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SURVEY REPORT

FROM THE JOINT NORWEGIAN/RUSSIAN ECOSYSTEM SURVEY IN THE BARENTS SEA AUGUST – OCTOBER 2009

Preface

The joint survey was carried out during the period 07th of August to 03rd of October 2009. The survey plans and tasks has been changed many time due to reduction budgeting for this investigation. The prohibition for working Norwegian vessel in REEZ also created problems for executing survey plan. In spite of this most of the tasks was carried out. Joint investigations include the 0-group fish survey, the acoustic survey for pelagic fish, the investigations of bottom fish, plankton and benthos. The northern shrimp investigation and marine mammals observation was reduced compared to previous years. Oceanographic investigations has been reduced, so two standard section was not conducted. Consequently, a joint, but somewhat reduced,“ecosystem survey” was carried out by IMR and PINRO also in 2009.

The present volume of the survey report covers many but not all of aspects of the survey. The main focus is on the hydrographical conditions of the Barents Sea, the results from the 0-group fish investigations and from the acoustic investigation on pelagic fish (capelin, young herring, blue whiting and polar cod). Preliminary materials on demersal fish, sea mammals and seabird observations are also presented in this report. Finalised analysis of results from investigations on plankton, bottom fishes and benthos will only be made available as an electronic attachment to this report on the internet. The first version of the report was made in Murmansk 06 -10 October during a meeting between scientists participating in the survey.

A list of the participating vessels with their respective scientific crews is given in Appendix I. The following specialists took part in preparing the survey report: from PINRO – T. Karaseva, Yu. Kovalev, P. Lubin, N. Lukin, E. Murashko, P. Murashko, T. Prokhorova, D. Prozorkevich, A. Trofimov, N. Ushakov; from IMR - J. Alvarez, B. Bogstad, Dalpadado P., E. Eriksen, Gjøsæter H., Heldal H.E., Jørgensen L.I., Knudsen T., Mauritzen M., B. Røttingen, S. Tjelmeland.

Photo: Dmitry Prozorkevich

Synopsis

The main aim of the ecosystem survey was to map the distribution and abundance of the young and adult stages of several pelagic and demersal fish species, and in addition to gather information about hydrographical features, zooplankton, benthos, seabirds and sea mammals.

The water temperature in all observed areas was still higher (0.4-1.1 °C) than the long term mean but somewhat lower than in the same period in 2008.

The 2009 year-class of capelin, haddock and cod are rich. 0-group of herring, redfish, polar cod and sandeel are near the average level. 0-group of Greenland halibut, saithe, long rough dab, wolffish were estimated as poor.

The total capelin stock was estimated at 3.76 million tonnes, which is 15% less than last year. About 2.3 million tonnes were assumed to be maturing. Estimated spawning stock is two times above to the long term mean and comparable with the last year level.

The polar cod stock was estimated to be 0.89 million tonnes, that is 27% lower than in 2008 but near the long term mean level.

The biomass of juvenile Norwegian spring spawning herring in south-western areas was estimated to be 0.74 million tonnes. In south-eastern areas biomass of 0.024 million tonnes is uncertain due to great mixing of Norwegian spring spawning herring with Kanin herring.

Blue whiting of age groups 1 to 9, but mostly age 4 - 7, were observed in the western and southwestern parts of the surveyed area. The biomass of this stock component was estimated to be 0.26 million tonnes, which is low, but somwhat higher than in 2008.

Preliminary results from investigations of the pollution levels in the Barents Sea show that the levels of organic and radioactive contaminants are comparable with those found earlier years. Investigations in the area adjacent to the sunken nuclear submarine “Komsomolets” do not indicate a significant leakage from the submarine.

Innhold

1 METHODS

During the survey data on cruise tracks, hydrography, trawl catches, integrator values etc. were exchanged by e-mail between Norwegian vessels “G.O. Sars”, “J. Hjort”, “Jan Mayen” and Russian vessel “Vilnyus”. Total Russian exchange of survey data were transmitted to “head” IMR vessel “J. Hjort” before the Russian vessel returned to port after the survey. Final survey data from all vessels were collected during the meeting in Murmansk 06/10.

1.1 Hydrography

The oceanographic investigations consisted of measurements of temperature and salinity in depth profiles distributed over the total investigated area and along the sections Kola, Kanin and Vardø-North. All vessels used CTD-probes.

1.1.1 0-group fish investigations

Since 1965 surveys in August/September have provided annual information on the abundance and spatial distribution of pelagically distributed 0-group fish of Barents Sea capelin (*Mallotus villosus*), Norwegian spring spawning herring (*Clupea harengus*), Northeast Arctic cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*) as well as several others (polar cod *Boreogadus saida*, long rough dab *Hippoglossus platessoides*, Greenland halibut *Reinhardtius hippoglossus*, redfish *Sebastes* spp. and others).

The distribution and abundance of 0-group fish were based on the catches, and measured in number of fish per square nautical mile. The trawling procedure consisted of pelagic trawl catches from a mid-water trawl with a quadratic mouth opening of 20x20 m. Since 1980 the standard procedure have been used on all vessels and trawling procedure consist of tows covering 3 depths, each over a distance of 0.5 nautical miles, with the headline of the trawl located at 0, 20 and 40 m and with trawling speed of 3 knots. Additional tows at 60, 80 and 100 m, also of 0.5 nm, were made when the 0-group fish layer was recorded deeper than 40 m depth on the echo-sounder.

The history of development of 0-group investigation, assessment methods and recalculating of abundance indices is described in details in earlier versions of the survey report (Anon. 1980, Anon. 1983, Anon. 2007) and in Eriksen et al., 2009).

1.2 Acoustic survey for pelagic fish

The survey area was equal to the total survey area covered during the ecosystem survey, i.e. the acoustic method was applied throughout the survey. All regions of the Barents Sea and adjacent areas of the Norwegian Sea were covered, with course lines 35 nautical miles apart.

All participating vessels used ER-60 echo sounders (with ER-60 software). All vessels used LSSS (“Large scale survey system”). “G.O. Sars”, “J. Hjort” and “Jan Mayen” were equipped with transducers on adjustable keels that can be lowered in rough weather to avoid the damping effect of bubbles. Echo intensities per nautical mile were integrated continuously, and mean values per 1 nautical miles were recorded for mapping and further calculations.

The echograms, with their corresponding s_A-values, were scrutinized every day. Contributions from the seabed, false echoes, and noise were deleted.

The corrected values for integrated echo intensity were allocated to species according to the trace pattern of the echograms and the composition of the trawl catches. Data from pelagic trawl hauls and bottom trawl hauls considered representative for the pelagic component of the stocks, which is measured acoustically, were included in the stock abundance calculations.

The echo sounders were watched continuously, and trawl hauls in addition to the predetermined hauls were carried out whenever the recordings changed their characteristics and/or the need for biological data made it necessary. Trawling was thus carried out both for identification purposes and to obtain biological observations, i.e., length, weight, maturity stage, stomach data, and age.

The vessels gave the s_A-values in absolute terms based on sphere calibrations, that is, as scattering cross section in m^2 per square nautical mile. The acoustic equipment of the vessels was calibrated by standard spheres (see Appendix 2).

1.2.1 Area coverage

In 2009 a total coverage of survey area was successful. The weather conditions were favourable during half part of the survey. In the beginning of August “Vilnyus” started surveying in the northern part of the covered area with extensions towards north-east. The wind and ice formation limited observations of “Vilnyus”. During second part of August and beginning of September “G.O.Sars” covered the western part, while “J.Hjort” covered the area along the Norwegian coast. ”J.Hjort” changed route due to lack permission for access to REEZ and moved to the northern area, where “Vilnus” started coverage of capelin area. “Jan Mayen” covered the area around Spitsbergen, but difficult ice condition prevented coverage of some areas in east from Spitsbergen. The Norwegian vessels covered NEZ and Grey zone, while “Vilnyus” covered the REEZ. See Fig. 2.1-2.3 for details of the realized survey track.

1.2.2 Computations of the stock sizes

The computations of number of individuals and biomass per length-and age group of the pelagic fish stocks were done in the same way as in previous years. For details see the 2006 ecosystem survey report (Anon. 2006).

1.3 Bottom trawl survey

The number and biomass of fish per length- and age-group will be calculated from bottom trawl catches using the “swept-area” method. These results will be presented later, since the age determination of demersal fish will be carried out after the survey.

Acoustic registrations of bottom fish were carried out along all cruise tracks, with division of s_A-values by species based on trawl catches data.

1.3.1 Strata system used

A new strata system was constructed in 2004 (IMR) and 2009 (PINRO) covering the whole Barents Sea to include the total survey area. The new geographic system is also depth stratified using GEBCO depth data.

1.4 Plankton investigations

Data on phytoplankton abundance was obtained in several ways during the joint Russian-Norwegian Survey. On the Norwegian vessels G.O. Sars, Johan Hjort and Jan Mayen samples for chlorophyll ***a*** were obtained at nearly all CTD stations through filtration of water from water bottles at discrete depths from 0 – 100 m including a surface sample taken using a bucket. The total number of samples varied slightly depending on bottom depth at the specific localities. Phytoplankton was filtered using GFC filters, and samples were frozen for later analysis of chl **a** content at the IMR laboratory. For the vessels mentioned above phytoplankton nutrient samples were obtained from the same water bottles on most CTD stations, at depths from the surface to the bottom according to a predefined scheme as determined for the Ecosystem cruise and specific bottom depth of each station. Normally, onboard G.O. Sars a fluorimeter is used as an additional instrument, connected to the CTD, logging chl ***a*** fluorescence as a continuous vertical profile along with temperature and salinity for all CTD stations. These data must be calibrated with the help of chl ***a*** determined from the water bottle samples obtained at the same stations.

Samples for phytoplankton species composition and abundance have been obtained from the Norwegian vessels “G.O. Sars”, “Johan Hjort” and “Jan Mayen”. For every second or third station quantitative water samples were obtained from water bottles at 5, 10, 20 and 30 m depth. Immediate upon retrieval of the seawater rosette sampler, one 25 ml phytoplankton sample were taken from each bottle at the above mentioned depths. The samples were pooled in a dark light-protected 100 ml flask adding 2 ml lugol as fixative for later analysis. Slightly less frequent a 10 µm meshed phytoplankton net with a 0.1 m^2 opening was vertically operated from 0-30 m to obtain a qualitative phytoplankton sample. After gentle mixing of the water from the net cod-end, one dark light-protected 100 ml flasks was filled with approximately 80 ml seawater, then adding 2.5 ml 20% formalin for fixation. At some stations a paralell sample was taken and fixated in 2 ml lugol.

On Russian vessels preliminary information on phytoplankton condition is gathered simultaneously with the zooplankton sampling. Usually, micro-algae are determined with binocular during the processing of zooplankton samples. The phytoplankton conditions are derived from the zooplankton samples by visual estimation of micro-algae concentration and frequency of cell occurrence using a 5-unit scale - single (1) to mass (5) occurrence. The micro-algae structure is defined to a genus level.

Zooplankton sampling on all three Norwegian vessels was carried out by WP-2 plankton nets with a 0.25 m^2 opening and 180 µm mesh size. Usually two hauls were made at each station, one was taken from the bottom to the surface and the other one from 100 m to the surface. In 2009 no stratified sampling was conducted with the Mocness multinet planktonsampler due to lack of financing plankton personell on board the vessels. The sampling on the Russian vessel was carried out by Juday-nets with 0.1 m^2 opening and 180 µm mesh size. Depth intervals for plankton sampling were the bottom-0m, 100-0m and 50-0m layers.

In addition on Russian vessel "Vilnyus" sampling of macroplankton were taken by plankton net BR (with a 0.2 m^2 opening and 564 µm mesh size) connected with bottom trawl.

On board the Norwegian vessels samples were normally split in two, one part was fixated in 4% borax neutralized formalin for species analysis and the other one was size-fractioned as follows; >2000 µm, 2000-1000 µm and 1000-180 µm size categories. These size-fractionated samples were weighed after drying at 60°C for 24 hours. For large organisms like medusae and ctenophores their volume fraction were determined by displacement volume. From the >2000 µm size fraction krill, shrimps, amphipods, fish and fish larvae were counted and their lengths measured separately before drying. Chaetognaths, *Pareuchaeta* sp. and *Calanus hyperboreus* from the >2000µm size fraction were counted and dried separately, but their sizes were not measured. Later all weights were determined at the IMR laboratory in Bergen.

Processing of Juday net samples from the Russian vessels included weighing of samples to within 0,0001 g, with preliminary removal of an excessive moisture on a filtering paper; species identification and abundance determination. Processing identification to a species, and a quantitative estimation. A more detailed processing of species and stage composition as well as numerical abundance will be undertaken in the laboratory according to standard procedures. Dry weights will be derived using a conversion factor of 0.2. All zooplankton data will be presented as biomass or numbers per 1 m^2 surface.

Final plankton results will be presented later, since the samples are worked up after the survey.

1.5 Stomach investigations

According to agreement at the Russian-Norwegian meeting in March 2006 capelin and polar cod stomachs were collected at the Norwegian ("G.O. Sars", "J. Hjort" and"Jan Mayen") and Russian ("Vilnyus") vessels in August-September 2009. Also stomach samples of cod and haddock were taken according to standard protocol on Norwegian vessels. On board "Vilnyus" the stomach were anylized both commercial (cod, haddock, other) and non-commercial fish species. About 10 000 stomach from different fish species were analyzed or collected during eco-survey.

1.6 Marine mammals and seabirds investigations

Marine mammals observations (species and numbers observed) were recorded onboard the Norwegian research vessels "G.O. Sars", "Johan Hjort", "Jan Mayen" and the Russian research vessel "Vilnyus".

Onboard the Norwegian vessels visual observations were made by three observers from the vessel bridges; one dedicated for observing sea birds and two dedicated for observing marine mammals. The marine mammal observers covered approximately the front 90° sector (45° each) and the sea bird observer covering one 90° sector along the ship sides. While most species were recorded continuously along the cruise transects when steaming between stations, the ship-following seabird species (northern fulmars and gulls) were counted every hour. Onboard the Russian research vessel observations of marine mammals and sea birds were carried out by one observer covering a full sector of 180° from the roof of the bridge about 9-10 m above the sea surface level. Observers were observing only along transects between stations. All species were recorded continuously along the transects.

Observer’s activity was limited by weather conditions. When the weather conditions were not sufficiently good for observations observation effort was stopped. Both observer activity and weather conditions were recorded.

1.7 Benthos observations

1.7.1 Purpose

The purpose of the benthos investigation was to monitor benthic habitats and communities in the Barents Sea by analysing the bycatch of the Campelen trawl on all Norwegian and Russian ships. This should lead to criteria for selection of suitable monitoring locations in the Norwegian and Russian EEZ and improved procedures for providing results on benthos relevant for an ecosystem approach to management of marine resources in the Barents Sea.

1.7.2 Criteria for selection of sampling locations

Bycatch of invertebrates were recorded from all bottom trawl hauls of the Russian RV “Vilnyus” and the Norwegian RV “G.O. Sars”, “Johan Hjort”, “Jan Mayen”. Increased benthic sampling was made at RV “Vilnyus”, “Johan Hjort”, “Jan Mayen”.

1.7.3 Bottom trawl

At RV “Vilnyus”, “Johan Hjort”, “Jan Mayen” the benthic invertebrate bycatch from all hauls with bottom trawl (Campelen) was processed to species level onboard. Species difficult to identify was photographed and preserved in alcohol for later identification. On RV “G.O. Sars” sorted and measured the bycatch into large invertebrate groups.

1.8 Pollution

1.8.1 Background

IMR routinely carries out monitoring of contaminants in the Barents Sea. This includes sampling of sea water, sediments and marine biota. The analysis includes different hydrocarbons, persistent organic pollutants (POPs) (PCB, DDT, HCH, HCB) and radionuclides. Monitoring of radionuclides is performed within the monitoring programme “Radioactivity in the Marine Environment” (RAME), which is coordinated by the Norwegian Radiation Protection Authority (NRPA). Monitoring of organic contaminants is performed in close cooperation with NGU (The Geological Survey of Norway) and National Institute of Nutrition and Seafood Research (NIFES).

1.8.2 Sample collection

Samples of sediments and seawater have been collected in the Barents Sea from 18 stations from the Norwegian vessels “G. O. Sars”, “Jan Mayen” and “Johan Hjort” and from 11 stations from the Russian vessel "Vilnyus" during the period August-October 2009 (Fig. 2.3).

Samples of marine biota have been collected from the same vessels from a large number of stations during the same period (an overview is given below).

1.8.2.1 Seawater

10 L seawater was collected per sample for analyses of polonium-210 (Po-210) and radium-226 (Ra-226), while 50 L seawater was collected per samples for analysis of strontium-90 (Sr-90). All samples were stored in plastic cans and acidified with hydrochloric acid. 200 L seawater was collected per sample for analyses of americium-241 (Am-241) and plutonium-isotopes. Samples were either stored in plastic cans and acidified with hydrochloric acid, or pre-concentrated to 10 L onboard. These samples were sent to NRPA at Østerås for further treatment.

Between 200 and 300 L seawater was passed through filters onboard for analysis of cesium-137 (Cs-137). The filters will be brought back to IMR and NRPA for further treatment.

Samples of 100 L were collected for analysis of technetium-99 (Tc-99). Onboard "G. O. Sars" and "Johan Hjort", the samples were passed through Amberlite IRA 400 anion exchange columns. The columns were brought back to IMR for further treatment. Onboard "Jan Mayen", these samples were stored in 25 L cans and sent to IMR.

1.8.2.2 Sediments

Both surface samples and sediment cores were collected using a Smøgen box corer. Some of the sediment cores were cut into slices of 1 or 2 cm thickness onboard the vessels. The samples were frozen and brought back to IMR and NRPA for further treatment. The samples will be analyzed for radionuclides, organic contaminants and trace metals.

Stations where sampling for investigations of pollution were performed is listed below. Samples of surface sediments and/or sediment cores were taken from all stations for investigations of organic contaminants and radioactive pollutants. Samples of seawater were taken from all the stations for investigations of radioactive pollution.

	CTD-Station	Date	Lat.		Long.		Salinity	Temp.	Depth
G. O. Sars	464	26/08/09	73	57.63	21	51.07	35.0404	7.1546	467
	474	28/08/09	74	48.35	18	0.97	34.4459	3.8195	294
	480	31/08/08	76	12.92	18	34.20	34.4527	4.3070	252
	493	03/09/09	72	1.12	15	30.19	34.6304	10.9624	672
Johan Hjort	479-482 (surface)	16/08/09	73	43.15	13	16.52	34.8236	9.5933	1681
	479-482 (bottom)	16/08/09	73	43.15	13	16.52	34.8911	-0.8690	1681
	533 (surface)	03/09/09	76	49.23	43	1.97	34.2221	3.0173	221
	533 (bottom)	03/09/09	76	49.79	43	2.64	35.0052	0.6245	212
	549	07/09/09	76	37.26	34	27.77	34.1048	2.9371	182
	571	13/09/09	74	31.72	41	17.93	34.8082	4.1814	204
	576	17/09/09	71	0.02	30	56.65	34.4081	8.7733	277
	591	19/09/09	75	0.24	31	12.70	35.0371	6.2303	351
	610	24/09/09	73	29.73	29	8.62	34.9503	7.5476	405
	624	28/09/09	72	56.31	25	59.96	34.9741	7.3038	374
	630	29/09/09	71	47.95	36	4.12	35.0126	5.9334	275

Jan Mayen	530	11/09/09	76	55.67	12	44.89	34.8187	7.0507	257
	558	18/09/09	79	38.92	15	26.64	33.9923	4.3673	138
	569	20/09/09	81	16.09	22	55.98	30.9728	-1.6096	210
	574	22/09/09	78	35.88	25	10.46	32.6537	0.192	157
	438	26/09/09	71	19.50	22	28.09	-	-	429

The yearly investigation of radioactive contaminants in sediments and seawater in the area around the sunken Russian submarine "Komsomolets" was also included in this sample collection.

1.8.2.3 Biota

Biota samples were collected from both pelagic and benthic trawls. For large fish species, attempts were made to collect filets from 25 fish from each station/area. Small fish, shrimps and benthos will be analyzed whole. The samples were frozen and brought back to IMR and NRPA for further treatment. The samples will be analyzed for radionuclides, organic contaminants and trace metals.

Stations where biota samples were collected is listed below. The samples will be analysed for organic contaminants and radioactive pollution.

