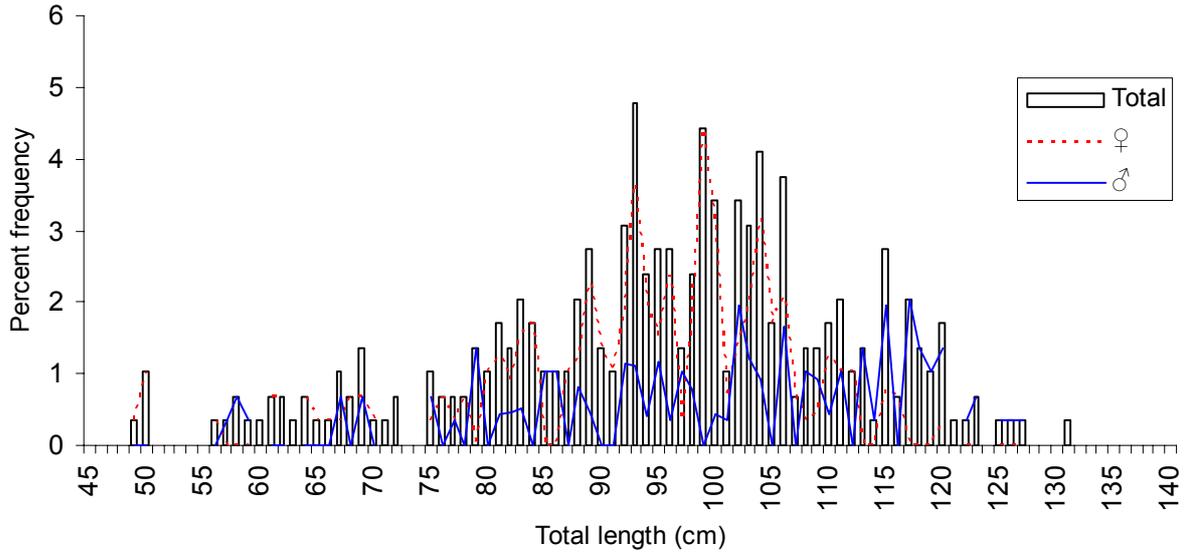


Figure 122 Length distribution of *S. grandis* (n = 293). The dotted line shows the portion of the females and the solid line shows the proportion of males in each length group.

S. grandis was caught in Area I and II south of Charlie-Gibbs Fracture zone and it occurred on both sides on the ridge. The depth range was 1 600 - 3 300 meters (Figure 123 and Figure 124) and the highest concentrations were recorded in Area I in the eastern part of the ridge.

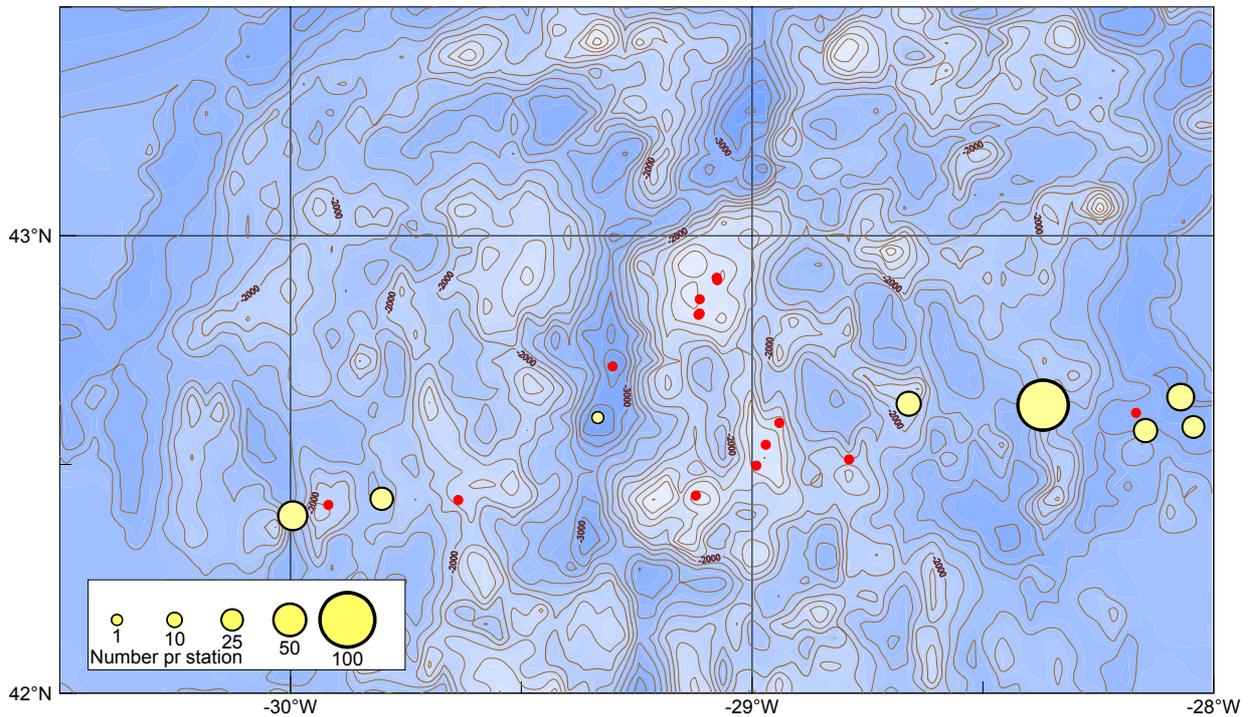


Figure 123 Distribution of *S. grandis* in Area I. Presence of the species is marked with a yellow circle where the size is proportional to abundance. Dots are stations with no catch of the taxon.

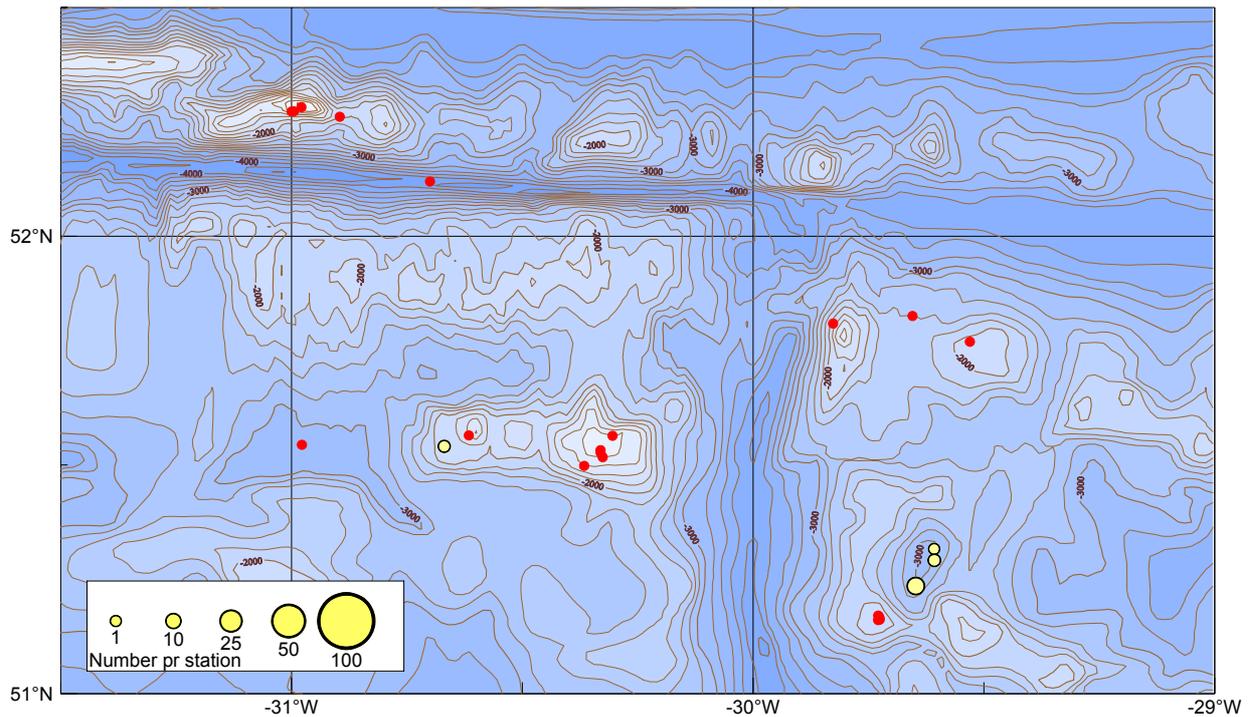


Figure 124 Distribution of *S. grandis* in Area II. Presence of the species on the stations is marked with a yellow circle where the size is proportional with abundance. Dots are stations with no catch of the taxon.

3.1.44 *Spectrunculus* sp.

En: No name

No: No name



Figure 125 Picture of a species belonging to the genus *Spectrunculus* taken during the cruise.

It is believed that one other species of the genus *Spectrunculus* occurred during the cruise. There were only small differences between this species and *S. grandis*, but because of the different colours and the overlaying length groups, it is believed that this could be another species.

A total of 55 *Spectrunculus* sp. was caught during the cruise. The length distribution is shown in Figure 126 and the range of the total length was 37 - 66 cm (mean = 53.0 cm, n = 53, SD = 4.5 cm). The average weight was 1.00 kg (SD = 0.29 kg, n = 48). Most were females (81 %, n = 27).

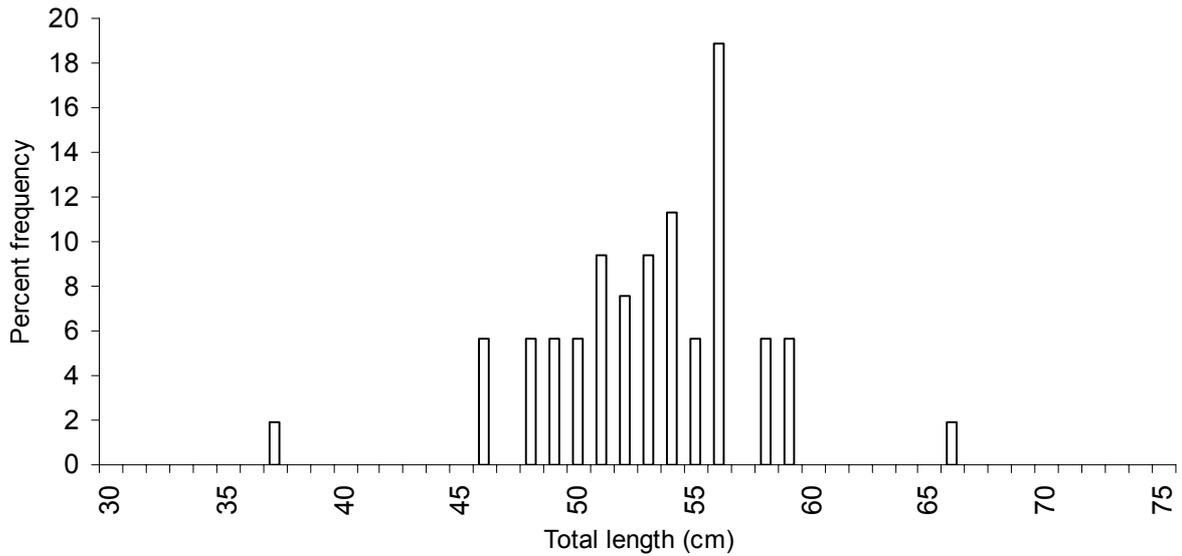


Figure 126 Length distribution of *Spectrunculus sp.* (n = 53)

Spectrunculus sp. was caught in all areas and on both sides of the ridge and north and south of Charlie-Gibbs Fracture zone. The depth range was 1 600 - 3 300 meters, but the species was most common shallower than 2 500 m (Figure 127 - Figure 129).

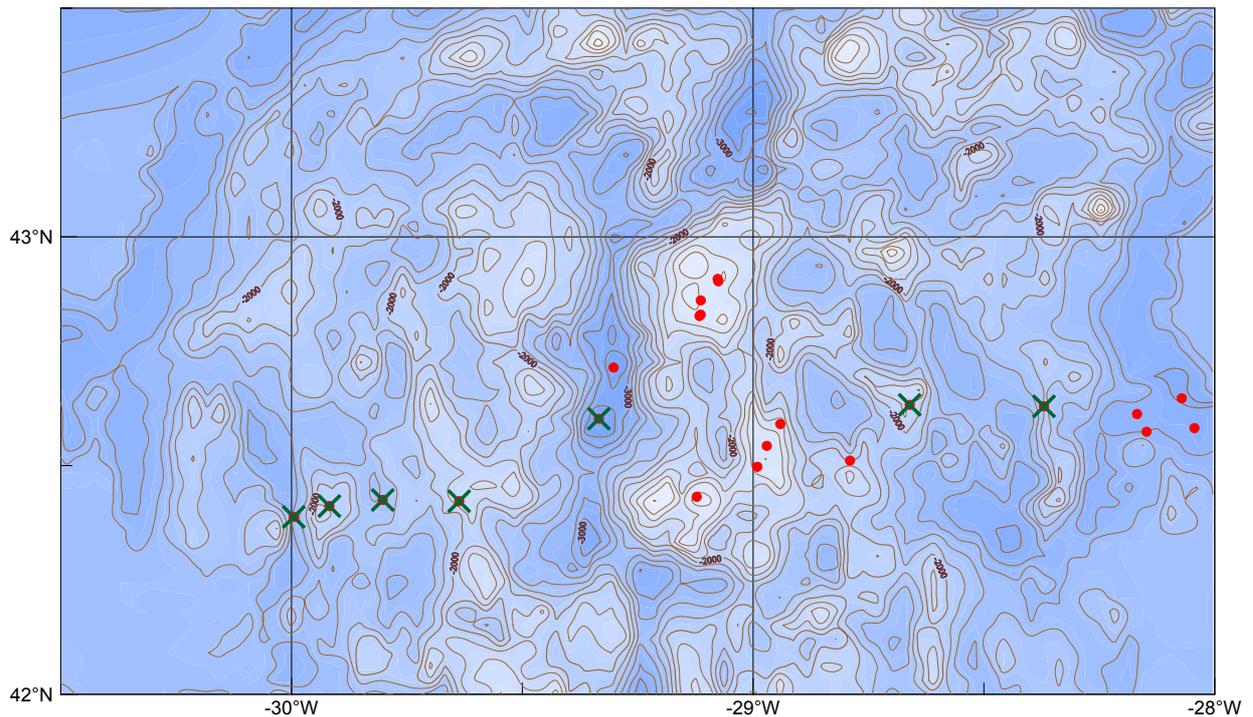


Figure 127 Distribution of *Spectrunculus sp.* in Area I. Presence of the species on the stations is marked with a green X, and absence of the species are marked with a red dot.