	Station	Species
JOHAN HJORT 23.09-16.09	282	cod, saith, deep-sea shrimp
	284	cod, deep-sea redfish
	288	cod, haddock
	290	cod, deep-sea redfish, norway pout
	292	saith, haddock
	296	deep-sea redfish, blue whiting
	298	deep-sea redfish, long rough dab
	299	amphipods
	304	krill
	307	long rough dab, polar cod, greenland halibut
	311	cod, polar cod
	313	long rough dab
	314	krill
	317	capelin
	318	greenland halibut
	353	haddock
	362	long rough dab
	365	greenland halibut, deep-sea shrimp
	368	long rough dab
	371	long rough dab
	375	long rough dab
	400	haddock

	402	haddock
	403	haddock
	407	haddock, deep-sea redfish
JOHAN HJORT 16.09-03.10	424	deep-sea redfish
	433	long rough dab, deep-sea shrimp
	442	capelin
	445	cod
	451	greenland halibut, 0-gr. cod, 0-gr. herring, 0-gr. haddock
	456	cod
	463	cod
	465	greenland halibut
	470	cod, golden redfish
	471	0-gr. herring
	472	cod, golden redfish, greenland halibut
	479	krill
	480	norway pout
	484	greenland halibut
	486	golden redfish
	494	blue whiting
	496	golden redfish
	495	herring
	497	deep-sea redfish
	498	herring
G. O. SARS	177	long rough dab
	178	deep-sea redfish, greenland halibut
	179	cod, haddock, deep-sea redfish, greenland halibut, long rough dab
	182	cod, deep-sea redfish, long rough dab
	186	capelin
	187	cod, haddock
	188	cod, haddock
	191	cod
	196	deep-sea redfish, deep-sea shrimps
	198	herring
	216	deep-sea redfish
	223	deep-sea redfish
J. Mayen	554	polar cod

1.8.2.4 Equipment used:

- A shipboard pump was used to collect surface (5 m) seawater.
- A CTD/rosette multi-bottle sampler with 12 10 L samplers was used to collect seawater from depths below 5 meters.

- A filter system consisting of a prefilter (1 micron) and two $Cu_2[Fe(CN_6)]$-impregnated cotton filters connected in series was used for collecting radiocaesium-samples.
- A ”WATSON-MARLOW”-pump and ion exchange columns containing a standard anion exchange resin (Amberlite IRA 400, Sigma-Aldrich) was used for Tc-extraction.
- A Smøgen boxcorer was used for sediment sampling.

1.8.3 Analyses

Technetium-99 and cesium-137 are analysed by means of radiochemical treatment followed by beta- and gamma-spetroscopy, respectively. The method for Polychlorinated biphenyls (PCB) and chlorinated pesticides includes liquid-liquid extraction, fractioning and clean-up of the extract and the analysis of the fractions with gas chromatography coupled to ECD-detector.

Analyses of pollutants are often time consuming, and we plan to have all the results ready within about a year. Some preliminary results are presented in chapter 2.10.

1.9 Fish pathology research

1.9.1 Background

The research aimed at study of health of commercial marine organisms was commenced by PINRO in 1999 in connection with the lack of the scientific information about pathology and deceases of marine organisms occurring in the Barents Sea and adjacent marine areas (ICES Subarea I and Divs. IIa and IIb). The research is of monitoring type. Its primary goal is to develop the system of express testing of the commercial fish population health, their habitat and safety of aquatic biological resources.

1.9.2 Purpose

The main purpose of the fish pathology research is annual estimation and control of epizootic state of cods, flatfishes and wolffishes, the completion of databank on fish diseases and pathology. Also this investigations are necessary to find and describe symptoms of diseases in cod, haddock, halibut, polar cod, long rough dab, capelin; to collect statistical data on the occurrence frequency of pathologies and disease symptoms and to sample ill fish tissues for laboratory diagnostic research.

1.9.3 Proceeding of analysis:

- Examination of skin, fins, head, eyes and viscera of fish when making biological analysis.
- Photographing ill specimens and pathologies revealed.
- Description of morphology and localization of pathologies.
- Holding fixed tumors, ulcers, necrotic skin parts, affected eyes and viscera of fish for histopathologic analysis.
- Registering and recording ill fish in trawl cards and in statistical tables.
- Registration of data by fishing areas, objects and 6 groups of pathologies (acute and healing ulcers , necrosis of fins and skin, eye changes, skeleton deformation, tumors, pathologies of liver and gonads).
- Preliminary analysis of primary data on diseases and pathologies of fish.

2 RESULTS AND DISCUSSION

Altogether, the joint survey included 127 vessel-days, compared to 141 in 2008 , 210 in 2007, 205 in 2006, 208 in 2005 and 215 in 2004. Altogether, the vessels sailed about 18000 nautical miles with observations of 460000 square nautical miles. In total, the Norwegian vessels carried out 448 trawl hauls and the Russian vessels 306 trawl hauls, so in total 754 hauls were made during the survey (while 776 hauls were made in 2008, 1007 in 2007 and 999 hauls – in 2006).

Survey routes with trawl stations; hydrographical and plankton and environmental stations are shown in Fig. 2.1, 2.2 and 2.3, respectively.

2.1 Hydrographical conditions

Figures 2.1.1-2.1.6 show the temperature and salinity conditions along the oceanographic sections: Kola, Kanin and Vardø – North. The mean temperatures in the main parts of these sections are presented in Table 2.1.1, along with historical data back to 1965. Anomalies have been calculated using the long-term mean for the period 1954-1990. Horizontal distribution of temperature and salinity are shown for depths of 0, 50, 100, 200 m and near the bottom in Figures 2.1.7-2.1.16. Anomalies of temperature and salinity at the surface and near the bottom are presented in Figures 2.1.17-2.1.20.

In general the temperature was 0.4-1.1°C above the long-term mean throughout the Barents Sea. The surface water temperatures were near the long-term mean in most of the investigated area. Positive temperature anomalies (> 0.5°C) were observed north of 77°N and in the south-eastern, partly eastern and westernmost parts of the Barents Sea (Fig. 2.1.17). Negative temperature anomalies (< –0.5°C) were found in the central part, as well as west of the northern island of Novaya Zemlya and in the area between Bear Island and West Spitsbergen. In the bottom layer, positive temperature anomalies (0.3-1.0°C) were found practically in everywhere except some small areas west of the southern island of Novaya Zemlya, east of Bear Island and south-east of the Spitsbergen Archipelago, where waters with negative temperature anomalies (< –0.5°C) were found (Fig. 2.1.18).

Compared to 2008 the surface temperature was lower (on average 0.3-0.8°C) in the central, south-eastern and partly north-eastern parts of the investigated area as well as north of Bear Island and near the Spitsbergen Archipelago. In the south-western, northern, partly north-eastern and westernmost parts of the Barents Sea on the other hands, the surface temperature was of 0.5-1.0°C higher than in 2008. The temperatures at 50 and 100 m depths were lower in 2009 than in the previous year mainly near the Spitsbergen Archipelago, west and north of the northern island of Novaya Zemlya and in the area approximately between 75 and 78°N. The rest of the Barents Sea was occupied by waters with temperatures higher or close to the same as in the previous year. The temperatures at 200 m depth and near the bottom were in general lower in 2009 than in 2008 throughout most of the Barents Sea.

The surface salinity was in general higher (by 0.1-0.4 on average) than the long-term mean throughout most of the investigated area except for fresher surface waters found in small areas west of West Spitsbergen, north of Bear Island and in the south-western Barents Sea (Fig. 2.1.19). The highest surface salinity anomalies (> +0.5) were observed in the eastern and northern Barents Sea. Compared to 2008 the surface salinity was in general higher for the investigated area. The water salinity below the surface layer was in general the same as in 2008 and slightly higher (up to 0.1) than the long-term mean throughout the Barents Sea except the Spitsbergen Bank where fresher waters than usual were found (Fig. 2.1.20).

The Kola Section is divided into three parts. The inner part represents the Coastal Murman Current and contains mostly coastal water masses, the central part represents the Murman Current and usually contains both coastal and Atlantic water masses, and the outer part represents the Central branch of the North Cape Current and contains mostly Atlantic water masses. At the beginning of August 2009, the positive temperature anomalies in the upper 50 m layer were 0.5°C in the Coastal Murman Current, 0.2°C in the Murman Current and 0.3°C in the Central branch of the North Cape Current. As for the upper 200 m layer, the positive temperature anomalies were 0.7°C in the Coastal Murman Current and 0.6°C both in the Murman Current and in the Central branch of the North Cape Current. Towards the end of September these temperature anomalies reached values of 0.7, 0.6 and 1.1°C respectively both in the upper 50 and 200 m layers, that was much higher (by 0.3-0.7°C) than in the same time in 2008. In general, the positive temperature anomalies in the upper 200 m layer remained unchanged in the inner and central parts of the Kola Section from the beginning of August to the end of September 2009. Whereas the temperature anomalies in the upper 50 m layer in all parts of the Kola Section and in the upper 200 m layer in the outer part become higher (by 0.2-0.8°C) towards the end of September compared to the beginning of August 2009. This was probably due to strong westerly winds in September 2009, causinged more intensive inflow of the Atlantic waters to the Barents Sea in the upper layers.

The Kanin Section is divided into two parts. The outer part represents the Novaya Zemlya Current and had positive temperature anomalies of 1.0 °C in the upper 200 m layer at the beginning of September 2009, corresponding to 0.2 °C higher than in 2008.

The Vardø – North Section covers in the south the Norwegian Coastal Current and the Murman Current containing both coastal and Atlantic water masses. North of this (about 72°15'-74°00'N) it cuts through the Central branch of the North Cape Current that carries Atlantic Water eastwards south of the Central Bank. North of 74°30'N, the section covers the Northern branch of the North Cape Current. This branch flows towards northeast on the west side of the Central Bank transporting Atlantic Water masses toward the Hopen Trench. The Central branch of the North Cape Current was warmer than usual and compared to the previous year.

The high temperature in the Barents Sea is mostly due to the inflow of water masses with high temperatures from the Norwegian Sea. During the last 7 years the inflow to the Barents Sea has had high temperatures.

2.2 Distribution and abundance of 0-group fish

The distribution of eleven 0-group fish species (capelin, cod, haddock, herring, polar cod, saithe, redfish, Greenland halibut, long rough dab, wolffish, sandeel) are shown in Figs 2.2.1-2.2.11. Abundance indices calculated for most ecologicaly important species (capelin, cod, haddock, herring, polar cod, saithe, redfish, Greenland halibut and long rough dab) from 1980-2009 are shown in Tables 2.2.1 to 2.2.2. The density grading in the figures is based on the catches, measured in number of fish per square nautical mile. More intensive coloring indicates dense concentrations. In the central part of the Barents Sea cod and haddock were observed from surface to bottom, relating to settlement of cod and haddock. Hence

underestimation of cod and haddock abundance is obvious. Length frequency distributions of the main species are given in Table 2.2.3.
Abundance indices for 2008 were recalculated due to mistakes in the calculations program. New indices are presented in Tables 2.2.1 to 2.2.2.

The 2009 year classes of capelin, cod and haddock can be characterized as abundant. The 2009 year class of herring, redfish, polar cod and sandeel are close to average, saithe, Greenland halibut, long rough dab and wolffish are poor.

The capelin in the western partt was smaller, while in eastern part larger than in 2008. Cod, herring and especially haddock were larger than in 2008 In spite of the fact that the investigations were carried out about one month later in 2009 than in most previous years. Otoliths were taken to split 0-group from older fish when both small and large fish were observed in the sample.

2.2.1 Capelin *(Mallotus villosus)*

Capelin were distributed over a wide area - from the Norwegian and Russian coast until 77˚N and between 20˚E and 57˚E (Fig. 2.2.1). The highest densities of capelin were observed in the south-eastern part of the Barents Sea between 35-50˚E and 68-74˚N. Scattered concentrations were found in the central part and were absent in the western part of Barents Sea.

Otoliths were taken regularly to split of 0-group from older fish. In samples taken for age reading 0-group capelin was generally not longer than 5.5 cm, except three samples, were fish length were 7.0 and 7.5 cm. The mean length of capelin was 4.2 cm, the smallest since 2006.

The calculated density varied from 0 to 30 million fish per square nautical mile. Mean catch per trawl was 2557 fish.

In four successive years, the abundance of capelin has been high, and the abundance in 2009 was about 2 times higher than the long term average level.

2.2.2 Cod *(Gadus morhua)*

0-group cod were distributed over a wide area, as usually (Fig. 2.2.2). The main dense concentrations were registered in the central part of the sea from 71˚N to 75˚N between 20˚ and 40˚E. Scattered registrations were observed until 79˚N and along the coast, west and north of Spitsbergen up to 82˚N.

Otoliths were taken at some stations to identify 0-group cod. Otoliths reading show that length of 0-group cod varied between 5 and 14 cm and length of the most of fish was between 7 and 10 cm. Hence length of cod was higher than the long term mean.

The calculated density varied from 0 to 4.2 million fish per square nautical mile. Mean catch was 973 fish per trawl haul.

The abundance index of 2009 year-class was 2 times higher than the long term mean level, but lower than in 2008. In the northern and central parts of the Barents Sea settlement of 0-group cod had begun, and cod were distributed in the whole water layer (Fig 2.2.12). Therefore cod abundance is underestimated.

2.2.3 Haddock *(Melanogrammus aeglefinus)*

0-group haddock were distributed in western and central parts of the Barents Sea: from the coast up to 77˚N, between 15˚ and 47˚E, and scattered concentration were observed along the western and northern coast of Spitsbergen (Fig. 2.2.3).

Otoliths were taken from fish larger than 15 cm to identify length of 0-group fish. Length of 0-group haddock varied between 5 and 17 cm and length of most of the fish was between 8.5 and 11.5 cm. Mean length of haddock was 10 cm, and was higher than long term mean.

During the last three years mean catch per trawl haul continually decreased, but was high in 2009, when the mean catch was 333 fish per trawl haul. The calculated density varied from 0 to 1.3 million fish per square nautical mile.

The 2009 year class of haddock is twice as high as the long term mean, and therefore the 2009 year class of haddock can be characterized as above average. In the central part of the Barents Sea settlement of 0- group haddock had begun, and haddock were distributed in the lower water layers. Therefore the abundance of haddock is underestimated.

2.2.4 Herring *(Clupea harengus)*

0-group herring were distributed in the central and southern parts of the Barents Sea. The densest concentration of herring was observed from the coast of northern Norway and up to 74˚N and between 25˚-40˚E (Fig.2.2.4). Scattered concentrations were observed to the west of Spitsbergen. Mean length of herring was 7.4 cm, and was somewhat higher than the long term mean. The length of herring varied between 3.5 and 12 cm, and most fish were 6-8.5 cm.

Mean catch per trawl haul was 635 fish, somewhat was less than in 2007 and 2008. The calculated density varied from 0 to 2.7 million fish per square nautical mile.

The 2009 year-class of 0-group herring is two times lower than the average level, and therefore the 2009 year class of herring can be characterized as poor.

2.2.5 Polar cod *(Boreogadus saida)*

The eastern component of polar cod was mostly distributed along the western and southern coast of Novaja Zemlja (Fig. 2.2.5). A dense concentration was observed close to the coast. The abundance index of the eastern component of 0-group polar cod is halv of the long term average.

Around Spitsbergen scattered concentrations of the western component of polar cod were registered. The abundance index of the western component of polar cod is higher than the long term average.

The mean length of 0-group polar cod was 4.6 cm, and was lower than in the last two years. Most of fish had length between 3 and 6 cm.

The 2009 year class of polar cod (summing the two components) seems to be medium. 0-group polar cod distributes further north and east of surveyed area and only a part of the total distribution was covered during this survey.

2.2.6 Saithe *(Pollachius virens)*

Distribution of 0-group saithe was very scattered. Saithe was observed only on some few stations in the central part and at one station to the west of Spitsbergen. (Fig. 2.2.6).

Length of 0-group saithe varied between 6 and 14 cm, and most of the fish was between 8 and 10 cm. Mean length of saithe was 9.7 cm, and was higher than long term mean.

The maximum calculated density reached 9422 fish per nautical mile and the maximum catch was only 58 fish.

Since 2006 abundance indices have continuously decreased, and in 2009 was 12 times lower than long term average. So the 2009 year-class of saithe in the Barents Sea may be characterized as very poor.

2.2.7 Redfish *(Sebastes sp.)*

0-group redfish was observed in two components: one was registered in the western and central parts of the Barents Sea and another – to the west and north of Spitsbergen (Fig. 2.2.7). The distribution area of redfish was wider in 2009 than in previous years. Dense concentrations of redfish were registered between 72-74˚N and 20˚-35˚E, and north-west of Spitsbergen.

In 2009 the mean fish length was 5.0 cm, and was higher than long term mean.

Mean catch per trawl haul reached 5123 fish. On 16 of the stations fish densities were higher than 1 million fish per square nautical mile, so the calculated density reached 26.5 million fish per square nautical mile.

The abundance of 0-group redfish is near the long term average. So the 2009 year-class may be characterized as average.

2.2.8 Greenland halibut *(Reinhardtius hippoglossoides)*

As in previous three years, 0-group Greenland halibut were found in small areas and in very low densities to the north and west of Spitsbergen (Fig. 2.2.8). The distribution of Greenland halibut was not completely covered. In addition, Greenland halibut starts to settle to the bottom before the ecosystem cruise is carried out. There might be a strong variation in the timing of larvae settling. Therefore calculated from pelagic sampling index of the 0-group Greenland halibut is not reflecting of the real year-class strength.

Mean length of fish was lower than in 2008, but higher than long term mean, and was 6.5 cm. Length of most of the fish varied between 5.5 and 8 cm.

The calculated density reached 1922 fish per square nautical mile.

The 0-group index is 4 times lower than long term average, and the 2009 year-class of Greenland halibut is very week.

2.2.9 Long rough dab *(Hippoglossoides platessoides)*

Long rough dab was observed in two components: one was registered to the west of Novaya Zemlya and the second along the east of Murman coast (Fig.2.2.9). Denser concentrations of 0-group long rough dab were not observed during surveys.

Mean length of fish was low and was 3.2 cm, which is the same as the last 4 years. In most catches fish length between 2.5 and 4.5 cm dominated.

Mean catch was very low and was 12 fish per trawl haul. Calculated density reached only 17 thousand fish per square nautical mile.

In total, the 2009 year-class of long rough dab is 5 times lower than long term mean. Therefore the 2009 year class may be characterized as poor.

2.2.10 Wolffish *(Anarhichas sp.)*

0-group wolffish was found at several stations. Some catches were taken around Spitsbergen, and some catches to the west of Novaya Zemlya (Fig. 2.2.10).

The calculated density reached 2408 fish per square nautical mile, as was little higher than in 2008. No index is calculated for this species.

2.2.11 Sandeel *(Ammodytes tobianus)*

Denser concentration of 0-group sandeel was found in the south-eastern parts of the Barents Sea and some catches were taken in the central and western part of the Barents Sea (Fig. 2.2.11).

Mean catch was 728 fish per trawl haul, somewhat higher than in 2008. The calculated density reached 2 million fish per square nautical mile, and was higher than in 2008. No index was calculated for this species.

2.2.12 Blue whiting *(Micromesistius poutassou)*

0-group of blue whiting was not registered during the survey.

2.3 Distribution and abundance of pelagic fish

2.3.1 Capelin *(Mallotus villosus)*

2.3.1.1 Distribution

The geographical density distribution of capelin at age 1+ and for the total stock are shown in Figs. 2.3.1 and 2.3.2. The total distribution area of capelin was as wide as in last year and covered most parts of the Barents Sea and the areas to the west of Spitsbergen. Compared to the last year, the northern border of capelin distribution was shifted to the south and located along 78°-79° N. The main dense concentrations were found in two small areas – to the east of the Hopen island and to the west of Novaja Zemlja. Young capelin also had a wide distribution up to 78° N but total area and density distribution were smaller than in last year.

A sample echogram of capelin distribution in the north-eastern area are shown in Figs. 2.3.3 and 2.3.4.

2.3.1.2 Abundance estimate and size by age

A detailed stock size estimate is given in Table 2.3.1, and the time series of abundance estimates is summarized in Table 2.3.2. The main results of the abundance estimation in 2009 are summarized in the text table below. The 2008 estimate is shown on a shaded background for comparison.