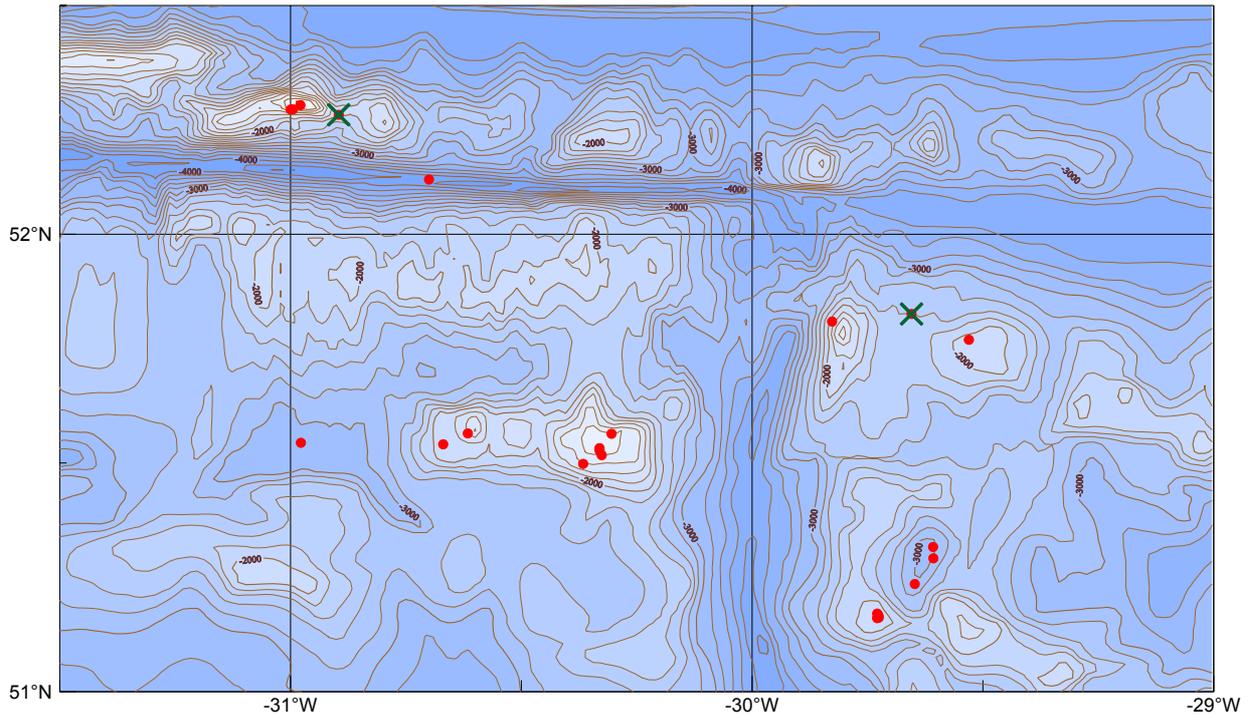


Figure 128 Distribution of *Spectrunculus sp.* in Area II. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

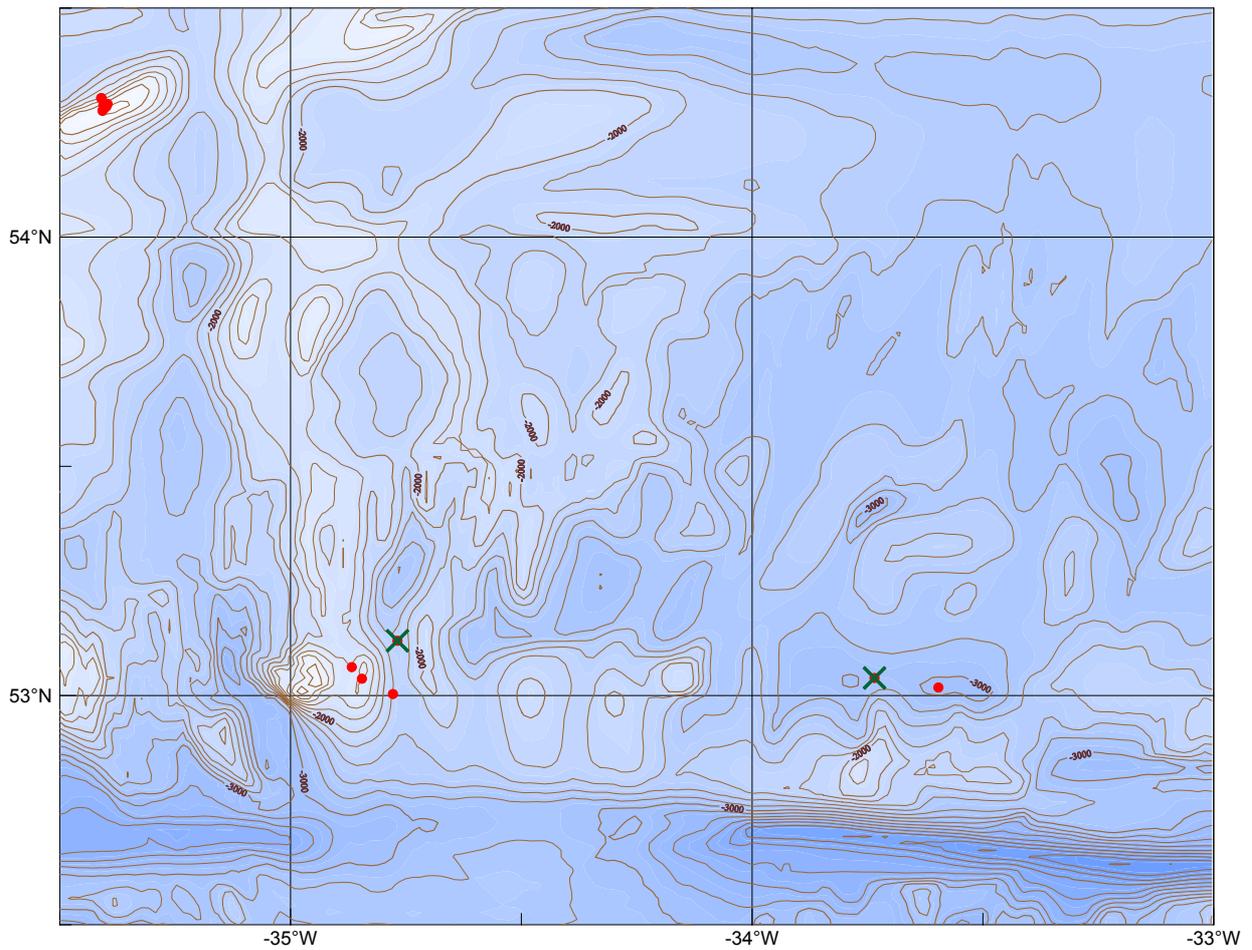


Figure 129 Distribution of *Spectrunculus sp.* in Area III. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.45 *Synaphobranchus kaupi*

En: Kaup's arrowtooth eel

No: Dyphavsål

A total of 17 *S. kaupi* was caught during the cruise. The length distribution is given in Figure 130. The average weight was 0.46 kg (SD = 0.19 kg, n = 8). Six out of eight sexed specimens were females.