Summary of stock size estimates for capelin

Year class		Age	Number (10^9)		Mean weight (g)		Biomass (10^3 t)	
2008	2007	1	124.0	312.9	3.4	3.1	417.4	970.1
2007	2006	2	166.4	231.4	10.9	12.1	1821.8	2796.3
2006	2005	3	61.5	24.9	24.6	24.6	1510.2	611.7
2005	2004	4	0.3	1.7	28.4	30.0	7.1	50.3
Total stock in:								
2009	2008	1-4	352.1	570.9	10.7	7.8	3756.5	4428.5
Based on TS value: 19.1 log L – 74.0, corresponding to $\sigma = 5.0 \cdot 10^7 \cdot L^{1.91}$								

The total stock is estimated at about 3.76 million tonnes. It is about 15% lower than the stock estimated last year but higher than the long term mean level. About 62 % (2.3 million tonnes) of this stock is above 14 cm and considered to be maturing. The 2008 year class (1-group) consists, according to this estimate, of about 124 billion individuals. This estimate is about 2.5 times lower than that obtained for the 1- group last year. The mean weight (3.4 g) is 0.3 g higher than that measured last year, and 0.2 g below the long-term average. The biomass of the 2008 year class is about 0.42 million tonnes, which is2.3 times less than one year olds in last year. It should be kept in mind that, given the limitations of the acoustic method concerning mixed concentrations of small capelin and 0-group fish and near-surface distribution, the 1-group estimate might be more uncertain than that for older capelin.

The estimated number of the 2007 year class (2-group) is about 166 billion, which is about 1.4 times lesser compared of the 2006 year class measured last year. Consequently the biomass of the two years old fish is about 1.82 million tonnes. The mean weight at this age is 10.9 g, which is lower than in last year (12.1 g), but is near the same as the long-term average (Table 2.3.2).

The 2006 year class is estimated at about 62 billion individuals. This age group with mean weight 24.6 g (about 5.3 g above the long-term average) has a biomass of about 1.5 million tonnes. The 2005 year class (now 4 years old) is estimated at 0.3 billion individuals. With a mean weight of 28.4 g this age group makes up only about 7 thousand tonnes. Practically no capelin older than four years was found.

2.3.1.3 Total mortality calculated from surveys

Table 2.3.3 shows the number of fish in the various year classes, and their “survey mortality” from age one to age two. As there has been no fishing on these age groups, the figures for total mortality constitute natural mortality only, and probably reflect quite well the predation on capelin. As can be seen from the table, the mortality was high prior to 1988, but then a substantial decrease occurred in 1988-89. This coincided with a considerable increase in the stock size caused by the rich 1989 year class. From 1990, the mortality again increased, up to

85% in 1992-93. This increase is in accordance with the observation of an increasing stock of cod, which were preying on a rapidly decreasing stock of capelin. The mortalities calculated for the period 1996-2002 varied between 20 and 52% and indicate a somewhat lower level of mortality. In 2003 a considerable increased natural mortality was observed, at the level (around 85 %) observed in 1985-86 and in 1992-93 and this high level was continued from 2003 to 2005. From 2006, the natural mortality started to decrease but increased again until 47% in 2009. The results of the calculation for the year classes 1992, 1994, and 2006 shows, however, that either the one-group are underestimated or the two-group is overestimated these years. Knowing that the measurement of the 1-group is more uncertain than the older age groups due to limitations in the acoustic method, the first mentioned possibility is the most probable.

2.3.2 Polar cod *(Boreogsdus saida)*

Compared to recent years, the polar cod distribution was almost completely covered. The geographical density distribution for fish at age 1+ and for the total stock are shown in Figs. 2.3.5 and 2.3.6. The main concentrations were found along west coast of Novaja Zemlja and in the area between the archipelagos Spitsbergen and Franz Josef Land. This situation is common during the autumn, when the polar cod stock is widely distributed in the northern part of the Barents Sea.

2.3.2.1 Distribution

The total distribution area of polar cod was found to the north of 73º N and until Franz Josef Land between 32º and 66º E. Two small patches of scattered concentrations were observed also to the north of Spitsbergen and to the south of Novaja Zemlja. The densest registrations of polar cod were found to the south of the archipelago Franz Josef Land between 45°-50° E.

Figure 2.3.7 shows a typical acoustic registration of polar cod.

2.3.2.2 Abundance estimation

The stock abundance estimate by age, number, and weight was calculated using the same computer program as for capelin.

A detailed estimate is given in Table 2.3.4, and the time series of abundance estimates is summarized in Table 2.3.5. The main results of the abundance in 2009 are summarized in the text table below. The 2008 estimate is shown on a shaded background for comparison.

Summary of stock size estimates for polar cod

Year class		Age	Number (10^9)		Mean weight (g)		Biomass (10^3 t)	
2008	2007	1	13.3	41.7	7.5	10.1	100.2	421.8
2007	2006	2	22.2	18.1	22.2	28.8	492.5	522.0
2006	2005	3	8.3	5.9	33.7	42.0	280.0	247.8
2005+	2004+	4	0.34	0.4	48.8	67.4	16.6	27.8
Total stock in								
2009	2008	1-4	44.1	66.1	20.2	18.4	889.3	1219.4
Based on TS value: 21.8 log L – 72.7, corresponding to $\sigma = 6.7 \cdot 10^7 \cdot L^{2.18}$								

The number of individuals in the 2008 year-class (the one-year-olds) is almost 68 % lower than the one-group measured last year. Therefore, the biomass of one-year-olds is 4.2 times lower compared to last year. The abundance of the 2007 year class (the two-year-olds) is 22.2 billions. This is almost 22 % higher than the two-group found last year but mean weight was 6.6 g lower. The biomass, therefore, decreased slightly compared to the 2006 year-class estimated last year. The three-years-old fish (2006 year class) is about 8.3 billions that is 1.4 times higher than the three-group estimated last year. The mean weight is lower, but the biomass of this age group is almost 1.1 times higher than that for the corresponding age group during the 2008 survey. The four-year-olds (2005 year class) are scarcely found and estimated at the same quantity as in last year. Also there were fish with age 5 and 6 but in insignificant quantities. The total stock, estimated at 0.89 million tonnes, is 1.4 times lesser to that found in 2008 and indicates that the polar cod stock is near stable composition.

2.3.2.3 Total mortality calculated from surveys

Table 2.3.6 shows the “survey-mortality rates” of polar cod in the period 1985 to 2009. The mortality estimates are unstable during the whole period. Although unstable mortalities may indicate errors in the stock size estimation from year to year, the impression remains that there is a considerable total mortality on young polar cod. Prior to 1993, these mortality estimates represent natural mortality only, as practically no fishing took place. In the period 1993 to 2006 catches were at a level between 0 and 50 000 tonnes. Since there has been a minimum landing size of 15 cm (from 1998, 13 cm) in that fishery, a considerable amount of this could consist of two- and even one-year-olds, and this may explain some, but only a small part of the high total mortality. From 2003 to 2004, and from 2006-2007 there are negative survey mortalities for age groups 1-2 and in 1998-1999 with 2003-2004 also for age group 2-3, confirming the impression expressed previously that in some years the estimate for various reasons were underestimates. Apart from these years, the survey mortalities have been quite stable in recent period.

2.3.3 Herring *(Clupea harengus)*

In the Barents Sea only young Norwegian spring spawning (Atlantic) herring is present, although some older herring may be found outside the coast of western Finnmark. At age 3-4 the herring migrates to the Norwegian Sea, where it spends the rest of the adult life. The young herring have very big fluctuation and abrupt changes in numbers in the Barents Sea.

In some cases it is difficult to assess the young herring stock size during autumn. The main problem is in distribution of herring schools close to the surface, above the range of the echo sounders. In the last 2 years a new problem occurred. First, due to warming condition young Atlantic herring migrated further southeast, where the water area is shallow (30-50 m depth). Consequently, most part of herring spread above sounder. Second, is in the local population of Kanin herring that have been observed in open part of the Barents Sea. During the survey in 2008 both kinds of herring aggregated into mix concentrations, and it was impossible to split their Sa values. Therefore, for eastern part of the Barents Sea an estimation of "mixed" herring has been done in the last year. In current year it was possible to allocate young Norwegian spring spawning herring from mixed concentrations due to small quantities of fish from Kanin component.

2.3.3.1 Distribution

The distribution of young Atlantic herring is shown in Figure 2.3.8. Total distribution area of herring in 2009 was near the same as in previous years and was divided into eastern and western components along 30° E. Western component of Atlantic herring with predominance of 3+ year olds were distributed over a large area between 12°- 24° E and up to 75° N.

Young herring of the eastern component were distributed in three local coastal areas between 30°- 36° E, 40°-43° E and 54°-58° E. In this areas 1+- 4+ year olds of Atlantic herring were found, and herring at age 1+ prevailed.

2.3.3.2 Abundance estimation

The estimated number and biomass of western and eastern components of Atlantic herring for total age- and length groups are given separately in Tables 2.3.7 and 2.3.8. In the text table below the main results of the abundance estimation in 2009 are summarized for young herring only (1-4 years old). The 2008 estimate have been revised for young Norwegian herring also and shown on a shaded background for comparison. It is noted that because of insufficient sampling of herring, especially in the western area, this estimate devided on age-groups should be considered highly uncertain.

Summary of abundance estimates of the portion of the herring stock found in the Barents Sea.

Year class		Age	Number (10^9)		Mean weight (g)		Biomass (10^3 t)	
2008	2007	1	1.538	0.0296	31.4	19.6	48.4	0.6
2007	2006	2	0.433	1.6264	119.5	47.3	51.8	76.9
2006	2005	3	1.807	3.987	159.0	72.1	287.3	287.3
2005	2004	4	0.446	3.223	184.7	115.7	82.4	373.1
Total stock in:								
2009	2008	1-4	4.224	8.866	111.2	83.2	469.9	737.9
Based on TS value: 20.0 log L – 71.9, corresponding to σ = 8.1·10-7 · L2.00								

The total abundance of both herring components was estimated at $4.2 \cdot 10^9$ sp. (2.1 times lower than in 2008) and biomass of $0.47 \cdot 10^6$ t is 1.5 times lower than it was found in 2008. Numbers of Atlantic herring at age 2-4 years decreased considerable compared with previous year. Numbers of year class at age 1 are evidently increased. Mean weight of all age classes was higher than in last year's due to lesser quantity of herring from Kanin stock.

Acoustic estimates of herring by age in autumn1999-2009. TSN and TSB are total stock numbers (10^6) and total stock biomass (10^3) respectively.

Age	1		2		3		4+		Sum	
Year	TSN	TSB	TSN	TSB	TSN	TSB	TSN	TSB	TSN	TSB
1999	48758.6	715.9	985.9	31.0	50.7	2.0			49795.2	748.9
2000	14731.0	382.6	11499.0	560.3					26230.0	942.9
2001	524.5	12.0	10544.1	604.3	1714.4	160.0			12783.0	776.3
2002									0.0	0.0
2003	99785.7	3090.3	4335.7	220.1	2475.6	325.5			106596.9	3636.4
2004	14265.0	406.4	36495.0	2725.3	901.0	106.6			51717.0*	3251.9*
2005	46380.0	983.7	16167.0	1054.5	6973.0	795.2			69520.0	2833.4
2006	1618.0	34.2	5535.0	398.4	1620.0	210.5			8773.0	643.0
2007	3941.0	147.5	2595.0	217.5	6378.0	810.1	250.0*	45.7*	13164.0	1220.9
2008	29.6	0.6	1626.4	76.9	3987.0**	287.3**	3222.6**	373.1**	8865.6	737.9
2009	1.538	48.4	433	51.8	1807	287.3	1686.0	393.0	5577.0	814.8
1999-2009	23003.5	582.2	8978.4	594.0	2678.0	331.6	1719.5	270.6	32092.9	1418.8

* - including older age groups not shown in the table

** - including Kanin herring

Since 1999, young Atlantic herring has been estimated in the Barents Sea, all previous years are enclosed in the text table below for comparison. During this period (except 2007-2009) one and two year olds prevailed. In 2007-2008 three and four year olds dominated in the south eastern area (from Kanin herring mostly). In 2009 herring of 3+ year olds were distributed mainly in the south western areas.

2.3.4 Blue whiting *(Micromesistius poutassou)*

In the south-western part of the Barents Sea blue whiting were observed as in previous years. The target strength used for blue whiting is uncertain, and the estimate should to a greater extent than the other estimates be considered as a relative quantity only.

2.3.4.1 Distribution

The distribution of blue whiting (all age groups) is shown in Figure 2.3.9. As in previous years the distribution area stretches eastward from the western boarder of the covered area up to 30° E and from northern coast of Norway up to 77° N to the west of Spitsbergen. During last three years of observations the total distribution area of blue whiting continued to decrease.

2.3.4.2 Abundance estimation

The estimated number and biomass of blue whiting per age- and length group is given in Table 2.3.9. Total abundance was estimated to be 1.5×10^9 individual fish and the biomass to 0.261×10^6 t. Since 2003-2004, when more than one million tonnes of blue whiting was found in this area, there has been a steady decrease in biomass, and the age distribution has been shifted towards older fish. The biomass increased from 2008 to 2009, but is still low. The main bulk of this stock component in 2009 consisted of 2005-2002 year-classes at age 4-7. Older fish were found in smaller quantities and only insignificant numbers of fish younger than 4 years old were found.

2.4 Demersal fish

Figs. 2.4.1-2.4.10 shows the distribution of demersal fish. Numbers of fish and number of stomachs sampled during the survey are presented in Appendix 3 and Appendix 4. Biomass age-based biomass assessments of main commercial fishes, as well as detailed analysis from taken samples, will be made available as electronic attachment to the report on internet.

2.4.1 Cod *(Gadus morhua)*

The distribution area of cod in the Barents Sea (Fig. 2.4.1) was completely covered. At this time of the year, towards the end of the feeding period, the distribution of cod is wide. Cod reach the limits of its natural habitat and spread far north and east. Total distribution of cod was near the same as in last year. Main concentrations were observed in two areas: one was to the south-west from Novaya Zemlya, and the other one was on the Great Bank, to the north-east of Hopen Island. The main biomass of cod has been concentrated in a range of depths from 100 m up to 250 m (78 %). Distribution of cod in 2009 coincided with distribution in 2008, except for northeast Barents Sea where this year dense concentrations of cod were observed.

2.4.2 Haddock *(Melanogrammus aeglefinus)*

The haddock distribution (Fig. 2.4.2) was completely covered during the survey. Haddock were distributed in the large area from the coast to 81°N and to the east until 57°E. The basic concentrations of a haddock were found around Bear Island and on shallow sites in the southeast part of the Barents Sea which coincide with the distribution in 2008. Denser concentrations (than in last year) were observed also near North Cape and to the west of Spitsbergen. The greatest concentrations were distributed on depths up to 100 m (49 %).

2.4.3 Saithe *(Pollachius virens)*

The survey has captured only a part of the distribution saithe around the northern coast of Norway (Fig. 2.4.3). The demersal component of the saithe population preferred to stay in a range of depths from 100 up to 200 m (81 %). Distribution of saithe in 2009 was similar to that observed in 2008, but with higher densities.

2.4.4 Greenland halibut *(Reinhardtius hippoglossoides)*

During the survey mainly young age groups of Greenland halibut were observed (Fig. 2.4.4). The adult part of the stock was distributed outside of the survey area. Foremost concentrations were located in traditional places on slope around Bear-Hope Islands and in the deeper part around Spitsbergen east to the Franz Josef Land. For the first time observation of young Greenland halibut in the northern part of the Kara Sea were made out during the ecosystem survey. As a result it was found significant concentrations of young age groups of Greenland halibut in Saint Anna's trench. Increasing concentration of Greenland halibut in the deep-water zone to the south of Bear Island is the main difference of distribution in current year compared with 2008.

2.4.5 Golden redfish *(Sebastes marinus)*

Golden redfish (Fig. 2.4.5) were distributed in the same part of the Barents Sea basin as in previous years. The main densities were detected along the shelf slope to the west of Spitsbergen archipelago and along the shelf slope to the southwest and central part of the Barents Sea. The great bulk was concentrated in depths from 200 up to 300 meters.

2.4.6 Deep-water redfish *(Sebastes mentella)*

The main dense concentrations of deep-water redfish were distributed in traditional places of dwelling, and were found in western and north-western parts of the Barents Sea (Fig. 2.4.6). Most concentrations were located along the shelf slope off the Bear - Hopen islands and to the west of Spitsbergen. Mainly young age groups of Sebastes mentella were found to the east of Franz Josef Land in Saint Anna trench.

2.4.7 Long rough dab *(Hippoglossoides platessoides)*

As in previous years, distribution of long rough dab was wider than the other species. It was found in practically all areas, and its catches were quite significant in most cases (Fig. 2.4.7). Catches of Long rough dab were taken as far east as 76° E and north as 83° N in area of Saint Anna trench. The greatest catches were found out in the central parts of the Barents Sea.

2.4.8 Wolffishes *(Anarhichas sp.)*

All of the three species - Atlantic wolffish (*Anarhichas lupus*), Spotted wolffish (*Anarhichas minor*) and Northern wolffish (*Anarhichas denticulatus*) had approximately the same catch rates.

Compared to 2008 the distribution of Atlantic wolffish was more limited (Fig. 2.4.8) and catches were lower. The greatest catches of Atlantic wolffish were to the northwest from Spitsbergen, near Bear Island, and on shallow sites in the southern part of the Barents Sea.

Spotted wolffish were spread more widely compared to 2008 (Fig. 2.4.9).

In current year distribution of Northern wolffish was similar to that observed in 2008 with small increasing in the west Spitsbergen area (Fig. 2.4.10). Most concentrations were located in the central areas and along the continental slope to the west of Spitsbergen. The main catches were in range of depths of 250-350 m (70 %).

2.5 Non-target fish species

A list of all fish species caught during the survey is given in Appendix 3 and 6. Some species were chosen as indicator species to demonstrate the distribution patterns of fishes from the different zoogeographic groups: the Thorny skate (*Amblyraja radiata*), Northem skate (*Amblyraja hyperborean*), Plaice (*Pleuronectes platessa*) (Figs. 2.5.1-2.5.3).

2.5.1 Thorny skate *(Amblyraja radiata)*, boreal zoogeographic group

As in 2008 this species was quite widely distributed in the Barents Sea excluding south eastern and north eastern regions (Fig. 2.5.1). In all observed areas catches of this species were higher than in 2008. Main larger catches were in central area, around Bear Island and to the west of Spitsbergen and on shallow sites of in the southeast of the Barents Sea. The Thorny skate preferred to keep in a wide range of depths from 50 up to 300 meters. The case of capture of thorny skate on a slope in Saint Anna's trench in a point 80^0 32'′N and 70 02'′E is marked.

2.5.2 Northern skate *(Amblyraja hyperborea)*, boreal zoogeographic group

Northern skate was distributed in the northeast part of the Barents Sea and along the shelf slope to the west of Spitsbergen (Fig. 2.5.2). The main catches were from range of depths from 200 up to 300 meters (41%).

2.5.3 Plaice *(Pleuronectes platessa)*

Plaice was distributed in a range of depths from 50 up to 100 meters (90 %) on northwest from Kanin peninsula (Fig. 2.5.3).

2.5.4 Norway pout *(Trisopterus esmarkii)*

As it was noted in the last year the tendency of expansion of Norway pout in the Barents Sea is continuing. Main dense concentrations of Norway pout were registered in the south-western areas (Fig. 2.5.4). At the same time along warm Spitsbergen current Norway pout was observed until 81° N. Along coastal North Cape current Norway pout were distributed eastward up to 47° E.

Seemingly, Norway pout have occupied the Blue whiting distribution area when the quantity of that species decline.

2.5.5 New and rare species in the Barents Sea

In the survey there were both new species to the area and recordings for rare species in the area observations (Fig. 2.5.5). Some of these species have their main distribution in the warm waters of the Norwegian Sea (*Molva molva*, *Schedophilus medusophagus*) or in the cold waters of the Kara Sea (*Arctogadus glacialis*) bordering the Barents Sea, while others have highly specialized habitats. The greatest quantities of rare species were observed along slope of shelf in deep areas in the northern part of the Barents Sea.

2.6 Phytoplankton

Data on chlorophyll **a**, nutrients and phytoplankton species composition are now being processed and analyzed at the IMR laboratory. A summary and some preliminary results will be available as electronical attachment to this report on the internet.

2.7 Zooplankton

The map of zooplankton sampling localities and sampling gear (Russian and Norwegian vessels) are shown in Fig. 2.2 and Fig. 2.7.1. The main results of zooplankton observations will be presented in an electronic attachement after the data have been worked up in the laboratories.
From Fig. 2.2 and Fig. 2.7.1 it is apparent that the investigated area is covered very well as seen from the number of CTD stations taken. From a total of 261 stations 373 WP2 net hauls were obtained by the norwegian vessels G.O. Sars, Johan Hjort and Jan Mayen. For the first time the area north of Svalabard was covered with respect to its mesozooplankton distribution. However, due to lack of financing and reduction of plankton personell onboard the vessels, no stratified sampling targeting slightly larger zooplankton (i.e. krill/amphipods) was conducted with the Mocness system. This is a definitve shortcoming with respect to the zooplankton 2009 coverage in the Barernts Sea compared to earlier years. However, the WP2 vertical net coverage is very satisfactory and comparable to the years 2007 and 2006. The table below gives an overview of total zooplankton hauls for different types of zooplankton sampling gear during the Ecosystem survey.

Total number of zooplankton net hauls obtained during the Norwegian and Russian surveys in the Barents Sea in August-October 2009.

Net	Norwegian ships			Russian ships
	«G.O.Sars»	«J.Hjort»	«Jan Mayen»	«Vilnyus»
WP-2	100	219	54	-
Juday	-	-	-	241
MOCNESS	-	-	-	-
BR	-	-	-	96

A map of the zooplankton biomass distribution based on joint Russian and Norwegian data is shown in Fig 2.7.1. From the Norwegian data, sampled in the western part it is evident that a greater region of the Barents Sea has very low biomass in 2009, hence compares to 2008, and that the influence of the normally higher biomass region of the western Barents Sea is still comparatively low. The average zooplankton biomass in 2009, based only on Norwegian data (i.e. the western half of the Barents Sea) is 5.87 g/m^2, a considerable reduction compared to two preceeding years, 7.13 g/m^2 observed in 2007 and 6.48 g/m^2 for 2008. The area around Svalbard had an average zooplankton biomass of 8.13 g/m^2. If this area is included in the calculation of the average for the whole Norwegian sector of the Barents Sea the average biomass is 6.31 g/m^2, but still below the value computed for 2008.

According to the Russian data (i.e. the eastern half of the Barents Sea), the highest biomass were observed in the central part of the sea (Fig. 2.7.1). However, because of limited availability of sampling in the north we had no data on condition of zooplankton for this part of the sea, where the basic biomass is formed at the expense of the Arctic species.

From the Norwegian vessels G.O. Sars a total of 100 WP-2 hauls (100-0 m and bottom-0 m) were conducted at 55 stations. From the Norwegian vessels no Juday net was deployed during the ecosystem survey in 2009. Hauls conducted west of the 500 m depth contour at the entrance to the Barents Sea as well as 200-0m net hauls where bottom depth significantly exceeds 200 m are not included. On Johan Hjort a total of 219 WP-2 hauls (100-0 m and bottom-0 m) were conducted at 152 stations. A total of 189 stations from all three Norwegian ships satisfied the extraction criteria for the bottom-0m stratum.

Species composition, abundance and biomass from WP2 and Juday nets collected at the same stations in 2004 and 2005 have been partly analyzed and compared. Preliminary analysis has shown a significant variability in stage composition of key species of *Calanus*. A more extensive comparison and analysis are now being undertaken based on data from 2004 and 2005, including Russian data from 2006 where they exist to help quantify this variability. The agreement on comparative collection of zooplankton samples by WP-2 and Juday net on Norwegian and Russian vessels (c.f. Meeting in April 2005/May 2006) will be followed up by both parties with regard to working up samples, exchange of raw data, analysis and publication in relevant reports, symposia or international refereed journals. It is suggested that current and past effort is strengthened with additional sampling and also new approaches in future surveys with the ultimate goal of a unified sampling approach.

It was recommended for 2007, based on experience during field sampling in 2005 and from preliminary comparisons based on data from 2004 and the agreement outlined above, that a dual net system should be built that can hold both a WP2 and a Juday net for better performance and more efficient comparisons between the sampling gear. This was done during spring-summer 2007 and the new gear was deployed during the latter part of the G.O. Sars Barents Sea Ecosystem cruise 6-30 September 2007. Preliminary results from this gear comparison exercise have already been obtained, but a more thorough analysis is still needed. Additional *in situ* comparisons with the dual net system are warranted as the total number of hauls at this stage is low (19) and therefore should be expanded to obtain a data set that can be explored statistically in a reliable manner. Such an approach implies a significant effort for both IMR and PINRO plankton laboratories and their scientists, and it must be carefully evaluated how much time and effort can be dedicated to such future work. Analysis of the currently available data might give answers to this. It should be an aim to present a more complete analysis of the dual-net as electronic attachment to the Joint Ecosystem Survey Report.

2.8 Marine mammals and seabirds

2.8.1 Marine mammals

Marine mammals were observed during parts of the survey in 2009, and the observations are presented in Table 2.8.1. and Fig. 2.8.1-2.8.3.

More than 900 individuals of marine mammals comprising 14 identified species were recorded in the Barents Sea during the survey in 2009. Like in previous years the most abundant species were the white-beaked dolphins (more than 25 % of the total number of observations and about a half of all recorded individuals). Groups of dolphins were often observed in the area of the Great Bank, the Central Bank, the Eastern basin and west of Spitsbergen. The groups of dolphins observed west of Novaya Zemlya were feeding on mixed aggregations of polar cod and capelin.

Among the odontocetes, also the harbour porpoises, killer whales and sperm whales were observed. Harbour porpoises mainly occupied the coastal zone in the southern part of the Barents Sea. Single registrations of killer whales were made to the north of Spitsbergen. Sperm whales were observed along the continental slope west of Spitsbergen but also in the central part of the Barents Sea on 31°E where this deep water species is not normally observed.

Of the baleen whales, minke and fin whales were among the most often observed species. Only few observations of humpback whales were recorded this year. The main observed aggregations of minke whales were to the west, south and north of Spitsbergen, on the Great Bank and in the southern-eastern part of the Barents Sea. On the Great Bank they were feeding on the dense aggregations of capelin, in the south-eastern part of the Barents Sea they were feeding on polar cod and young haddock. The majority of the fin whales were concentrated around Spitsbergen and near the Bear Island, while some individuals were observed along the ice edge. Compared to 2008 the number of baleen observed was redused by 75%. This is due to lack of observer effort in the northern core area of the baleen whales. Due to rearrangement of the Norwegian vessels after survey start, the marine mammal observers were covering central areas rather than the northern high density areas, as originally planned.

Harp seals, ringed seals, bearded seals and walruses were also observed. Among the seals, the most abundant were harp seals, which were observed to the east of Spitsbergen. To the east from 38°E harp seals were feeding on macrozooplankton assemblages.

2.8.2 Seabirds

During the ecosystem cruise 50 915 individual birds from 23 species were recorded from the vessels “Vilnius”, “Johan Hjort”, and “Jan Mayen” (Table 2.8.2). Northern fulmar, kittiwake and Brünnichs guillemot were the single most observed species comprising 75 %, 15 % and 3 % of all observations, respectively. However, as northern fulmars and gulls are ship-followers and hence the numbers and distributions may depend on the presence of the ship, Russian observers on board “Vilnius” did not record the occurrence of these species in 2009. On Norwegian vessels these birds were counted every hour.

The alcid seabirds were observed throughout the study area (Fig. 2.8.4), but species abundances and distributions varied geographically. Puffins dominated in the southern areas, common guillemots in the south-east, and Brünnichs guillemots in central and northern areas, although also common in the Pechora Sea. Little auks were numerous in northern Barents Sea, while black guillemots, also a northern species, were observed close to the Svalbard and Franz Josef Land archipelagos. Razorbills inhabited the southern coastal areas.

Northern fulmars, thus mainly recorded by the Norwegian observers, dominated more or less throughout most the surveyed area (Fig. 2.8.5). Among the tubenosed birds (*Procellariformes*) also sooty shearwaters (4 individuals) were observed.

The distributions of the gull species, as observed from Norwegian vessels, are shown in Fig. 2.8.5. Kittiwakes dominated numerically and were widely distributed. Glaucous gulls, great black-backed gulls and herring gulls were inhabited the southern and south-eastern Barents Sea, and glaucous gulls were also observed by Spitsbergen. Fourteen individuals of lesser black-backed gulls were observed in the Pechora Sea.

Skuas were abundant in central and northern Barents Sea, and pomarine skua dominated numerically (Fig. 2.8.6). Arctic skua was distributed throughout the Barents Sea, great skua the southern Barents Sea and west of Spitsbergen, while few observations of long-tailed skuas were observed in the central Barents Sea.

More anecdotal observations of other aquatic birds were also registered; common eiders and purple sandpipers inhabited the southern and south-eastern Barents Sea, while Arctic terns were observed in throughout the Barents Sea.

The observed distributions of birds shown in Fig. 2.8.4-2.8.6 are not effort corrected. Greater observation effort on the vessels Jan Mayen and Johan Hjort (one dedicated seabird observer) than on Vilnius (one combined marine mammal and seabird observer) likely bias the observed sea bird densities towards the western Barents Sea

2.9 Benthos investigations

The three vessels involved in the ecosystem survey in 2009 sampled in different areas of the Barents Sea. Bottom trawl (Campelen) was used on all ships in the whole survey area. The biomass of invertebrates varied from 10 g to 4000 kg per nautical mile of trawling.

As usual the eight animal groups – Annelida, Bryozoa, Coelenterata, Crustacea, Echinodermata, Mollusca, Porifera and Varia were used for the benthic bycatch distribution analysis. Total biomass of all registered invertebrate bycatch (exept Nothern shrimp *(Pandalus borealis)* was summarised per station and presented in Figure 2.9.1. The biomass-hotspots were located on the shallow banks at the south-west part of the Barents sea and near the Bear island. The low biomasses were as usual in the central part of the Barents Sea.

In the south-west of the research area the sponges make up larger part of the biomass (Fig. 2.9.1). The echinoderms (sea stars, sea urchins, brittle stars, sea cucumbers and sea lilies) make up large proportions of the biomass in central and northern part of the Barents Sea. The crustacean biomass is mainly found in central and eastern parts of the Barents Sea. As the crustaceans, the molluscs (bivalves and snails) are present with their largest biomasses in the north-eastern part of the Barents Sea. Totally 400 taxa were identified through the ecosystem survey (Appendix 5).

2.9.1 King crab *(Paralithodes camtschaticus)*

The distribution area for king crab located close to the coast between 30-45° E (Fig.2.9.2). This year and last survey are shown the decrees dynamic in the king crab stock. The location of the crab distribution in generally is the same. The westernmost catch was in Varanger fjord. The maximal quantity of king crab is decreased from 100 to 7 specimens per nautical mile. But the few trawl stations near the shore and inside the fjords is not enough to make a realistic distribution map of red king crab.

2.9.2 Snow crab *(Chionoecetes opilio)*

Generally snow crab distribution in the Barents Sea in 2009 was near the same as in the last year. But frequency occurrence of snow crab decreased in 2009 compare with the 2008

(Fig.2.9.3). This species was registered on 64 stations (compare with 55 stations in 2007 and 3 stations in 2006). The maximal abundance of snow crab in 2009 was 25 specimens per nautical mile compare with 100 specimens in 2008.

2.9.3 Northern shrimp *(Pandalus borealis)*

Northern shrimp was registered at 84 % of the stations (Fig. 2.9.4). The density ranged between 0 and 6 tons/km^2. Densest concentrations were as usual found round Svalbard, and in the central parts of the survey area, particularly in the Hopen Deep. While in the shallow waters around the Spitsbergen Bank and in the eastern parts of the survey area concentrations were low. In 2008 the overall mean density of shrimp was 245 kg/km^2, somewhat lower than the 2007 estimate of 337 kg/km^2.

2.10 Pollution

Radionuclides

Preliminary results show that the concentrations of Cs-137 in biota in the Barents Sea in 2009 are low. Generally, the levels of Cs-137 in biota in the Barents Sea do not exeed 1 Bq/kg fresh weight. The levels have shown a slight decreasing trend in the period 1992-2007 (NRPA, 2009). Analyses of Cs-137 in sediments and seawater and Tc-99 in seawater are in progress at IMR. Analyses of other radionuclides will be performed at the NRPA.

The sunken submarine "Komsomolets"

IMR collect samples of sediment and bottom water in the vicinity of the sunken submarine "Komsomolets" every year. The 2009-levels do not indicate a leakage of significance from the submarine (Fig 2.10.1). The levels are comparable to those found in adjacent areas.

Polychlorinated biphenyls (PCB) og pesticides in biota

Samples of saithe and haddock were analysed for polychlorinated biphenyls (PCB) and chlorinated pesticides in fish lever. The concentrations (in µg/kg wet weight) of sum PCB7 ("Seven Dutch"), and of the pesticides sum DDT, HCB, sum HCH and TNC had mean values in haddock liver of correspondingly 28 µg/kg, 14 µg/kg, 5,1 µg/kg, 1,7 µg/kg and 6,2 µg/kg; and in saithe liver of correspondingly 30 µg/kg, 28 µg/kg, 5,5 µg/kg, 1,9 µg/kg og 9 µg/kg. For all the compounds this is a decrease from earlier measurements in the Barents Sea since as long ago as the year 2000. As an example, the levels of PCB7 and Sum DDT for saithe, haddock and cod measured since 1997 are shown in the figures 2.10.2 og 2.10.2 (for Barents Sea, Norwegian Sea and North Sea).

PCB7-levels are on average the highest of alle the studied groups of compounds. The levels are still relatively low. Climate and Pollution Agency (KliF) has established a cliassification system with five classes of environmental condition which include PCB7 and SumDDT in cod liver. The classes are from class I: "insignificantly/little contaminated" to class V: "strongly contaminated". Average levels for cod measured since 1997 in all the marine areas were all found to be in class I, while some individual fish with the highest levels of Sum DDT and (in case of the North Sea) PCB7 were found to be in class II.

2.11 Fish pathology research

In the studied area, 63177 fish were put to the ichthyopathologic analysis and 444 ill specimens (0.70 %) were found among them. In fish, registered were ulcers, eye pathology, skeleton deformations, necrosis of fins and skin, tumors. In 96.8 % of cases, in ill fish, the eyes were affected. Mainly, the pathology with conditional name “red eye syndrome” found in capelin and Gadidae including fingerlings was recorded. The frequency of occurrence of red eyes in fish of different species (cod, haddock, polar cod, long rough dab and capelin) varied from 0.05 % in haddock and long rough dab to 1.59 % in polar cod, on the average, 0.68 % (Figures 1.11.1 A, 1.11.2).

The frequency of ill polar cod occurrence varied from 0.3 to 10.0 %. It was 1.5 %, on the average.

In cod fingerlings, the red eyes were observed for the first time, the occurrence frequency was 3.1 %. Besides they had hemorrhagic affection of head and tumors of abdominal cavity wall caused by the infestation of juveniles by intracellular parasites (Fig.1.11.1 B).

Fish Pathology Research is interesting now, so it is necessary futher to realise this investigations by Russians and Norwegians jointly.

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4 TABLES

Table 2.1.1 Mean water temperatures in the main parts of standard oceanographic sections in the Barents Sea and adjacent waters in August-September 1965-2009. The sections are: Kola **(70º30´N – 72º30´N, 33º30´E),** Kanin S **(68º45´N – 70º05´N, 43º15´E),** Kanin N **(71º00´N – 72º00´N, 43º15´E), North Cape – Bear Island (**NCBI**, 71º33´N, 25º02´E – 73º35´N, 20º46´E), Bear Island – West (**BIW**, 74º30´N, 06º34´E – 15º55´E), Vardø – North (**VN**, 72º15´N – 74º15´N, 31º13´E) and Fugløya – Bear Island (**FBI**, 71º30´N, 19º48´E – 73º30´N, 19º20´E).**

Year	Section and layer (depth in metres)								
	Kola	Kola	Kola	Kanin S	Kanin N	NCBI	BIW	VN	FBI
	0-50	50-200	0-200	0-bot.	0-bot.	0-200	0-200	50-200	50-200
1965	6.7	3.9	4.6	4.6	3.7	5.1	-	3.8	5.2
1966	6.7	2.6	3.6	1.9	2.2	5.5	3.6	3.2	5.3
1967	7.5	4.0	4.9	6.1	3.4	5.6	4.2	4.4	6.3
1968	6.4	3.7	4.4	4.7	2.8	5.4	4.0	3.4	5.0
1969	6.7	3.1	4.0	2.6	2.0	6.0	4.2	3.8	6.3
1970	7.8	3.7	4.7	4.0	3.3	6.1	-	4.1	5.6
1971	7.1	3.2	4.2	4.0	3.2	5.7	4.2	3.8	5.6
1972	8.7	4.0	5.2	5.1	4.1	6.3	3.9	4.6	6.1
1973	7.7	4.5	5.3	5.7	4.2	5.9	5.0	4.9	5.7
1974	8.1	3.9	4.9	4.6	3.5	6.1	4.9	4.3	5.8
1975	7.0	4.6	5.2	5.6	3.6	5.7	4.9	4.5	5.7
1976	8.1	4.0	5.0	4.9	4.4	5.6	4.8	4.4	5.8
1977	6.9	3.4	4.3	4.1	2.9	4.9	4.0	3.6	4.9
1978	6.6	2.5	3.6	2.4	1.7	5.0	4.1	3.2	4.9
1979	6.5	2.9	3.8	2.0	1.4	5.3	4.4	3.6	4.7
1980	7.4	3.5	4.5	3.3	3.0	5.7	4.9	3.7	5.5
1981	6.6	2.7	3.7	2.7	2.2	5.3	4.4	3.4	5.3
1982	7.1	4.0	4.8	4.5	2.8	5.8	4.9	4.1	6.0
1983	8.1	4.8	5.6	5.1	4.2	6.3	5.1	4.8	6.1
1984	7.7	4.1	5.0	4.5	3.6	5.9	5.0	4.2	5.7
1985	7.1	3.5	4.4	3.4	3.4	5.3	4.6	3.7	5.6
1986	7.5	3.5	4.5	3.9	3.2	5.8	4.4	3.8	5.5
1987	6.2	3.3	4.0	2.7	2.5	5.2	3.9	3.5	5.1
1988	7.0	3.7	4.5	3.8	2.9	5.5	4.2	3.8	5.7
1989	8.6	4.8	5.8	6.5	4.3	6.9	4.9	5.1	6.2
1990	8.1	4.4	5.3	5.0	3.9	6.3	5.7	5.0	6.3
1991	7.7	4.5	5.3	4.8	4.2	6.0	5.4	4.8	6.2
1992	7.5	4.6	5.3	5.0	4.0	6.1	5.0	4.6	6.1
1993	7.5	4.0	4.9	4.4	3.4	5.8	5.4	4.2	5.8
1994	7.7	3.9	4.8	4.6	3.4	6.4	5.3	4.8	5.9
1995	7.6	4.9	5.6	5.9	4.3	6.1	5.2	4.6	6.1
1996	7.6	3.7	4.7	5.2	2.9	5.8	4.7	3.7	5.7
1997	7.3	3.4	4.4	4.2	2.8	5.6	4.1	4.0	5.4
1998	8.4	3.4	4.7	2.1	1.9	6.0	-	3.9	5.8
1999	7.4	3.8	4.7	3.8	3.1	6.2	5.3	4.8	6.1
2000	7.6	4.5	5.3	5.8	4.1	5.7	5.1	4.2	5.8
2001	6.9	4.0	4.7	5.6	4.0	5.7	4.9	4.2	5.9
2002	8.6	4.8	5.8	4.0	3.7	-	5.4	4.6	6.5
2003	7.2	4.0	4.8	4.2	3.3	-	-	4.7	6.2
2004	9.0	4.7	5.7	5.0	4.2	-	5.8	4.8	6.4
2005	8.0	4.4	5.3	5.2	3.8	6.7	-	5.0	6.2
2006	8.3	5.3	6.1	6.1	4.5	-	5.8	5.3	6.9
2007	8.2	4.6	5.5	4.9	4.3	6.9	5.6	4.9	6.5
2008	6.9	4.6	5.2	4.2	4.0	6.2	5.1	4.8	6.4
2009	7.2	4.3	5.0	-	4.3	-	-	5.2	6.4
Average (1965-2009)	7.5	3.9	4.8	4.4	3.4	5.8	4.8	4.3	5.8

Table 2.2.1 0-group abundance indices (in millions) with 95% confidence limits, not corrected for capture efficiency