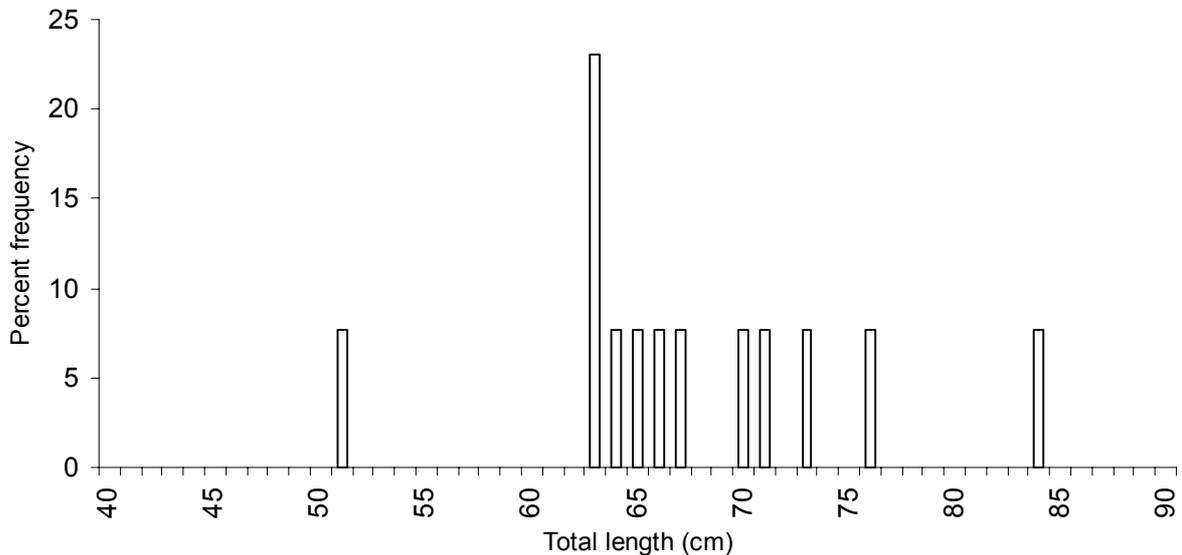


Figure 130 Length distribution of *S. kaupi* (n = 13)

S. kaupi was caught in Area I and Area II on the more central part of the ridge but only south of Charlie-Gibbs Fracture Zone. In Area I it occurred on both sides of the ridge and at depths between 900 and 2 000 m (Figure 131 and Figure 132).

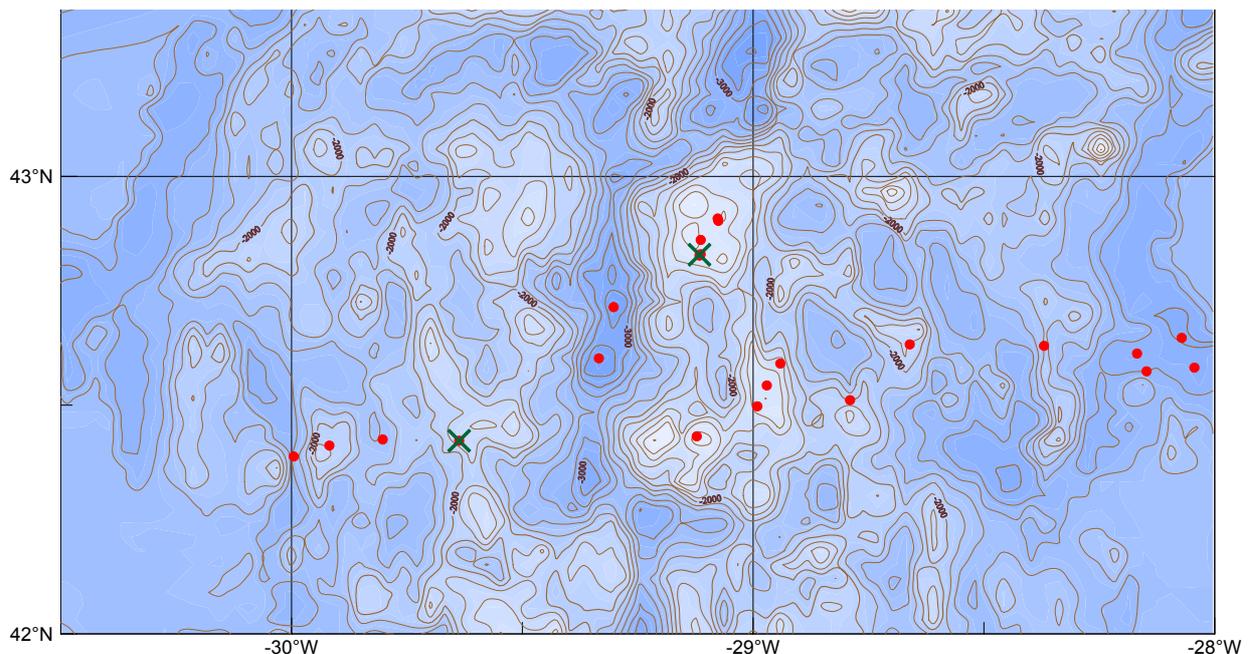


Figure 131 Distribution of *S. kaupi* in Area I. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

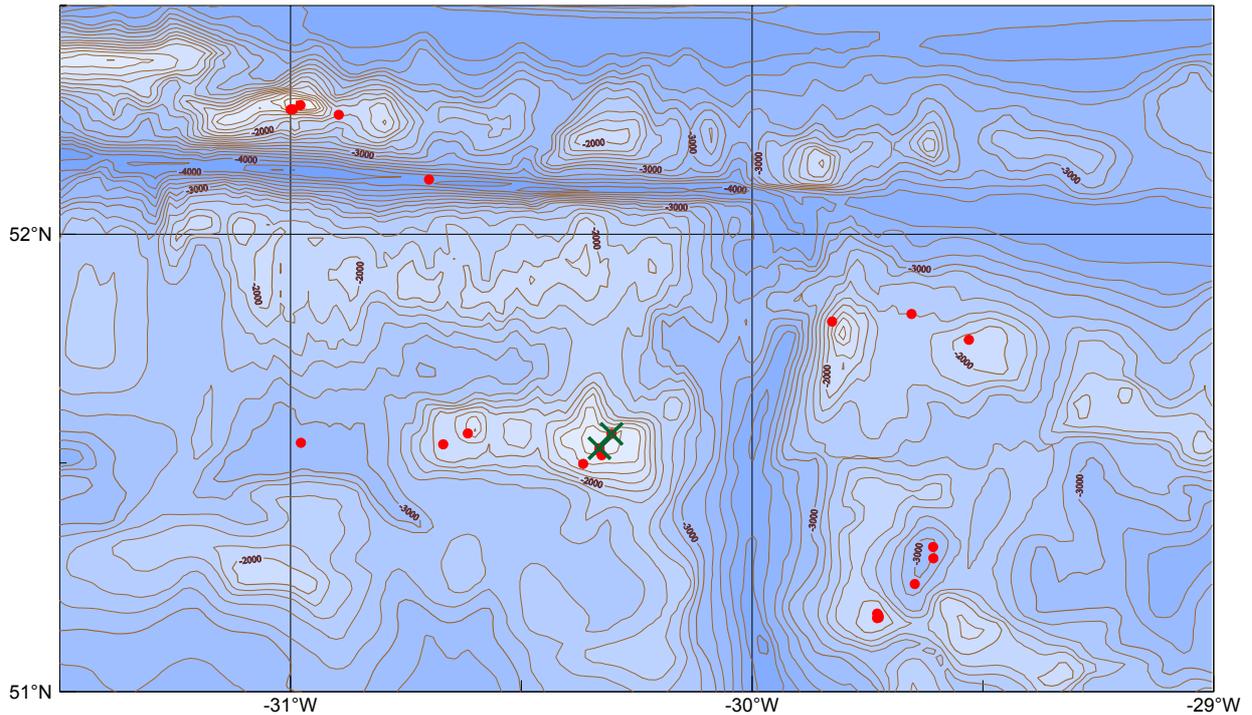


Figure 132 Distribution of *S. kaupi* in Area II. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.1.46 *Synphobranchus*

En: No name

No: No name

One specimen of *Synphobranchus* was recorded that could not be identified to species. It was caught in Area I in the central part of the ridge at 1 000 m depth (Figure 133). It was a female with the total length of 78 cm and the weight was 0.59 kg.