Year	Capelin			Cod			Haddock			Herring			Redfish		
	Abundance index	Confidence limit		Abundance index	Confidence limit		Abundance index	Confidence limit		Abundance index	Confidence limit		Abundance index	Confidence limit	
1980	197278	131674	262883	72	38	105	59	38	81	4	1	8	277873	0	701273
1981	123870	71852	175888	48	33	64	15	7	22	3	0	8	153279	0	363283
1982	168128	35275	300982	651	466	835	649	486	812	202	0	506	106140	63753	148528
1983	100042	56325	143759	3924	1749	6099	1356	904	1809	40557	19526	61589	172392	33352	311432
1984	68051	43308	92794	5284	2889	7679	1295	937	1653	6313	1930	10697	83182	36137	130227
1985	21267	1638	40896	15484	7603	23365	695	397	992	7237	646	13827	412777	40510	785044
1986	11409	98	22721	2054	1509	2599	592	367	817	7	0	15	91621	0	184194
1987	1209	435	1983	167	86	249	126	76	176	2	0	5	23747	12740	34755
1988	19624	3821	35427	507	296	718	387	157	618	8686	3325	14048	107027	23378	190675
1989	251485	201110	301861	717	404	1030	173	117	228	4196	1396	6996	16092	7589	24595
1990	36475	24372	48578	6612	3573	9651	1148	847	1450	9508	0	23943	94790	52658	136922
1991	57390	24772	90007	10874	7860	13888	3857	2907	4807	81175	43230	119121	41499	0	83751
1992	970	105	1835	44583	24730	64437	1617	1150	2083	37183	21675	52690	13782	0	36494
1993	330	125	534	38015	15944	60086	1502	911	2092	61508	2885	120131	5458	0	13543
1994	5386	0	10915	21677	11980	31375	1695	825	2566	14884	0	31270	52258	0	121547
1995	862	0	1812	74930	38459	111401	472	269	675	1308	434	2182	11816	3386	20246
1996	44268	22447	66089	66047	42607	89488	1049	782	1316	57169	28040	86299	28	8	47
1997	54802	22682	86922	67061	49487	84634	600	420	780	45808	21160	70455	132	0	272
1998	33841	21406	46277	7050	4209	9890	5964	3800	8128	79492	44207	114778	755	23	1487
1999	85306	45266	125346	1289	135	2442	1137	368	1906	15931	1632	30229	46	14	79
2000	39813	1069	78556	26177	14287	38068	2907	1851	3962	49614	3246	95982	7530	0	16826
2001	33646	0	85901	908	152	1663	1706	1113	2299	844	177	1511	6	1	10
2002	19426	10648	28205	19157	11015	27300	1843	1276	2410	23354	12144	34564	130	20	241
2003	94902	41128	148676	17304	10225	24383	7910	3757	12063	28579	15504	41653	216	0	495
2004	16701	2541	30862	19157	13987	24328	19144	12649	25638	133350	94873	171826	849	0	1766
2005	41808	12316	71300	21532	14732	28331	33283	24377	42190	26332	1132	51532	12332	631	24034
2006	166400	102749	230050	7860	3658	12061	11421	7553	15289	66819	22759	110880	20864	10057	31671
2007	157913	87370	228456	9707	5887	13527	2826	1787	3866	22481	4556	40405	159159	44882	273436
2008	288799	178860	398738	52975	31839	74111	2742	830	4655	15915	4477	27353	9962	0	20828
2009	189767	113154	266379	54579	37311	71846	13040	7988	18093	18916	8249	29582	66671	29636	103706
Mean	77706			19880			4040			28579			64744		

Table 2.2.1 Continued

Year	Saithe			Gr halibut			Long rough dab			Polar cod (east)			Polar cod (west)		
	Abundance index	Confidence limit		Abundance index	Confidence limit		Abundance index	Confidence limit		Abundance index	Confidence limit		Abundance index	Confidence limit	
1980	3	0	6	111	35	187	1273	883	1664	28958	9784	48132	9650	0	20622
1981	0	0	0	74	46	101	556	300	813	595	226	963	5150	1956	8345
1982	143	0	371	39	11	68	1013	698	1328	1435	144	2725	1187	0	3298
1983	239	83	394	41	22	59	420	264	577	1246	0	2501	9693	0	20851
1984	1339	407	2271	31	18	45	60	43	77	127	0	303	3182	737	5628
1985	12	1	23	48	29	67	265	110	420	19220	4989	33451	809	0	1628
1986	1	0	2	112	60	164	6846	4941	8752	12938	2355	23521	2130	180	4081
1987	1	0	1	35	23	47	804	411	1197	7694	0	17552	74	31	117
1988	17	4	30	8	3	13	205	113	297	383	9	757	4634	0	9889
1989	1	0	3	1	0	3	180	100	260	199	0	423	18056	2182	33931
1990	11	2	20	1	0	2	55	26	84	399	129	669	31939	0	70847
1991	4	2	6	1	0	2	90	49	131	88292	39856	136727	38709	0	110568
1992	159	86	233	9	0	17	121	25	218	7539	0	15873	9978	1591	18365
1993	366	0	913	4	2	7	56	25	87	41207	0	96068	8254	1359	15148
1994	2	0	5	39	0	93	1696	1083	2309	267997	151917	384078	5455	0	12032
1995	148	68	229	15	5	24	229	39	419	1	0	2	25	1	49
1996	131	57	204	6	3	9	41	2	79	70134	43196	97072	4902	0	12235
1997	78	37	120	5	3	7	97	44	150	33580	18788	48371	7593	623	14563
1998	86	39	133	8	3	12	27	13	42	11223	6849	15597	10311	0	23358
1999	136	68	204	14	8	21	105	1	210	129980	82936	177023	2848	407	5288
2000	206	111	301	43	17	69	233	120	346	116121	67589	164652	22740	14924	30556
2001	20	0	46	51	20	83	162	78	246	3697	658	6736	13490	0	28796
2002	553	108	998	51	0	112	731	342	1121	96954	57530	136378	27753	4184	51322
2003	65	0	146	13	0	34	78	45	110	11211	6100	16323	1627	0	3643
2004	1395	860	1930	70	28	113	36	20	52	37156	19040	55271	367	125	610
2005	55	36	73	9	4	14	200	109	292	6540	3196	9884	3216	1269	5162
2006	142	60	224	11	1	20	710	437	983	26016	9996	42036	2078	464	3693
2007	51	6	96	1	1	0	262	45	478	25883	8494	43273	2532	0	5134
2008	45	22	69	6	0	13	956	410	1502	6649	845	12453	91	0	183
2009	22	0	46	7	4	10	115	51	179	23570	9661	37479	21433	5642	37223
Mean	181			29			587			35898			8997		

Table 2.2.2 0-group abundance indices (in millions) with 95% confidence limits, corrected for capture efficiency

	Capelin			Cod			Haddock			Herring		
Year	Abundance index	Confidence limit		Abundance index	Confidence limit		Abundance index	Confidence limit		Abundance index	Confidence limit	
1980	740289	495187	985391	276	131	421	265	169	361	77	12	142
1981	477260	273493	681026	289	201	377	75	34	117	37	0	86
1982	599596	145299	1053893	3480	2540	4421	2927	2200	3655	2519	0	5992
1983	340200	191122	489278	19299	9538	29061	6217	3978	8456	195446	69415	321477
1984	275233	161408	389057	24326	14489	34164	5512	3981	7043	27354	3425	51284
1985	63771	5893	121648	66630	32914	100346	2457	1520	3393	20081	3933	36228
1986	41814	642	82986	10509	7719	13299	2579	1621	3537	93	27	160
1987	4032	1458	6607	1035	504	1565	708	432	984	49	0	111
1988	65127	12101	118153	2570	1519	3622	1661	630	2693	60782	20877	100687
1989	862394	690983	1033806	2775	1624	3925	650	448	852	17956	8252	27661
1990	115636	77306	153966	23593	13426	33759	3122	2318	3926	15172	0	36389
1991	169455	74078	264832	40631	29843	51419	13713	10530	16897	267644	107990	427299
1992	2337	250	4423	166276	92113	240438	4739	3217	6262	83909	48399	119419
1993	952	289	1616	133046	58312	207779	3785	2335	5236	291468	1429	581506
1994	13898	70	27725	70761	39933	101589	4470	2354	6586	103891	0	212765
1995	2869	0	6032	233885	114258	353512	1203	686	1720	11018	4409	17627
1996	136674	69801	203546	280916	188630	373203	2632	1999	3265	549608	256160	843055
1997	189372	80734	298011	294607	218967	370247	1983	1391	2575	463243	176669	749817
1998	113390	70516	156263	24951	15827	34076	14116	9524	18707	476065	277542	674589
1999	287760	143243	432278	4150	944	7355	2740	1018	4463	35932	13017	58848
2000	140837	6551	275123	108093	58416	157770	10906	6837	14975	469626	22507	916746
2001	90181	0	217345	4150	798	7502	4649	3189	6109	10008	2021	17996
2002	67130	36971	97288	76146	42253	110040	4381	2998	5764	151514	58954	244073
2003	340877	146178	535575	81977	47715	116240	30792	15352	46232	177676	52699	302653
2004	53950	11999	95900	65969	47743	84195	39303	26359	52246	773891	544964	1002819
2005	148466	51669	245263	72137	50662	93611	91606	67869	115343	125927	20407	231447
2006	515770	325776	705764	25061	11469	38653	28505	18754	38256	294649	102788	486511
2007	480069	272313	687825	42628	26652	58605	8401	5587	11214	144002	25099	262905
2008	995101	627202	1362999	234144	131081	337208	9864	1144	18585	201046	68778	333313
2009	673027	423386	922668	185457	123375	247540	33339	19707	46970	104233	31009	177458
Mean	266916			76659			11243			169164		

Table 2.2.2 Continued

	Saithe			Polar cod (east)			Polar cod (west)		
Year	Abundance index	Confidence limit		Abundance index	Confidence limit		Abundance index	Confidence limit	
1980	21	0	47	203226	69898	336554	82871	0	176632
1981	0	0	0	4882	1842	7922	46155	17810	74500
1982	296	0	699	1443	154	2731	10565	0	29314
1983	562	211	912	1246	0	2501	87272	0	190005
1984	2577	725	4430	871	0	2118	26316	6097	46534
1985	30	7	53	143257	39633	246881	6670	0	13613
1986	4	0	9	102869	16336	189403	18644	125	37164
1987	4	0	10	64171	0	144389	631	265	996
1988	32	11	52	2588	59	5117	41133	0	89068
1989	10	0	23	1391	0	2934	164058	15439	312678
1990	29	4	55	2862	879	4846	246819	0	545410
1991	9	4	14	823828	366924	1280732	281434	0	799822
1992	326	156	495	49757	0	104634	80747	12984	148509
1993	1033	0	2512	297397	0	690030	70019	12321	127716
1994	7	1	12	2139223	1230225	3048220	49237	0	109432
1995	415	196	634	6	0	14	195	0	390
1996	430	180	679	588020	368361	807678	46671	0	116324
1997	341	162	521	297828	164107	431550	62084	6037	118131
1998	182	91	272	96874	59118	134630	95609	0	220926
1999	275	139	411	1154149	728616	1579682	24015	3768	44262
2000	851	446	1256	916625	530966	1302284	190661	133249	248072
2001	47	0	106	29087	5648	52526	119023	0	252146
2002	2112	134	4090	829216	496352	1162079	215572	36403	394741
2003	286	0	631	82315	42707	121923	12998	0	30565
2004	4779	2810	6749	290686	147492	433879	2892	989	4796
2005	176	115	237	44663	22890	66436	25970	9987	41953
2006	280	116	443	182713	73645	291781	15965	3414	28517
2007	286	3	568	191111	57403	324819	22803	0	46521
2008	142	68	216	42657	5936	79378	619	25	1212
2009	62	0	132	168990	70509	267471	154687	37022	272351
Mean	520			291798			73411		

Table 2.2.3 Length distribution (%) of 0-group fish in the Barents Sea and adjacent waters, August-October 2009

Length, mm	Cod	Haddock	Capelin	Herring	Saithe	Redfish	Polar cod	Gr. halibut	LRD	Sandeel
10 - 14 mm						0.3				
15 - 19 mm						0.0				
20 - 24 mm		0.1	0.2			0.0	0.1		3.8	
25 - 29 mm			1.6			0.1	0.5		20.7	0.8
30 - 34 mm		0.1	10.1			0.4	6.8		27.7	5.2
35 - 39 mm			17.1	0.1		2.3	9.1	1.6	32.0	10.0
40 - 44 mm			22.8	0.1		11.7	19.5		11.4	15.3
45 - 49 mm	0.1	0.0	25.1	0.4		32.3	27.2		3.9	17.0
50 - 54 mm	0.3	0.0	19.3	3.8		33.5	23.2		0.2	26.5
55 - 59 mm	0.7	0.2	3.1	6.6		14.6	11.4	21.5	0.2	19.5
60 - 64 mm	2.2	0.2	0.6	15.5		3.9	2.1	29.6		3.8
65 - 69 mm	3.8	0.6		14.1	2.4	1.1	0.1	15.6		0.9
70 - 74 mm	8.2	1.2		16.5	2.6		0.1	16.4		0.5
75 - 79 mm	13.9	3.2		13.3	1.9			12.0		0.3
80 - 84 mm	17.4	6.0		10.1	8.2			3.2		0.1
85 - 89 mm	17.5	9.4		6.9	15.5					0.1
90 - 94 mm	14.2	13.3		3.0	9.2					
95 - 99 mm	10.6	14.1		3.5	32.9					
100 - 104 mm	4.8	13.2		2.1	5.5					
105 - 109 mm	3.5	11.8		3.2	1.0					
110 - 114 mm	1.9	10.7		0.6						
115 - 119 mm	0.6	6.4		0.1	10.3					
120 - 124 mm	0.2	4.1		0.1	8.4					
125 - 129 mm	0.1	2.7								
130 - 134 mm		1.2			1.0					
135 - 139 mm		0.7			0.9					
140 - 144 mm		0.3								
145 - 149 mm		0.2								
150 - 154 mm		0.2								
155 - 159 mm										
Mean length, cm	8.5	10.0	4.2	7.4	9.7	5.0	4.6	6.5	3.2	4.7
Long term mean length, cm	7.5	9.0	4.8	7.1	9.2	3.8	4.0	6.2	3.4	5.6

Table 2.3.1. Acoustic estimate of the Barents Sea capelin, August-October 2009

Length (cm)	Age/Year class 1	2	3	4	Sum (10^9)	Biomass (10^3 t)	Mean weight (g)
	2008	2007	2006	2005			
6.0 - 6.6	0.022				0.022	0.0	1.0
6.5 - 7.0	0.211				0.211	0.2	1.0
7.0 - 7.5	0.695				0.695	0.8	1.2
7.5 - 8.0	1.932				1.932	3.3	1.7
8.0 - 8.5	9.910	0.068			9.979	19.8	2.0
8.5 - 9.0	19.592				19.592	46.9	2.4
9.0 - 9.5	22.901	0.808			23.709	67.1	2.8
9.5 - 10.0	24.444	0.360			24.804	82.3	3.3
10.0 - 10.5	25.150	1.673			26.824	106.1	4.0
10.5 - 11.0	11.826	3.286			15.112	72.4	4.8
11.0 - 11.5	4.929	5.089			10.018	54.7	5.5
11.5 - 12.0	1.400	16.871			18.271	117.7	6.4
12.0 - 12.5	0.437	16.257			16.694	122.5	7.3
12.5 - 13.0	0.420	26.085	0.009		26.513	224.1	8.5
13.0 - 13.5	0.062	24.569	0.140		24.770	242.4	9.8
13.5 - 14.0	0.024	24.103	0.325		24.452	272.3	11.1
14.0 - 14.5	0.015	13.755	1.494		15.263	192.9	12.6
14.5 - 15.0	0.051	9.958	1.581		11.590	164.5	14.2
15.0 - 15.5		6.002	3.677		9.679	159.1	16.4
15.5 - 16.0		5.313	6.720		12.033	222.8	18.5
16.0 - 16.5		5.065	8.415		13.479	282.5	21.0
16.5 - 17.0		3.255	12.818	0.029	16.101	377.3	23.4
17.0 - 17.5		1.151	9.490	0.061	10.702	287.2	26.8
17.5 - 18.0		1.996	7.073	0.161	9.230	278.6	30.2
18.0 - 18.5		0.650	6.439		7.089	234.5	33.1
18.5 - 19.0		0.068	1.952		2.020	72.2	35.7
19.0 - 19.5			1.206		1.206	46.9	38.9
19.5 - 20.0			0.127		0.127	5.5	43.4
TSN (10^9)	124.021	166.382	61.465	0.251	352.118		
TSB (10^3 t)	417.4	1821.8	1510.2	7.1		3756.5	
Mean length (cm)	9.6	13.4	16.8	17.5	12.7		
Mean weight (g)	3.4	10.9	24.6	28.4			10.7
SSN (10^6)	0.066	47.213	60.992	0.251	108.522		
SSB (10^3 t)	0.9	809.0	1505.7	7.2		2322.9	

Based on TS value: 19.1 log L - 74.0, corresponding to $\sigma = 5.0 \cdot 10^{-7} \cdot L^{1.9}$

Table 2.3.2. Acoustic estimates of the Barents Sea capelin stock by age in autumn. Biomass (B) in 10^6 tonnes, average weight (AW) in grams. All estimates based on TS = 19.1Log L -74.0 dB

Age	1		2		3		4		5		Sum 1+5
Year	B	AW	B	AW	B	AW	B	AW	B	AW	B
1973	1.69	3.2	2.32	6.2	0.73	18.3	0.41	23.8	0.01	30.1	5.16
1974	1.06	3.5	3.06	5.6	1.53	8.9	0.07	20.8	+	25	5.72
1975	0.65	3.4	2.39	6.9	3.27	11.1	1.48	17.1	0.01	31	7.80
1976	0.78	3.7	1.92	8.3	2.09	12.8	1.35	17.6	0.27	21.7	6.41
1977	0.72	2	1.41	8.1	1.66	16.8	0.84	20.9	0.17	22.9	4.80
1978	0.24	2.8	2.62	6.7	1.20	15.8	0.17	19.7	0.02	25	4.25
1979	0.05	4.5	2.47	7.4	1.53	13.5	0.10	21	+	27	4.15
1980	1.21	4.5	1.85	9.4	2.83	18.2	0.82	24.8	0.01	19.7	6.72
1981	0.92	2.3	1.83	9.3	0.82	17	0.32	23.3	0.01	28.7	3.90
1982[1]	1.22	2.3	1.33	9	1.18	20.9	0.05	24.9			3.78
1983	1.61	3.1	1.90	9.5	0.72	18.9	0.01	19.4			4.24
1984	0.57	3.7	1.43	7.7	0.88	18.2	0.08	26.8			2.96
1985	0.17	4.5	0.40	8.4	0.27	13	0.01	15.7			0.85
1986	0.02	3.9	0.05	10.1	0.05	13.5	+	16.4			0.12
1987[2]	0.08	2.1	0.02	12.2	+	14.6	+	34			0.10
1988	0.07	3.4	0.35	12.2	+	17.1					0.42
1989	0.61	3.2	0.20	11.5	0.05	18.1	+	21			0.86
1990	2.66	3.8	2.72	15.3	0.44	27.2	+	20			5.82
1991	1.52	3.8	5.10	8.8	0.64	19.4	0.04	30.2			7.30
1992	1.25	3.6	1.69	8.6	2.17	16.9	0.04	29.5			5.15
1993	0.01	3.4	0.48	9	0.26	15.1	0.05	18.8			0.80
1994	0.09	4.4	0.04	11.2	0.07	16.5	+	18.4			0.20
1995	0.05	6.7	0.11	13.8	0.03	16.8	0.01	22.6			0.20
1996	0.24	2.9	0.22	18.6	0.05	23.9	+	25.5			0.51
1997	0.42	4.2	0.45	11.5	0.04	22.9	+	26.2			0.91
1998	0.81	4.5	0.98	13.4	0.25	24.2	0.02	27.1	+	29.4	2.06
1999	0.16	4.2	1.01	13.6	0.27	26.9	0.09	29.3			1.53
2000	1.70	3.8	1.59	14.4	0.95	27.9	0.08	37.7			4.32
2001	0.37	3.3	2.40	11	0.81	26.7	0.04	35.5	+	41.4	3.62
2002	0.23	3.9	0.92	10.1	1.04	20.7	0.02	35			2.21
2003	0.20	2.4	0.10	10.2	0.20	18.4	0.03	23.5			0.53
2004	0.20	3.8	0.29	11.9	0.12	21.5	0.02	23.5	+	26.3	0.63
2005	0.10	3.7	0.19	14.3	0.04	20.8	+	25.8			0.33
2006	0.29	4.8	0.35	16.1	0.14	24.8	0.01	30.6	+	36.5	0.79
2007	0.93	4.2	0.85	15.5	0.10	27.5	+	28.1			1.88
2008	0.97	3.1	2.80	12.1	0.61	24.6	0.05	30.0			4.43
2009	0.42	3.4	1.82	10.9	1.51	24.6	0.01	28.4			3.76
Average	0.67	3.62	1.35	10.78	0.83	19.30	0.23	24.80	0.07	28.05	2.98

1 [1] Computed values based on the estimates in 1981 and 1983

2 [2] Combined estimates from multispecies survey and succeeding survey with "Eldjarn"

Table 2.3.3. Survey mortalities for capelin from age 1 to age 2

Year	Year class	Age 1 (10^9)	Age 2 (10^9)	Total mort. %	Total mort. Z
1984-1985	1983	154.8	48.3	69	1.16
1985-1986	1984	38.7	4.7	88	2.11
1986-1987	1985	6.0	1.7	72	1.26
1987-1988	1986	37.6	28.7	24	0.27
1988-1989	1987	21.0	17.7	16	0.17
1989-1990	1988	189.2	177.6	6	0.06
1990-1991	1989	700.4	580.2	17	0.19
1991-1992	1990	402.1	196.3	51	0.72
1992-1993	1991	351.3	53.4	85	1.88
1993-1994	1992	2.2	3.4	-	-
1994-1995	1993	19.8	8.1	59	0.89
1995-1996	1994	7.1	11.5	-	-
1996-1997	1995	81.9	39.1	52	0.74
1997-1998	1996	98.9	72.6	27	0.31
1998-1999	1997	179.0	101.5	43	0.57
1999-2000	1998	155.9	110.6	29	0.34
2000-2001	1999	449.2	218.7	51	0.72
2001-2002	2000	113.6	90.8	20	0.22
2002-2003	2001	59.7	9.6	84	1.83
2003-2004	2002	82.4	24.8	70	1.20
2004-2005	2003	51.2	13.0	75	1.39
2005-2006	2004	26.9	21.7	19	0.21
2006-2007	2005	60.1	54.8	9	0.09
2007-2008	2006	221.7	231.4	-	-
2008-2009	2007	313.0	166.4	47	0.63

Table 2.3.4. Acoustic estimate of polar cod in August-October 2009

Length (cm)	Age/Yearclass					Sum	Biomass	Mean weigt(g)
	1	2	3	4				
	2008	2007	2006	2005		(10^6)	(10^3 t)	
6.5 - 7.0	9					9	0	2.2
7.0 - 7.5	29					29	0.1	3.0
7.5 - 8.0	114					114	0.4	3.1
8.0 - 8.5	463					463	1.7	3.7
8.5 - 9.0	752	5				756	3.6	4.8
9.0 - 9.5	1657	70				1726	8.2	4.8
9.5 - 10.0	2108	216				2323	14.1	6.1
10.0 - 10.5	2798	264				3062	22.2	7.2
10.5 - 11.0	2277	365				2643	21.0	8.0
11.0 - 11.5	1259	753				2012	19.1	9.5
11.5 - 12.0	762	1012	1			1775	19.0	10.7
12.0 - 12.5	588	383	114			1086	13.5	12.4
12.5 - 13.0	63	1277	0			1341	19.8	14.8
13.0 - 13.5	385	1311	29			1724	28.7	16.7
13.5 - 14.0	13	1938	297			2248	40.1	17.8
14.0 - 14.5		1963	265			2228	45.2	20.3
14.5 - 15.0		2853	676			3529	79.0	22.4
15.0 - 15.5		2463	817	1		3281	79.1	24.1
15.5 - 16.0		2548	474	1		3022	82.0	27.1
16.0 - 16.5		1841	264	1		2106	62.1	29.5
16.5 - 17.0		1784	849	6		2639	89.5	33.9
17.0 - 17.5		424	1402			1826	63.1	34.5
17.5 - 18.0		183	910	111		1205	43.1	35.8
18.0 - 18.5		428	751	1		1180	44.1	37.4
18.5 - 19.0		99	319			418	17.1	40.8
19.0 - 19.5		1	322	78		400	19.1	47.9
19.5 - 20.0			259	21		280	13.8	49.4
20.0 - 20.5			142	26		168	8.6	51.4
20.5 - 21.0			172	9		181	10.8	59.5
21.0 - 21.5		21	106	10		137	8.1	59.5
21.5 - 22.0		11	23	11		45	3.1	67.7
22.0 - 22.5			35	19		55	3.7	66.9
22.5 - 23.0			13			13	0.9	70.3
23.0 - 23.5			12	12		25	1.8	71.9
23.5 - 24.0			6	6		12	1.1	89.8
24.0 - 24.5				18		18	1.5	86.2
24.5 - 25.0			4			4	0.3	91.0
25.0 - 25.5			2	2		4	0.5	107.5
25.5 - 26.0								
26.0 - 26.5				+		+	+	120.5
26.5 - 27.0				+		+	+	104.0
27.0 - 27.5				+		+	+	109.0
27.5 - 28.0								
28.0 - 28.5				+		+	+	149.4
28.5 - 29.0				+		+	+	157.3
TSN(10^6)	13276	22213	8265	336		44090		
TSB(10^3 t)	100.2	492.5	280.0	16.6			889.3	
Mean length (cm)	10.3	14.6	17.0	19.7		13.8		
Mean weight (g)	7.5	22.2	33.9	49.6				20.2

Based on TS value: 21.8 log L - 72.7, corresponding to $\sigma = 6.7 \cdot 10^{-7} \cdot$

Table 2.3.5. Acoustic estimates of polar cod by age in August-September. TSN and TSB is total stock numbers (10^6) and total stock biomass (10^3 tonnes) respectively. Numbers based on TS = 21.8 Log L - 72.7 dB

Year	Age 1		Age 2		Age 3		Age 4+		Total	
	TSN	TSB	TSN	TSB	TSN	TSB	TSN	TSB	TSN	TSB
1986	24038	169.6	6263	104.3	1058	31.5	82	3.4	31441	308.8
1987	15041	125.1	10142	184.2	3111	72.2	39	1.2	28333	382.8
1988	4314	37.1	1469	27.1	727	20.1	52	1.7	6562	86.0
1989	13540	154.9	1777	41.7	236	8.6	60	2.6	15613	207.8
1990	3834	39.3	2221	56.8	650	25.3	94	6.9	6799	127.3
1991	23670	214.2	4159	93.8	1922	67.0	152	6.4	29903	381.5
1992	22902	194.4	13992	376.5	832	20.9	64	2.9	37790	594.9
1993	16269	131.6	18919	367.1	2965	103.3	147	7.7	38300	609.7
1994	27466	189.7	9297	161.0	5044	154.0	790	35.8	42597	540.5
1995	30697	249.6	6493	127.8	1610	41.0	175	7.9	38975	426.2
1996	19438	144.9	10056	230.6	3287	103.1	212	8.0	33012	487.4
1997	15848	136.7	7755	124.5	3139	86.4	992	39.3	28012	400.7
1998	89947	505.5	7634	174.5	3965	119.3	598	23.0	102435	839.5
1999	59434	399.6	22760	426.0	8803	286.8	435	25.9	91463	1141.9
2000	33825	269.4	19999	432.4	14598	597.6	840	48.4	69262	1347.8
2001	77144	709.0	15694	434.5	12499	589.3	2271	132.1	107713	1869.6
2002	8431	56.8	34824	875.9	6350	282.2	2322	143.2	52218	1377.2
2003	15434	114.1	2057	37.9	2038	63.9	1545	64.4	21074	280.2
2004	99404	627.1	22777	404.9	2627	82.2	510	32.7	125319	1143.8
2005	71675	626.6	57053	1028.2	3703	120.2	407	28.3	132859	1803.3
2006	16190	180.8	45063	1277.4	12083	445.9	698	37.2	74033	1941.2
2007	29483	321.2	25778	743.4	3230	145.8	315	19.8	58807	1230.1
2008	41693	421.8	18114	522.0	5905	247.8	415	27.8	66127	1219.4
2009	13276	100.2	22213	492.5	8265	280.0	336	16.6	44090	889.3
Average	32297	255.0	16105	364.4	4527	166.4	565	30.1	53447	818.2

Table 2.3.6. Survey mortalities for polar cod from age 1 to age 2, and from age 2 to age 3

Year	Year class	Age 1 (10^9)	Age 2 (10^9)	Total mort. %	Total mort Z
1986-1987	1985	24.0	10.1	58	0.86
1987-1988	1986	15.0	1.5	90	2.30
1988-1989	1987	4.3	1.8	58	0.87
1989-1990	1988	13.5	2.2	84	1.81
1990-1991	1989	3.8	4.2	-	-
1991-1992	1990	23.7	14.0	41	0.53
1992-1993	1991	22.9	18.9	17	0.19
1993-1994	1992	16.3	9.3	43	0.56
1994-1995	1993	27.5	6.5	76	1.44
1995-1996	1994	30.7	10.1	67	1.11
1996-1997	1995	19.4	7.8	59	0.91
1997-1998	1996	15.8	7.6	52	0.73
1998-1999	1997	89.9	22.8	75	1.37
1999-2000	1998	59.4	20.0	66	1.09
2000-2001	1999	33.8	15.7	54	0.77
2001-2002	2000	77.1	34.8	55	0.80
2002-2003	2001	8.4	2.1	75	1.38
2003-2004	2002	15.4	22.7	-	-
2004-2005	2003	99.4	57.1	43	0.56
2005-2006	2004	71.7	45.1	37	0.48
2006-2007	2005	16.2	25.8	-	-
2007-2008	2006	29.5	18.1	39	0.50
2008-2009	2007	41.7	22.2	47	0.63

Year	Year class	Age 2 (10^9)	Age 3 (10^9)	Total mort. %	Total mort Z
1986-1987	1984	6.3	3.1	51	0.71
1987-1988	1985	10.1	0.7	93	2.67
1988-1989	1986	1.5	0.2	87	2.01
1989-1990	1987	1.8	0.7	61	2.57
1990-1991	1988	2.2	1.9	14	0.15
1991-1992	1989	4.2	0.8	81	1.66
1992-1993	1990	14.0	3.0	78	1.54
1993-1994	1991	18.9	5.0	74	1.33
1994-1995	1992	9.3	1.6	83	1.76
1995-1996	1993	6.5	3.3	51	0.68
1996-1997	1994	10.1	3.1	69	1.18
1997-1998	1995	7.8	4.0	49	0.67
1998-1999	1996	7.6	8.8	-	-
1999-2000	1997	22.8	14.6	36	0.44
2000-2001	1998	20.0	12.5	38	0.47
2001-2002	1999	15.7	6.4	59	0.90
2002-2003	2000	34.8	2.0	94	2.86
2003-2004	2001	2.1	2.6	-	-
2004-2005	2002	22.8	3.7	84	1.83
2005-2006	2003	51.7	12.1	77	1.50
2006-2007	2004	45.1	3.2	93	2.64
2007-2008	2005	25.8	5.9	77	1.50
2008-2009	2006	18.1	8.3	54	0.78

Table 2.3.7. Acoustic estimate of young Norwegian spring spawning herring in the western part of the Barents Sea August-October 2009

Length (cm)	Age / Year class							Sum (10^6)	Biomass (10^3 t)	Mean weight (g)
	1	2	3	4	5	6	7			
	2008	2007	2006	2005	2004	2003	2002			
13.0 - 13.4	15	0	0	0	0	0	0	15	0.2	14.9
13.5 - 13.9	15	0	0	0	0	0	0	15	0.3	16.9
14.0 - 14.4	81	0	0	0	0	0	0	81	1.5	19.0
14.5 - 14.9	55	0	0	0	0	0	0	55	1.1	20.0
15.0 - 15.4	80	0	0	0	0	0	0	80	1.8	23.0
15.5 - 15.9	99	0	0	0	0	0	0	99	2.5	24.7
16.0 - 16.4	110	0	0	0	0	0	0	110	3.4	31.0
16.5 - 16.9	315	0	0	0	0	0	0	315	10.1	32.2
17.0 - 17.4	400	0	0	0	0	0	0	400	13.5	33.7
17.5 - 17.9	117	0	0	0	0	0	0	117	4.2	36.3
18.0 - 18.4	39	0	0	0	0	0	0	39	1.6	41.0
18.5 - 18.9	15	0	0	0	0	0	0	15	0.6	42.0
19.0 - 19.4	0	27	0	0	0	0	0	27	1.2	45.0
19.5 - 19.9	0	20	0	0	0	0	0	20	1.0	52.0
20.0 - 20.4	0	0	0	0	0	0	0	0	0.0	
20.5 - 20.9	0	0	0	0	0	0	0	0	0.0	
21.0 - 21.4	0	5	0	0	0	0	0	5	0.4	71.4
21.5 - 21.9	0	0	0	0	0	0	0	0	0.0	
22.0 - 22.4	0	0	0	0	0	0	0	0	0.0	
22.5 - 22.9	0	8	0	0	0	0	0	8	0.6	80.0
23.0 - 23.4	0	5	0	0	0	0	0	5	0.4	90.0
23.5 - 23.9	0	6	0	0	0	0	0	6	0.5	93.0
24.0 - 24.4	0	59	0	0	0	0	0	59	6.7	113.5
24.5 - 24.9	0	59	22	0	0	0	0	81	9.4	116.5
25.0 - 25.4	0	40	85	0	0	0	0	125	15.0	120.3
25.5 - 25.9	0	85	145	0	0	0	0	230	30.9	134.1
26.0 - 26.4	0	23	243	0	0	0	0	266	37.0	139.4
26.5 - 26.9	0	5	187	38	0	0	0	231	34.6	149.6
27.0 - 27.4	0	5	273	4	0	0	0	282	45.6	161.8
27.5 - 27.9	0	0	210	7	0	0	0	217	36.4	167.7
28.0 - 28.4	0	0	125	43	75	0	0	243	42.9	176.6
28.5 - 28.9	0	58	62	58	3	0	0	182	34.7	191.2
29.0 - 29.4	0	0	116	122	61	0	0	299	57.4	192.1
29.5 - 29.9	0	0	0	66	226	0	0	292	63.6	217.6
30.0 - 30.4	0	0	173	66	72	0	0	311	69.2	222.1
30.5 - 30.9	0	0	34	0	148	0	0	182	44.5	244.3
31.0 - 31.4	0	0	0	0	196	16	0	212	55.7	262.2
31.5 - 31.9	0	0	0	0	121	67	0	188	53.1	283.0
32.0 - 32.4	0	0	0	0	49	106	24	180	51.7	287.6
32.5 - 32.9	0	0	0	0	34	0	34	68	21.0	307.7
33.0 - 33.4	0	0	0	0	48	0	25	73	21.8	298.3
33.5 - 33.9	0	0	0	0	0	17	28	45	14.7	325.3
TSN (106)	1341	404	1675	405	1034	206	113	5178		
TSB(103 t)	40.9	49.9	276.4	78.8	251.5	59.1	34.4		791.0	
Mean length (cm)	16.5	24.9	27.5	29.0	30.7	32.1	33.0	25.5		
Mean weight (g)	30.5	123.3	165.0	194.6	243.3	287.2	305.6			152.8

TS=20.0* log(L) - 71.9

Table 2.3.8. Acoustic estimate of herring in the eastern part of Barents Sea August-September 2009

Length (cm)			Age/Yearclass				Sum	Biomass	Mean
			1	2	3	4			
			2008	2007	2006	2005	(10^6)	(10^3 t)	weigt(g)
14.5	-	14.9	3	0	0	0	3	0.1	24.7
15.0	-	15.4	3	0	0	0	3	0.1	27.3
15.5	-	15.9	10	0	0	0	10	0.3	29.9
16.0	-	16.4	7	0	0	0	7	0.2	32.8
16.5	-	16.9	51	0	0	0	51	1.8	35.8
17.0	-	17.4	85	0	0	0	85	3.3	39.0
17.5	-	17.9	27	0	0	0	27	1.2	42.4
18.0	-	18.4	7	0	0	0	7	0.3	45.9
18.5	-	18.9	3	0	0	0	3	0.2	49.7
19.0	-	19.4	0	0	0	0	0	0	
19.5	-	19.9	0	3	0	0	3	0.2	57.7
20.0	-	20.4	0	7	7	0	15	1.0	64.0
20.5	-	20.9	0	7	0	0	7	0.5	67.0
21.0	-	21.4	0	10	0	10	21	1.4	69.5
21.5	-	21.9	0	0	0	0		0	
22.0	-	22.4	0	0	62	0	62	4.9	79.7
22.5		22.9	0	0	62	21	83	7.2	86.8
23.0		23.4	0	0	0	0	0	0	
23.5		23.9	0	0	0	0	0	0	
24.0		24.4	0	0	0	0	0	0	
24.5		24.9	0	0	0	10	10	1.1	107.0
TSN(10^6)			197	29	132	41	399		
TSB(10^3 t)			7.5	1.9	10.8	3.6		23.8	
Mean length (cm)			17.1	20.7	22.4	22.9	19.7		
Mean weight (g)			37.9	66	82.1	87.5			59.7

Table 2.3.9. Acoustic estimate of blue whiting in the Barents Sea August-October 2009

Length (cm)	Age/Yearclass									Sum (10^6)	Biomass (103 t)	Mean weigt(g)
	1	2	3	4	5	6	7	8	9+			
	2008	2007	2006	2005	2004	2003	2002	2001	2000			
21.0 - 21.5	1									1	0.1	48.0
21.5 - 22.0												
22.0 - 22.5												
22.5 - 23.0												
23.0 - 23.5	1									1	0.1	68.0
23.5 - 24.0												
24.0 - 24.5			+									102.0
24.5 - 25.0												
25.0 - 25.5			+									97.8
25.5 - 26.0		2	2							4	0.3	90.0
26.0 - 26.5				7						7	0.8	104.3
26.5 - 27.0				13						13	1.4	111.6
27.0 - 27.5				24						24	2.8	116.8
27.5 - 28.0				39	1					40	5.1	128.6
28.0 - 28.5				18	71					88	12.0	135.4
28.5 - 29.0				16	88					104	15.1	145.8
29.0 - 29.5					150	35				185	27.4	148.0
29.5 - 30.0				25	110	5				139	22.0	158.0
30.0 - 30.5					115	67				182	30.2	165.6
30.5 - 31.0					115	49	2			166	28.6	172.6
31.0 - 31.5				1	63	104	10			179	32.5	182.0
31.5 - 32.0					77		34			112	21.7	194.4
32.0 - 32.5				5		65	14			85	16.7	197.3
32.5 - 33.0						29	33			63	13.8	221.2
33.0 - 33.5						49				49	11.0	224.8
33.5 - 34.0								23		23	5.7	245.5
34.0 - 34.5								5	16	21	5.0	238.6
34.5 - 35.0									16	16	3.9	245.5
35.0 - 35.5								3	1	5	1.3	267.4
35.5 - 36.0								1	2	3	0.9	304.9
36.0 - 36.5								2	2	4	1.0	278.4
36.5 - 37.0							5		1	6	1.6	293.1
37.0 - 37.5									+	+	0.1	337.5
37.5 - 38.0									+	+	0.1	319.0
38.0 - 38.5									+	+	0.1	332.0
38.5 - 39.0									+	+	0.1	344.0
TSN(10^6)	2	2	2	148	789	403	100	35	38	1519		
TSB(10^3 t)	0.1	0.2	0.2	20.0	127.4	74.8	20.7	8.6	9.3		261.4	
Mean length (cm)	22.3	25.7	25.7	28.2	29.9	31.3	32.4	34.2	34.5	30.5		
Mean weight (g)	58.0	91.1	90.6	134.6	161.4	185.4	207.4	250.1	249.3			172.1

TS=21.8* lg(L) - 72.7

Table 2.8.1. Number of marine mammal observed during the ecosystem survey, August-September 2009