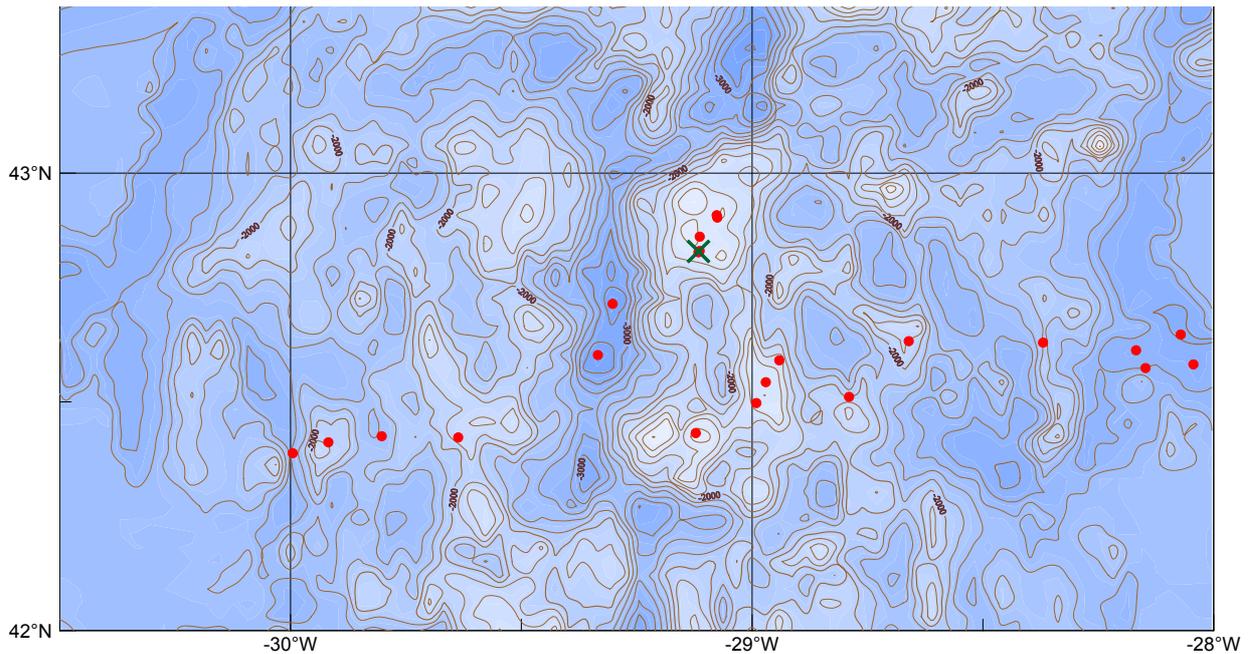


Figure 133 The station where *Synphobranchus* sp. Presence at a station is indicated by an X. Dots are stations with no catch of the taxon.

3.2 Invertebrates

3.2.1 *Anthozoa*

En: Corals

No: Korall



Figure 134 Picture of corals taken during the cruise.

Corals easily got stuck to the line and most of the corals were taken at the shallowest stations. Corals were recorded at 10 stations. The entire catch from a station was frozen in plastic bags and saved for further examination.

3.2.2 *Brachyura*

En: Crab

No: Krabbe

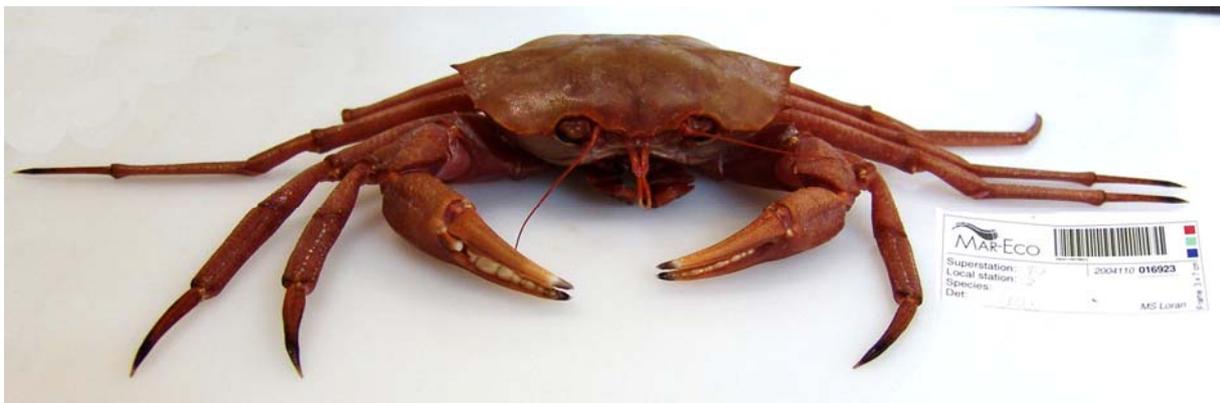


Figure 135 Picture of a crab taken during the cruise.

Crabs were taken both on the line and in the traps. They all appeared to be the same species, but were frozen for further studies. The crabs were caught at 2 stations (in total 7 specimens).

3.2.3 *Natantia*

A single specimen of an unidentified shrimp (*Natantia*) was caught and frozen pending further investigations.

3.2.4 Unidentified invertebrates



Figure 136 Picture of a jellyfish or a cephalopod taken during the cruise.

At least four different unidentifiable invertebrates were taken at four stations. Three were frozen awaiting further investigations.

4 Discussion

The fishing operations were carried out without major problems. Only a small amount of gear was lost, mainly in the shallowest areas. Catches were made in all sub-areas and all depth strata. During the cruise approximately 8 840 animals, representing at least 50 different species of fishes and a few invertebrates were caught.

The technical success was assured through a very professional use of the very advanced ship and efficient gear handling by the very skilled captain and crew. The crew's experience with deepwater fishing was invaluable for operating the different gear at the extensive depths. This ensured correct positioning of the sets, and secure retrieval despite current-induced displacement. The handling of catch and gear onboard the vessel was also very efficient. The captain and crew were also highly cooperative and helpful throughout the operation. Every request was carried out without any question, and inventive solutions to problems were always found.

Chondrichthyan fishes dominated the catch. Among the species caught were sleeper sharks (Greenland and little sleeper sharks), false catsharks, Portuguese sharks, birdbeak dogfish, lantern sharks, catsharks, gulper sharks, deep-sea rays and chimaeroids. Many bony fishes also occurred, including slickheads, wolffish, grenadiers, fork-beards, tusk (and several other gadiform fishes), black scabbardfish, cuskeels, redfish, cut-throat eels. Some fishes were also netted at the surface, including a juvenile blue shark, a sunfish, a triggerfish, an amberjack, and several juvenile wreckfish. The few invertebrates captured included corals, crabs, and shrimp.

It was an aim to fish with all three gear types in every depth interval on both sides on the ridge, both in the southern and northern subarea. All three gear types were applied successfully in the southern sub-area, but because gillnets and traps apparently did not catch a different species mix than the longline, the gillnet and trap effort was reduced in the north in order to save time. This allowed a more thorough exploration by longline in the northern sub-area. Different kinds of gears usually have different size and species selectivity, but the number of deployments has to be higher than in this experiment to detect such differences.