Class / suborder	Species name	Johan Hjort	Jan Mayen	Vilnus	Total	%
Cetacea/ baleen whales	Blue whale	-	1	-	**1**	**0.10**
	Fin whale	-	23	9	**32**	**3.28**
	Humpback whale	-	1	14	**15**	**1.54**
	Minke whale	2	20	18	**40**	**4.10**
	Bowhead whale	-	-	1	**1**	**0.10**
	Unidentified whale	-	2	1	**3**	**0.31**
Cetacea/ toothed whales	Sperm whale	1	1	-	**2**	**0.21**
	Killer whale	-	10		**10**	**1.03**
	Harbour porpoise	-	-	8	**8**	**0.82**
	White-beaked dolphin	105	260	104	**469**	**48.10**
	Dolphin spp.	-	13		**13**	**1.33**
Pinnipedia	Harp seal	-	309	43	**352**	**36.10**
	Ringed seal	-	1	3	**4**	**0.41**
	Bearded seal	-	16	-	**16**	**1.64**
	Whalrus	-	7	-	**7**	**0.72**
	Seal spp.	-	1	-	**1**	**0.10**
Other	Polar bear	-	-	1	**1**	**0.10**
Total		**108**	**665**	**202**	**975**	**100**

Table 2.8.2. Number of seabirds observed by species during the Joint Norwegain/Russian Ecosystem Survey 2009

Species	**Latin name**	**No. of ind.**
Little auk	*Allevalle*	471
Razorbill	*Alca torda*	23
Brünnichs guillemot	*Uria lomvia*	1570
Common guillemot	*Uria aalge*	61
Guillemot spp.	*Uria spp.*	121
Black guillemot	*Cepphus grylle*	108
Puffin	*Fratercula arctica*	198
Fulmar	*Fulmarus glacialis*	38011
Lesser black-backed gull	*Larus fuscus*	14
Glaucous gull	*Larus hyperboreus*	1279
Great black-backed gull	*Larus marinus*	249
Herring gull	*Larus argentatus*	623
Kittiwake	*Rissa tridactyla*	7773
Great skua	*Stercorarius skua*	4
Long-tailedskua	*Stercorarius longicaudus*	2
Arctic skua	*Stercorarius parasiticus*	46
Pomarine skua	*Stercorarius pomarinus*	217
Skua spp.	*Stercorarius sp.*	5
Arctic tern	*Sterna paradisaea*	92
Northern gannet	*Morus bassanus*	1
Purple sand-piper	*Calidris maritima*	15
Long-tailed duck	*Clangula hyemalis*	2
Sooty shearwater	*Puffinus griseus*	4
Common eider	*Somateria mollissima*	26

5 FIGURES

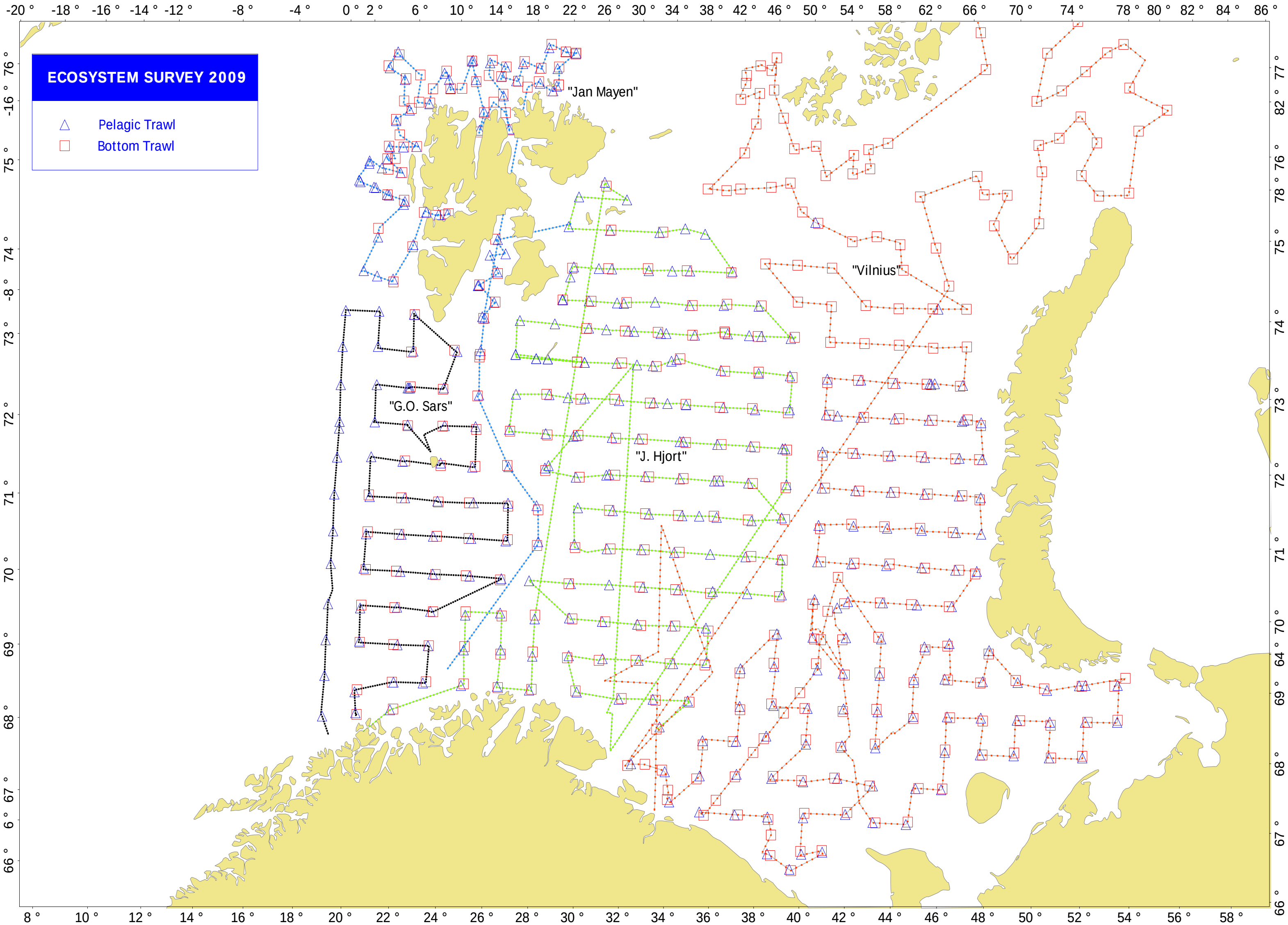


Figure 2.1 **Trawl stations for "G.O. Sars" "Johan Hjort", "Jan Mayen" and"Vilnyus", August – October 2009**

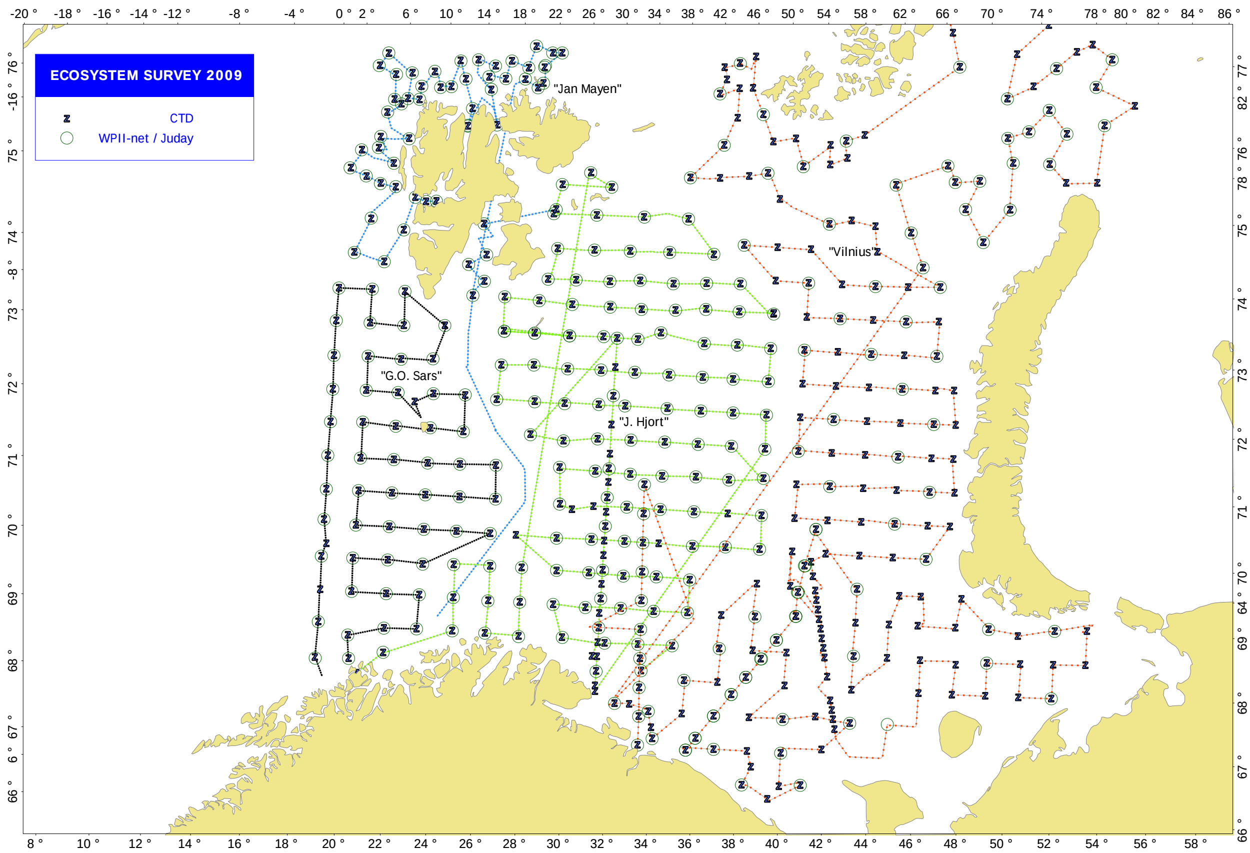


Figure 2.2 **Hydrograhy and plankton stations for "G.O. Sars" "Johan Hjort", "Jan Mayen" and "Vilnyus", August - October 2009**

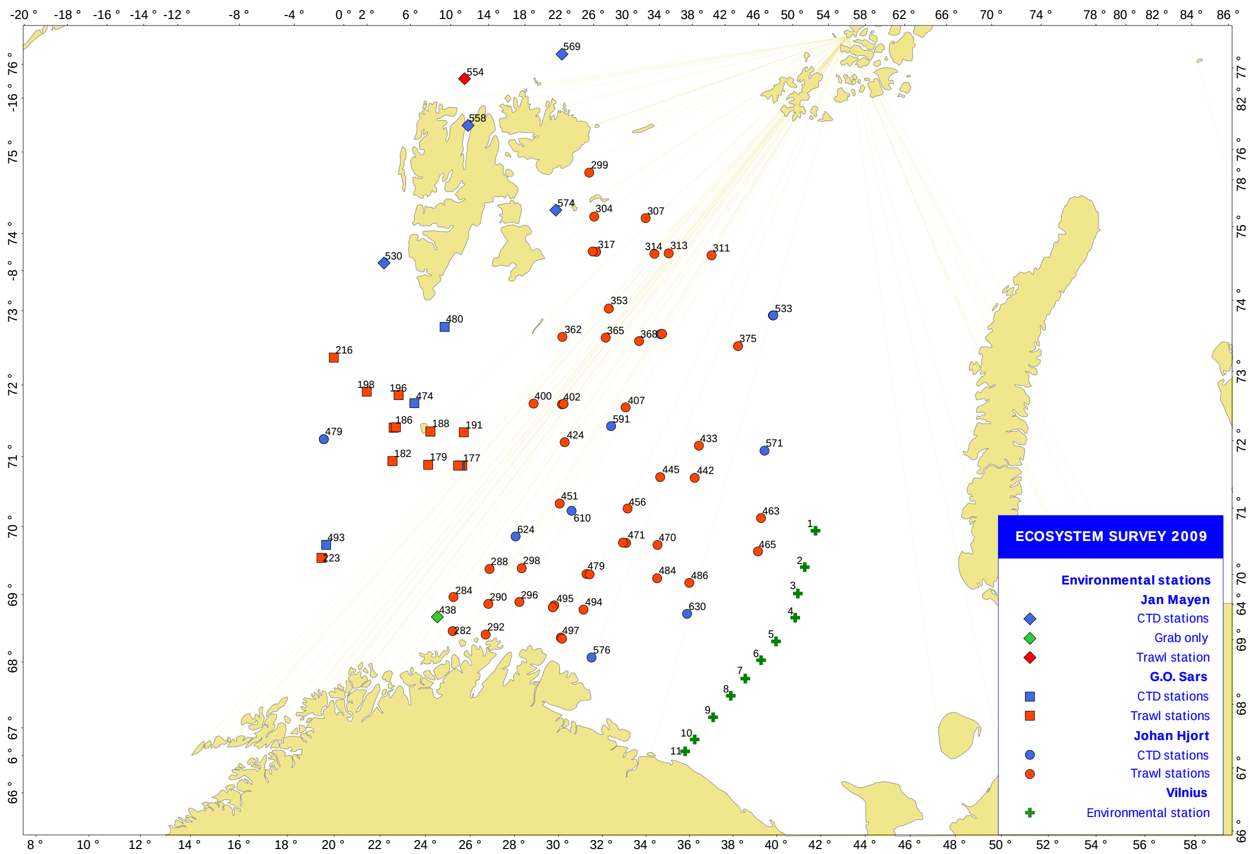


Figure 2.3 **Environmental stations for "G.O. Sars", "Johan Hjort", "Jan Mayen" and "Vilnyus", August - October 2009**