The fish were identified to lowest possible taxonomical level, preferably species. Many species were recognised with satisfactory confidence based on available identification literature and taxonomical competence gained by the participant's former experience from work with deepwater fishes in other waters of the North Atlantic. But inevitably there were specimens that could not be identified with certainty to lower than family or genus level. Samples of these were frozen for the Bergen Museum collection, pending further examination by specialists. It was however not feasible to save the entire catch from the operation.

Sixteen fish specimens belonging to the family *Alepocephalidae* (Slickheads) were captured (in all sub-areas combined), but could not be readily identified to genus or species level. The specimens were superficially similar. They were caught in both Area I and Area II, but they occurred in two distinct different depth intervals. Specimen from both depth intervals were preserved frozen for further examination and identification.

There was also uncertainty with regards to the ten specimens of the genus *Apristurus*, and 8 specimens of these were saved for further examination. Similarly an unusual specimen of

Centrophorus, and 12 specimens of what we believed to be *Centroscymnus owstoni* were saved for further examination and identification.

A chimaeroid fish from Area I was determined to be *Chimaera monstrosa* but subsequently questions have been raised with regards to the validity of this identification. The specimen was caught far outside the known geographical and bathymetrical range of this species, and it was also unusually large. However, it was very similar in shape and the colours and texture of the skin to *C. monstrosa* and did definitely not share characters with *H. pallidus* and *H. affinis* that do occur in the same area. Since it was believed that this was a common *C. monstrosa*, the specimen was unfortunately thrown overboard after measuring.

11 specimens most probably belonging to the genus *Coryphaenoides* (1) could not be identified to species. They looked similar and four individuals were preserved frozen for further investigations.

142 specimens of what was believed to be *Coryphaenoides striaturus* (*Coryphaenoides* 2) were recorded. Later it has been suggested that this was not correct and that there may have been two different, but very similar species in this sample. Only closer examination of the preserved specimens will provide clarification.

There are also questions with regards to the identity of *Spectrunculus grandis*, and it is possible that the catches now referred to this species actually consist of two species. Some of the specimens in the sample had unusual colours and other superficial features different from those described for *S. grandis*. In Area I the unusual specimens were caught more or less at the same stations as the more familiar-looking *S. grandis*, but in the north they were restricted to Charlie-Gibbs Fracture Zone (on both sides). "Classical" *S. grandis* were only caught in the southernmost part of Area II and not at all in Area III.

5 References

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6 Appendix

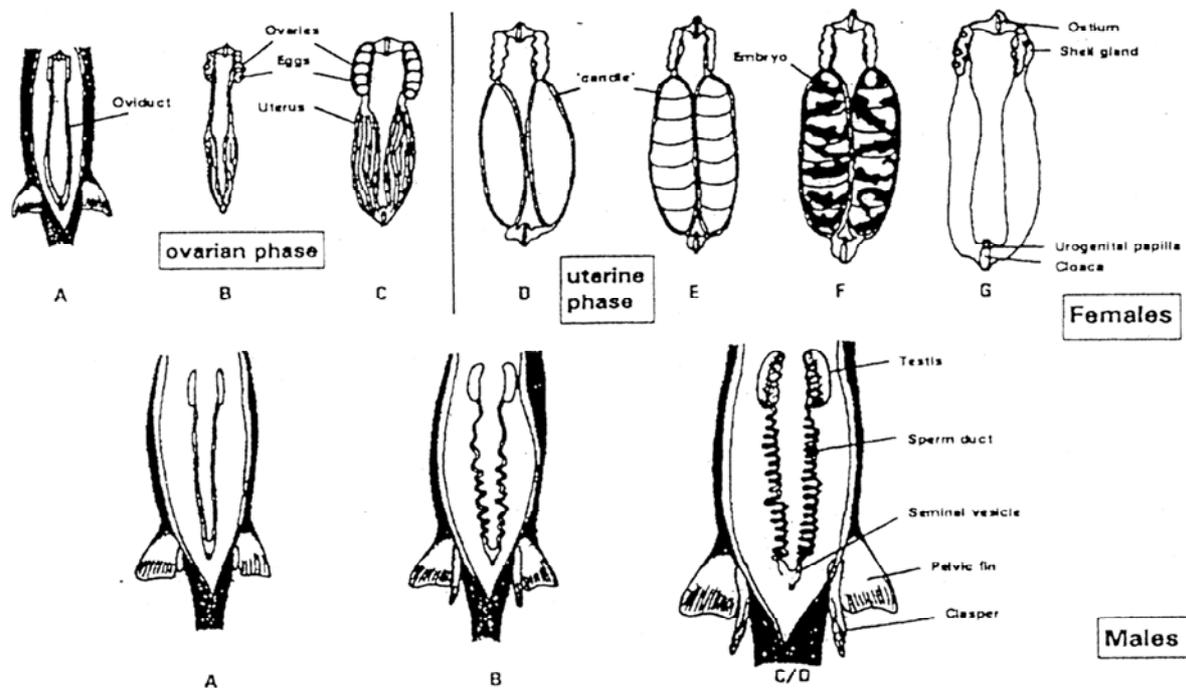
Appendix I Orders and families of fishes occurring in the catches. Species identified to closest genus only is marked with sp in the species column.

Class	Order	Family	Genus	Species	
<i>Chondrichthyes</i>	<i>Carcharhiniformes</i>	<i>Carcharhinidae</i>	<i>Prionace</i>	<i>P. glauca</i>	
		<i>Pseudotriakidae</i>	<i>Pseudotriakis</i>	<i>P. microdon</i>	
		<i>Scyliorhinidae</i>	<i>Apristurus</i>	<i>A. sp</i>	
			<i>Galeus</i>	<i>G. murinus</i>	
			<i>Centrophorus</i>	<i>C. squamosus</i>	
		<i>Squaliformes</i>	<i>Centrophoridae</i>		<i>C. sp.</i>
				<i>Deania</i>	<i>D. calcea</i>
			<i>Dalatiidae</i>	<i>Centroscymnus</i>	<i>C. crepidater</i>
					<i>C. coelolepis</i>
					<i>C. owstoni</i>
		<i>Etmopterus</i>	<i>E. princeps</i>		
		<i>Somniosus</i>	<i>S. microcephalus</i>		
			<i>S. rostratus</i>		
	<i>Rajiformes</i>	<i>Rajidae</i>	<i>Bathyraja</i>	<i>B. pallida</i>	
				<i>B. richardsoni</i>	
			<i>Raja</i>	<i>R. bata</i>	
				<i>R. bathyphila</i>	
				<i>C. monstrosa</i>	
	<i>Chimaeriformes</i>	<i>Chimaeridae</i>	<i>Chimaera</i>	<i>H. affinis</i>	
			<i>Hydrolagus</i>	<i>H. pallidus</i>	
<i>Osteichthyes</i>	<i>Anguilliformes</i>	<i>Synphobranchidae</i>	<i>Histiobranchus</i>	<i>H. bathybius</i>	
			<i>Synphobranchus</i>	<i>S. kaupi</i>	
				<i>S. sp</i>	
				<i>H. atlanticus</i>	
				<i>B. brosme</i>	
	<i>Beryciformes</i>	<i>Trachichthyidae</i>	<i>Hoplostethus</i>	<i>H. atlanticus</i>	
			<i>Brosme</i>	<i>B. brosme</i>	
	<i>Gadioformes</i>	<i>Lotidae</i>	<i>Macrouridae</i>	<i>Coryphaenoides</i>	<i>C. sp.</i>
					<i>C. armatus</i>
					<i>C. rupestris</i>
				<i>C. striatulus</i>	
			<i>Macrourus</i>	<i>M. berglax</i>	
		<i>Moridae</i>	<i>Antimora</i>	<i>A. rostrata</i>	
			<i>Lepidion</i>	<i>L. eques</i>	
				<i>L. guentheri</i>	
			<i>L. schmidti</i>		
		<i>Mora</i>	<i>M. moro</i>		
	<i>Phycis</i>	<i>P. blennoides</i>			
<i>Ophidiiformes</i>	<i>Ophidiidae</i>	<i>Spectrunculus</i>	<i>S. grandis</i>		
			<i>S. sp</i>		
<i>Osmeriformes</i>	<i>Alepocephalidae</i>				
<i>Perciformes</i>	<i>Anarhichadidae</i>	<i>Anarhichas</i>	<i>A. denticulatus</i>		
		<i>Seriola</i>	<i>S. dumerili</i>		
	<i>Carangidae</i>	<i>Polyprion</i>	<i>P. americanus</i>		
	<i>Polyprionidae</i>	<i>Aphanopus</i>	<i>A. carbo</i>		
	<i>Trichiuridae</i>	<i>Sebastes</i>	<i>S. marinus</i>		
<i>Scorpaeniformes</i>	<i>Sebastidae</i>				
<i>Tetraodontiformes</i>	<i>Balistidae (</i>	<i>Balistes</i>	<i>B. capriscus</i>		
		<i>Molidae</i>	<i>M. mola</i>		

Appendix II Generalised maturity scale for bony fishes used by the Institute of Marine Research in Norway.

Code	Stadium	Description
1	Virgin	Ovaries small. No visible eggs/sperm
2	Maturing	Ovaries bigger in volume. Visible eggs/sperm but not extrudable..
3	Spawning	Running gonads. Eggs/sperm can be extruded under moderate pressure.
4		Gonads shrunken and with visible blood vessels. Regeneration has started, and the gonads may be larger than in Stage 1 but has no visible eggs/sperm.
5	Spent	Used only if it is uncertain if the gonad is Stage 1 or 4

Appendix III Maturity description for viviparous sharks (M. Stehmann, ISH - March 1998)



MALES

A or 1 = immature, juvenile

Claspers undeveloped as small, flexible sticks being shorter than extreme tips of posterior pelvic fin lobes. Gonads (testes) small, whitish, sperm ducts straight and thread-like.

B or 2 = maturing, adolescent, subadult

Claspers becoming extended, longer than tips of posterior pelvic fin lobes, their tips (glues) becoming structured, but their skeleton still soft and flexible. Gonads enlarged, sperm ducts beginning to meander posteriorly.

C or 3 = mature, adult

Claspers fully formed and stiff, eventually present cartilaginous hooks, claws or spines of glans free and sharp. Gonads enlarged, well rounded, filled with flowing sperm and often reddish in colour. Sperm ducts tightly coiled and well filled with sperm.

D or 4 = active

Glans clasper often dilated and swollen, with free cartilaginous spine mostly erect; sperm flowing from cloaca under pressure on seminal vesicle and/or present in clasper groove.

FEMALES

Ovarian stages

A or 1 = immature, juvenile

Ovaries small, their internal structure gelatinous or granulated. No oocytes differentiated or all uniformly small, granular. Oviducts (uteri) narrow, thread like.

B or 2 = maturing, adolescent

Ovaries somewhat enlarged, walls more transparent. Oocytes becoming differentiated to various small sizes. Uteri largely as stage A/1 but may become widened posteriorly. Ovaries at first maturity will not show corpora lutea, or a very few only, whereas ovaries of resting females prior to repeated reproduction will show corpora lutea in greater number.

C or 3 = mature, adult

Ovaries large, well rounded. Oocytes obviously enlarged, all to about the same size, can easily be counted and measured.

Uterine stages

D or 4 = developing

Uteri well filled and rounded with seemingly unsegmented yolk content ("candle").

E or 5 =differentiating

Uteri well filled and rounded with segmented content of large yolk balls, can easily be counted and measured. Embryos variously small, atop their huge yolk balls, larger ones with external gills and unpigmented (still "candle"). (Stages D and E, or 4 and 5, have for convenience been rather artificially separated and might be seen also as substages of one and the same stage D/E, or 4/5).

F or 6 = expecting

Embryos more or less fully formed, pigmented, external gills lost, yolk sacs obviously reduced. Can be counted, measured and sexed easily.

G or 7 = post natal, spent

Ovaries at resting stage, similar to stages A/1 or B/2. Uteri empty but still widened considerably over their full length in contrast to stages A/1 or B/2.

Appendix IV Station and catch journal from the cruise. The catches are in number pr station (local station).

Station	Date	1. end			2. end			# of hooks		# of		Stuck	Loss of gaer
		Latitude	Longitude	Depth	Latitude	Longitude	Depth	Bottom line	Vertical line	Traps	Gillnets		
1	05.jul	N42°34,91	W28°02,64	2925	N42°33,91	W28°05,84	2827	3470	-	-	-	-	-
2	06.jul	N42°38,82	W28°04,29	2992	N42°36,63	W28°03,97	2909	3470	-	-	-	-	-
3	06.jul	N42°34,43	W28°08,86	2734	N42°34,14	W28°11,98	2582	3470	-	1	-	-	-
4	06.jul	N42°36,76	W28°10,09	2908	N42°37,06	W28°10,35	-	-	-	2	-	-	-
5	06.jul	N42°37,77	W28°22,18	2125	N42°37,58	W28°19,16	2436	3470	-	-	15	x	-
6	07.jul	N42°37,96	W28°39,64	1572	N42°37,83	W28°36,31	2340	3470	-	2	-	-	-
7	07.jul	N42°30,65	W28°47,40	1760	N42°30,90	W28°47,22	1865	-	-	1	-	-	-
8	07.jul	N42°32,58	W28°58,22	1411	N42°32,01	W28°54,99	1892	3470	-	-	15	-	All
9	07.jul	N42°35,44	W28°56,46	1478	N42°39,91	W28°53,12	2411	3470	-	3	-	-	-
10	08.jul	N42°29,84	W28°59,45	1100	N42°29,83	W28°56,27	1358	3470	-	4	-	x	-
11	08.jul	N42°25,90	W29°07,32	883	N42°26,39	W29°05,99	1149	2315	-	4	-	-	-
12	08.jul	N42°25,33	W29°38,20	1580	N42°25,37	W29°40,42	1964	2315	-	1	-	-	-
13	08.jul	N42°25,49	W29°48,14	2429	N42°25,49	W29°46,13	2018	2315	-	-	-	-	-
14	09.jul	N42°24,69	W29°55,08	1929	-	-	-	-	-	3	-	-	-
15	09.jul	N42°23,26	W29°59,71	2650	N42°24,88	W30°00,00	2675	2315	-	-	8	-	-
16	09.jul	N42°36,14	W29°20,05	3366	N42°37,82	W29°19,51	3280	2315	-	-	-	-	-
17	09.jul	N42°42,85	W29°18,13	3388	N42°43,05	W29°18,10	3323	-	-	8	-	-	-
18	09.jul	N42°51,66	W29°06,81	850	-	-	-	-	260	-	-	-	-
19	09.jul	N42°54,47	W29°04,60	973	-	-	-	-	260	-	-	-	-
20	09.jul	N42°49,79	W29°06,82	842	-	-	-	-	260	-	-	-	-
21	10.jul	N42°49,61	W29°06,97	972	N42°51,00	W29°06,89	944	2315	-	-	-	x	-
22	10.jul	N42°54,16	W29°04,52	966	-	-	-	-	520	-	-	-	-
23	12.jul	N51°09,70	W29°43,56	612	-	-	-	-	260	-	-	-	-
24	12.jul	N51°09,87	W29°43,56	624	-	-	-	-	260	-	-	-	-
25	12.jul	N51°10,07	W29°43,63	738	-	-	-	-	260	-	-	-	-
26	12.jul	N51°10,24	W29°43,74	786	-	-	-	-	260	-	-	-	-
27	12.jul	N51°09,65	W29°43,75	692	-	-	-	-	260	-	-	-	-
28	12.jul	N51°14,12	W29°38,85	3055	N51°13,05	W29°40,29	2685	2315	-	-	-	-	-
29	13.jul	N51°17,49	W29°36,44	3090	N51°17,09	W29°33,97	2510	2315	-	2	-	-	-
30	13.jul	N51°18,98	W29°36,47	3059	-	-	-	-	-	1	-	-	-
31	13.jul	N51°46,15	W29°31,82	1906	N51°46,11	W29°34,05	1724	2315	-	-	8	-	90 %
32	13.jul	N51°49,53	W29°39,28	2280	N51°47,97	W29°38,66	2004	2315	-	-	-	-	-
33	13.jul	N51°48,54	W29°49,60	1327	N51°46,97	W29°49,23	1570	2315	-	-	-	-	-
34	14.jul	N51°33,82	W30°18,27	1208	N51°34,82	W30°16,47	1592	2315	-	-	-	x	-
35	14.jul	N51°31,94	W30°19,83	888	N51°33,75	W30°17,84	1031	2315	-	-	-	x	-
36	14.jul	N51°31,59	W30°19,82	878	-	-	-	-	260	-	-	-	-
37	14.jul	N51°31,01	W30°19,55	810	-	-	-	-	260	-	-	-	-
38	14.jul	N51°29,88	W30°21,96	1542	N51°30,82	W30°20,16	948	2315	-	-	-	x	-
39	15.jul	N51°33,87	W30°36,95	1880	N51°34,76	W30°36,95	1528	2315	-	1	-	-	-
40	15.jul	N51°32,44	W30°40,15	2404	N51°33,22	W30°37,94	1750	2315	-	1	-	-	-
41	15.jul	N51°32,64	W30°58,65	3533	N51°32,97	W30°59,77	3502	1157	-	2	-	-	-
42	16.jul	N53°01,05	W33°35,78	3094	N53°01,53	W33°36,99	3069	1157	-	-	-	-	-
43	16.jul	N53°02,30	W33°44,09	2619	N53°02,41	W33°45,45	2647	1157	-	-	-	-	-
44	16.jul	N53°02,20	W34°50,72	1050	N53°00,98	W34°46,69	848	1735	-	-	-	-	40 %
45	16.jul	N53°00,20	W34°46,69	2061	N53°00,56	W34°48,59	1305	1735	-	-	-	-	70 %
46	16.jul	N53°03,72	W34°52,04	1649	N53°03,02	W34°50,67	1265	1735	-	-	-	-	-
47	17.jul	N53°07,17	W34°46,09	2277	N53°05,97	W34°46,49	2006	1735	-	-	-	-	-
48	17.jul	N54°17,27	W35°24,31	433	-	-	-	-	260	-	-	-	-
49	17.jul	N54°17,26	W35°24,11	476	-	-	-	-	260	-	-	-	-
50	17.jul	N54°17,09	W35°24,13	468	-	-	-	-	260	-	-	-	-
51	17.jul	N54°18,20	W35°24,62	506	N54°17,41	W35°24,30	519	1157	-	-	-	-	-
52	18.jul	N54°16,83	W35°24,25	440	-	-	-	-	260	-	-	-	-
53	18.jul	N54°16,69	W35°24,36	512	-	-	-	-	260	-	-	-	-
54	18.jul	N54°16,53	W35°24,44	583	-	-	-	-	260	-	-	-	-
55	18.jul	N54°17,44	W35°23,78	680	-	-	-	-	260	-	-	-	-
56	18.jul	N54°17,31	W35°23,90	681	-	-	-	-	260	-	-	-	-
57	18.jul	N54°17,09	W35°23,94	651	-	-	-	-	260	-	-	-	-
58	18.jul	N54°18,18	W35°24,54	540	N54°17,78	W35°25,07	518	1157	-	-	-	-	-
59	18.jul	N54°17,32	W35°24,31	450	N54°16,66	W35°24,30	466	1157	-	-	-	-	-
60	19.jul	N52°16,91	W30°58,72	549	N52°16,19	W30°59,38	709	1157	-	-	-	-	-
61	19.jul	N52°16,37	W30°59,70	584	-	-	-	-	260	-	-	-	-
62	19.jul	N52°16,35	W30°59,99	592	-	-	-	-	260	-	-	-	-
63	19.jul	N52°15,66	W30°53,73	2106	N52°15,80	W30°51,21	1580	2315	-	-	-	-	-
64	19.jul	N52°07,17	W30°42,00	4200	N52°07,33	W30°43,22	4300	1157	-	-	-	-	-
99	Catches at the surface			-	-	-	-	-	-	-	-	-	-
Sum								83311	5980	30	54	-	-

1	Station	
2	Alepocephalidae	
3	Anarhichas denticulatus	
4	Antimora rostrata	1
5	Aphanopus carbo	
6	Apristurus sp	
7	Balistes capriscus	
8	Bathyraja pallida	1
9	Bathyraja richardsoni	3
10	Brosme brosme	
11	Centrophorus sp.	1
12	Centrophorus squamosus	2
13	Centroscyrnus coelolepis	
14	Centroscyrnus crepidater	
15	Centroscyrnus owstoni	
16	Chimaera monstrosa	
17	Coryphaenoides sp. 1	8
18	Coryphaenoides sp. 2	
19	Coryphaenoides armatus	107
20	Coryphaenoides rupestris	158
21	Deania calcea	
22	Etmopterus princeps	1
23	Galeus murinus	1
24	Histiobranchus bathybius	10
25	Hoplostethus atlanticus	4
26	Hydrolagus affinis	2
27	Hydrolagus pallidus	1
28	Lepidion eques	
29	Lepidion guentheri	
30	Lepidion schmidti	
31	Macrouridae	1
32	Macrourus berglax	
33	Mola mola	
34	Mora moro	
35	Phycis blennoides	
36	Polyprion americanus	
37	Prionace glauca	
38	Pseudotriakis microdon	
39	Raja bata	
40	Raja bathyphila	
41	Sebastes marinus	
42	Seriola dumerili	
43	Somniosus microcephalus	
44	Somniosus rostratus	
45	Spectrunculus grandis	26
46	Spectrunculus sp	37
47	Synaphobranchus kaupi	
48	Synaphobranchus sp	
49	Anthozoa	
50	Brachyura	
51	Natantia	
52	Invertebra	1
53	Total	148
54		209
55		0
56		77
57		1
58		1
59		258
60		0
61		196
62		0
63		660
64		0
65		1038
66		0
67		253
68		0
69		78
70		283
71		0
72		7
73		162
74		29
75		5
76		18
77		23
78		36
79		14
80		51
81		68
82		74
83		75
84		65
85		85
86		0
87		81
88		0