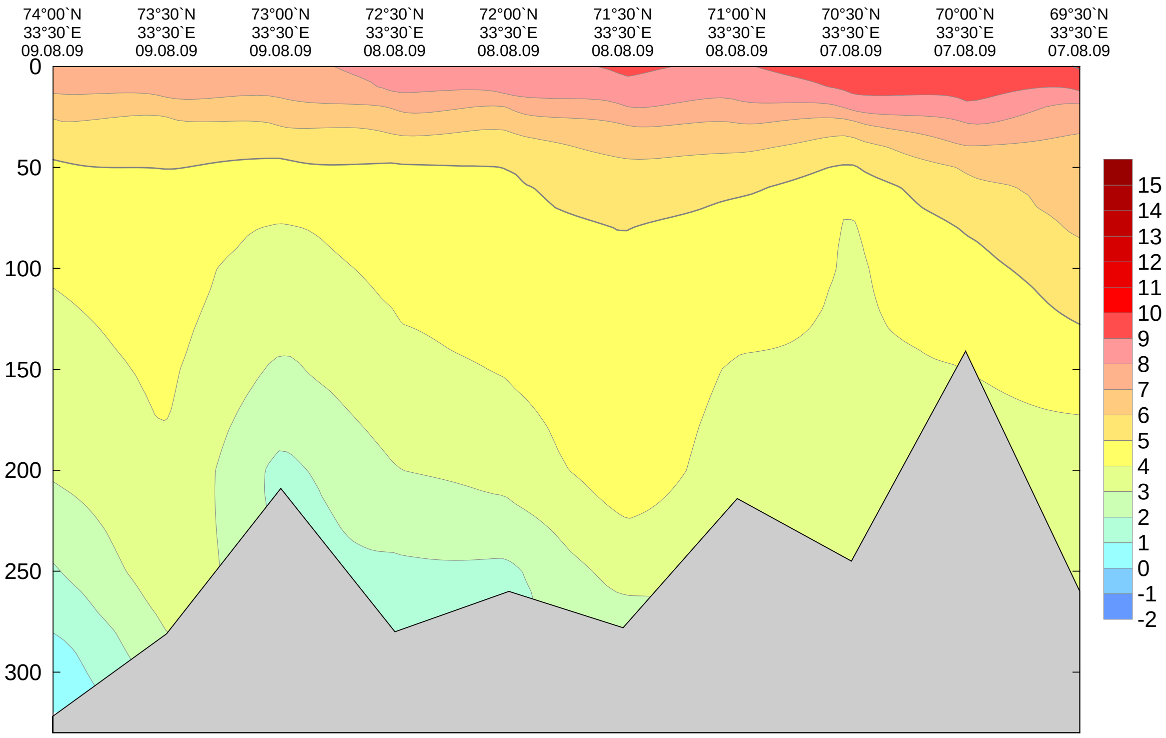


Figure 2.1.1 Temperature (°C) in the Kola Section, 7-9 August 2009

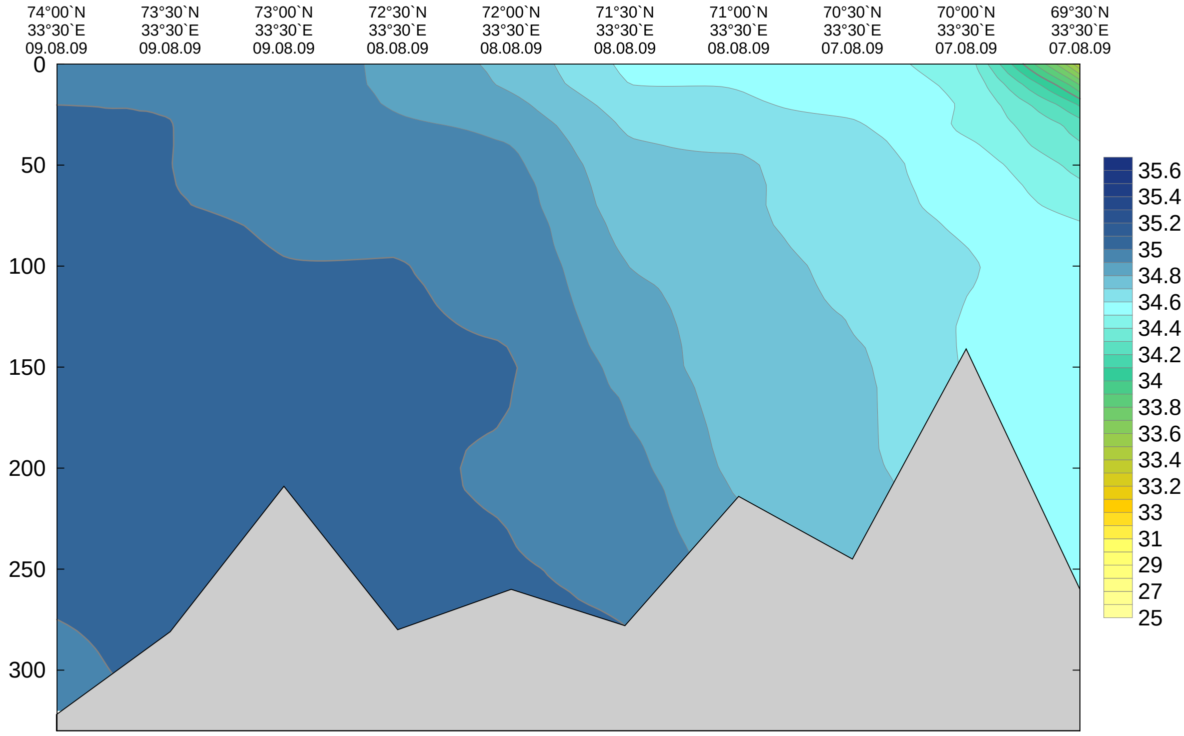


Figure 2.1.2 Salinity in the Kola Section, 7-9 August 2009

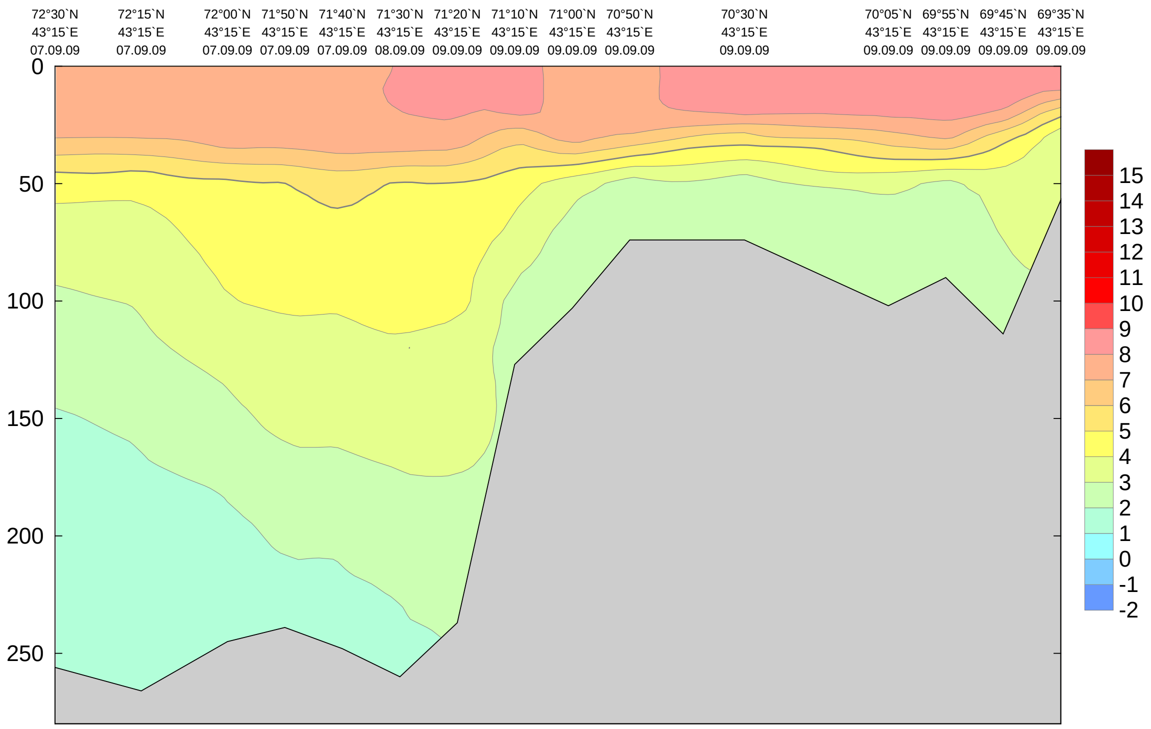


Figure 2.1.3. Temperature (°C) in the Kanin Section, 7-9 September 2009

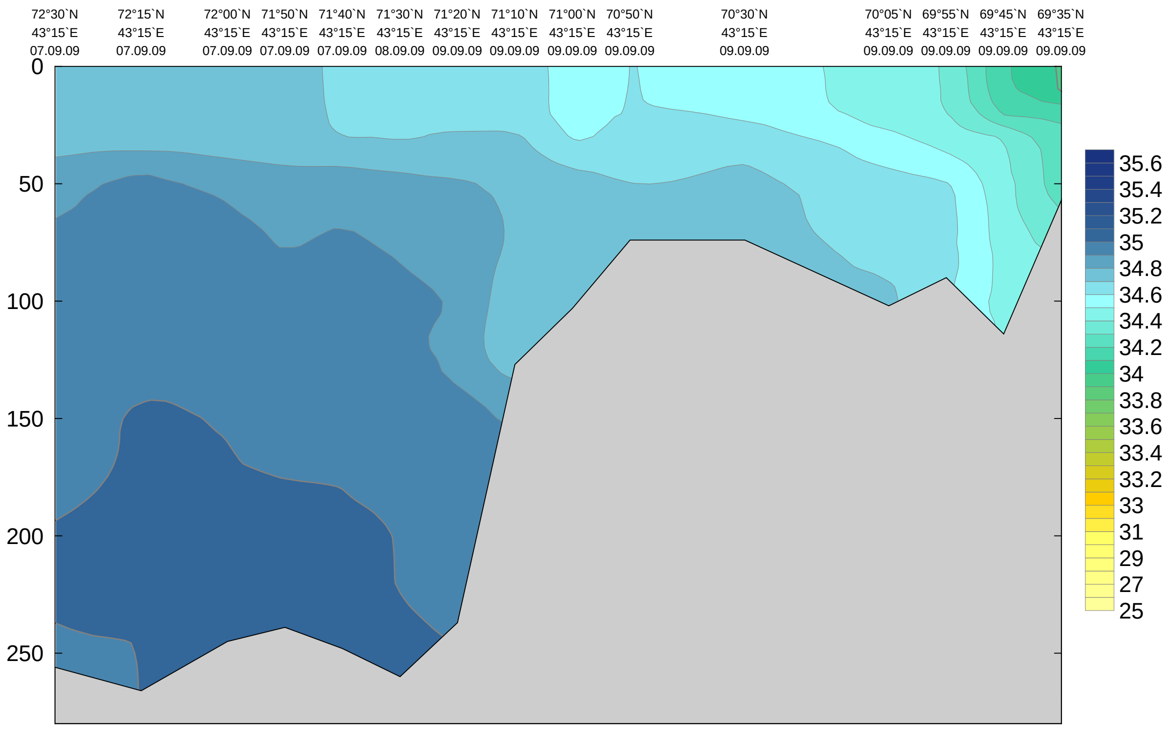


Figure 2.1.4 Salinity in the Kanin Section, 7-9 September 2009

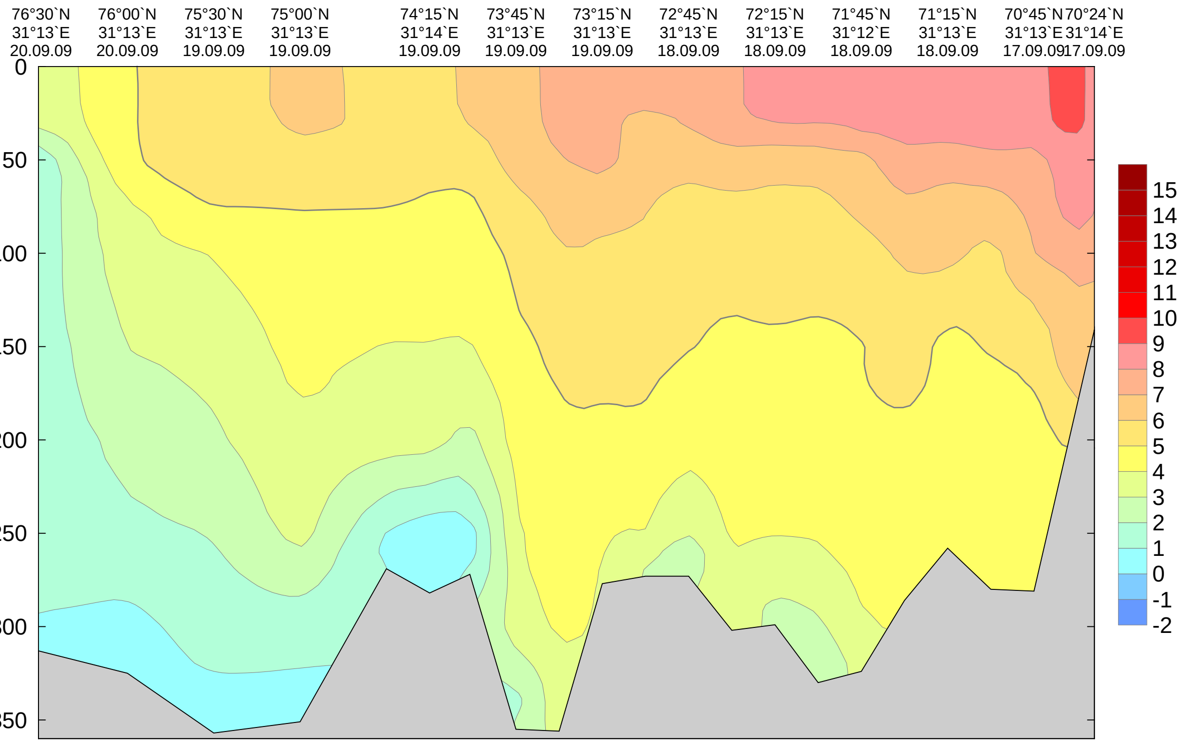


Figure 2.1.5 Temperature (°C) in the Vardø – North Section, 17-20 September 2009

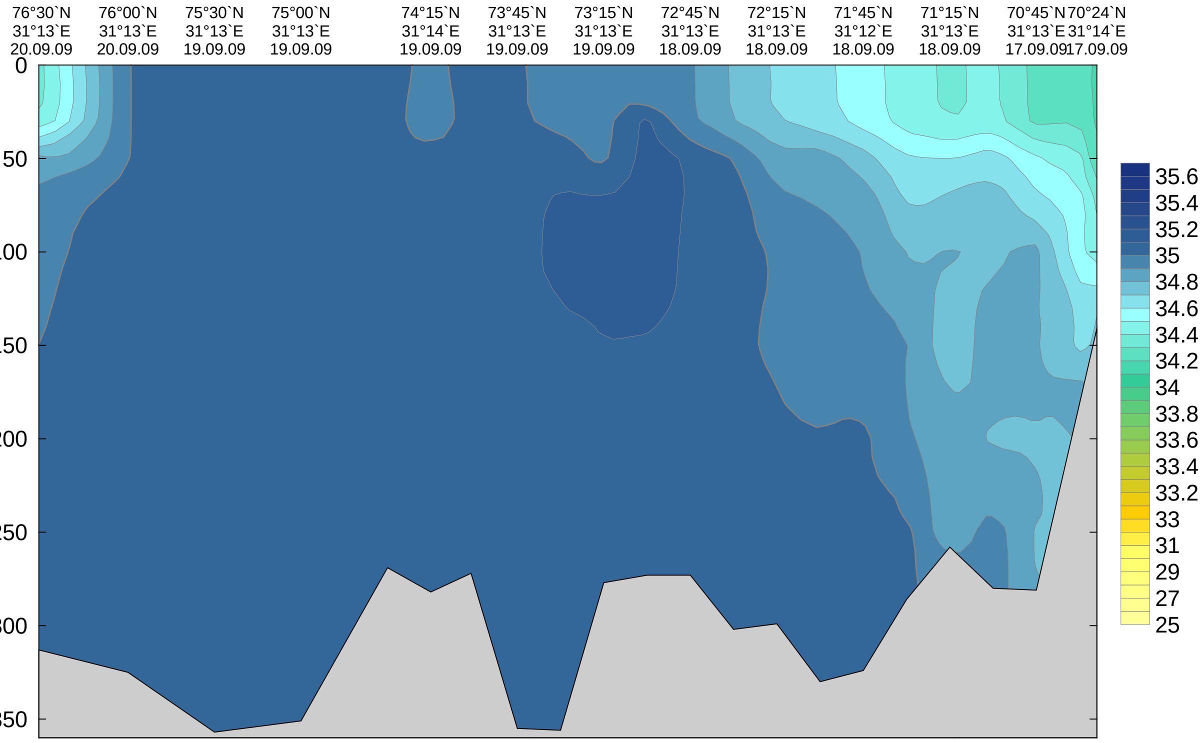


Figure 2.1.6 Salinity in the Vardø – North Section, 17-20 September 2009

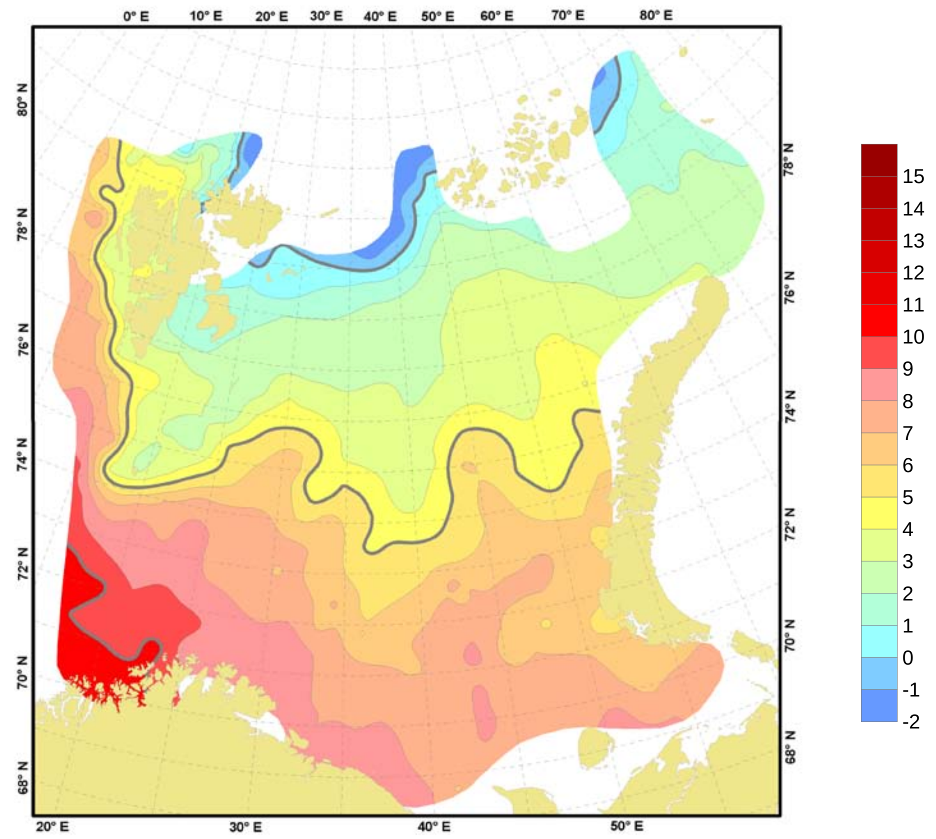


Figure 2.1.7 Distribution of surface temperature (°C), August-September 2009

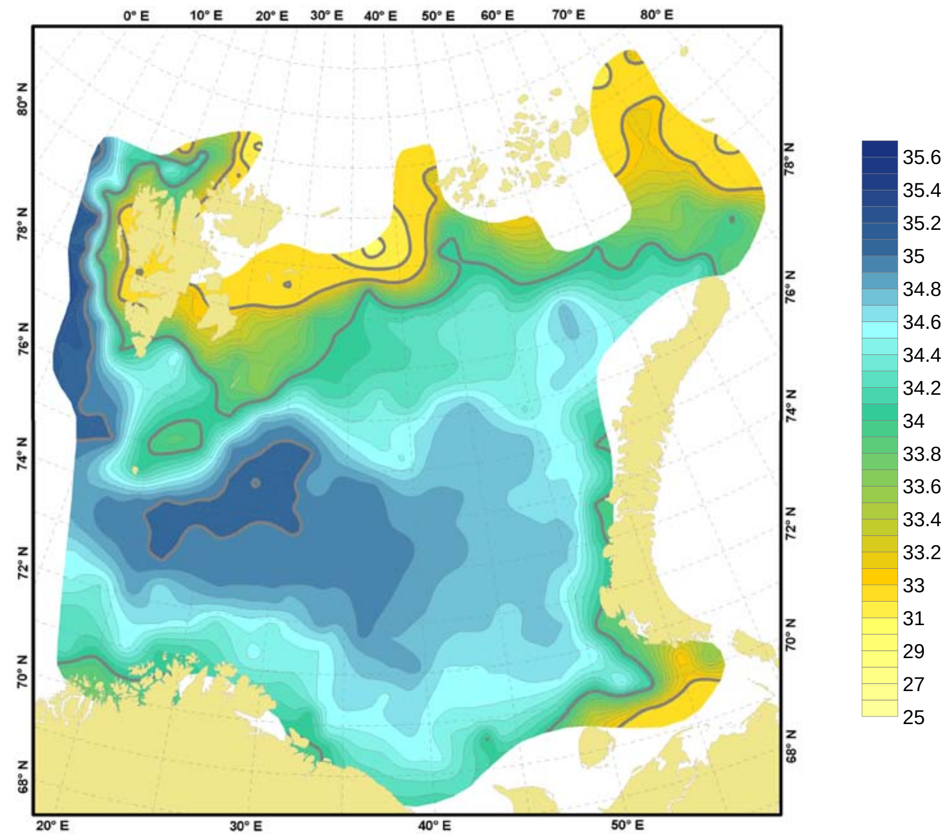


Figure 2.1.8 Distribution of surface salinity, August-September 2009

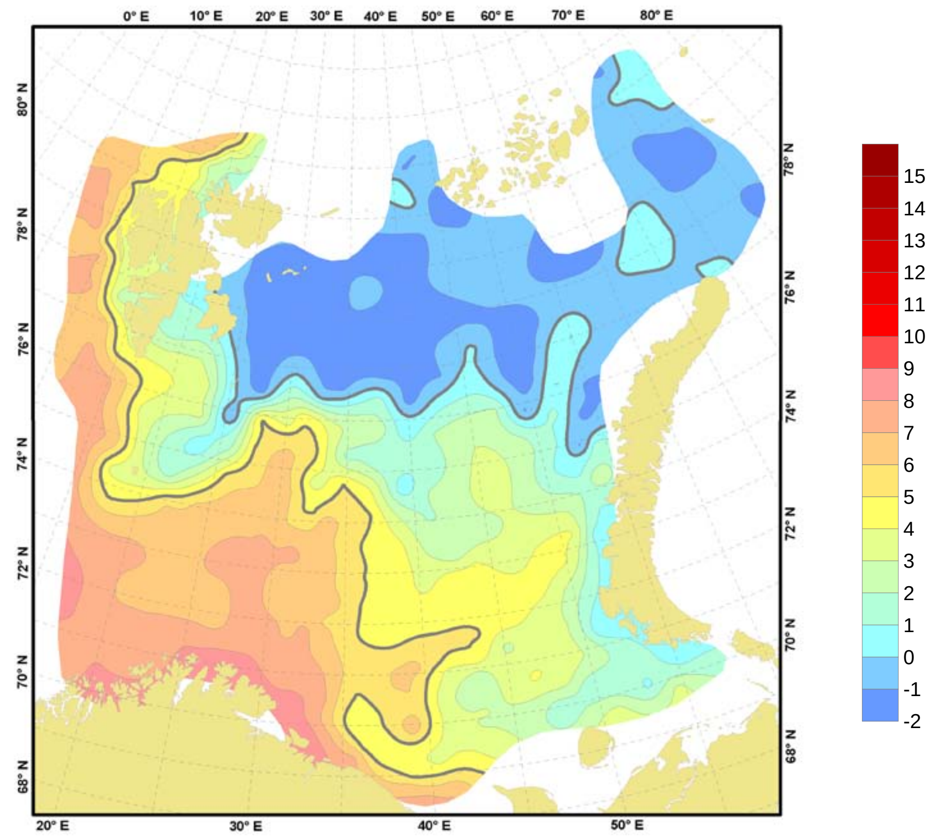


Figure 2.1.9 Distribution of temperature (°C) at the 50 m depth, August-September 2009

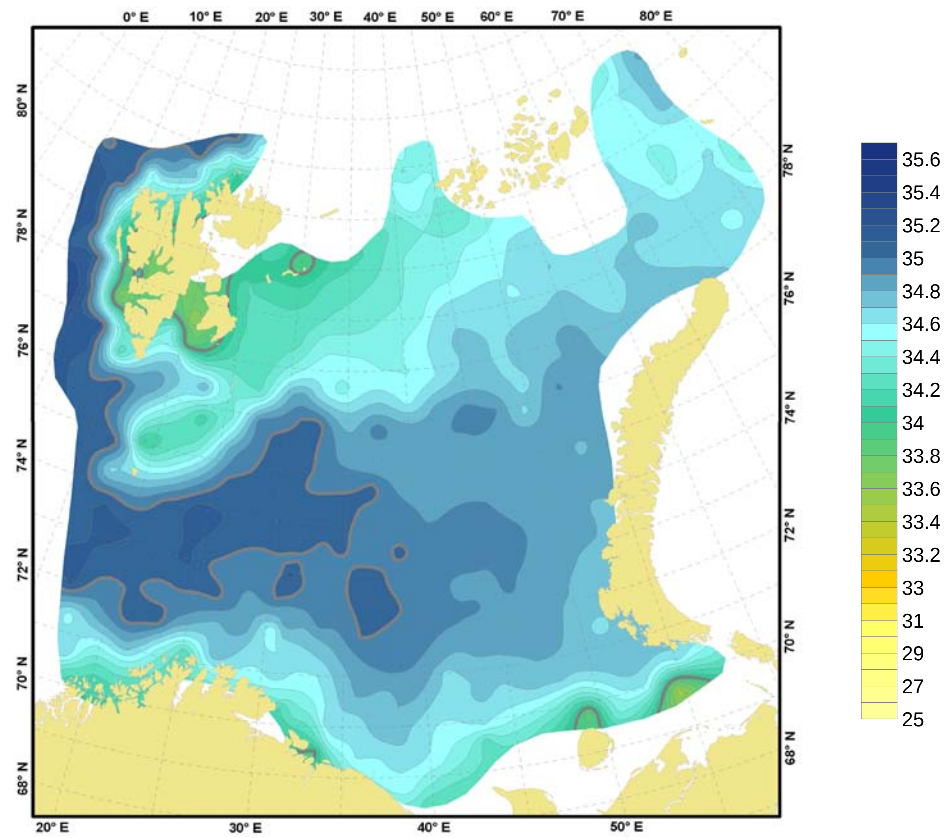


Figure 2.1.10 Distribution of salinity at the 50 m depth, August-September 2009

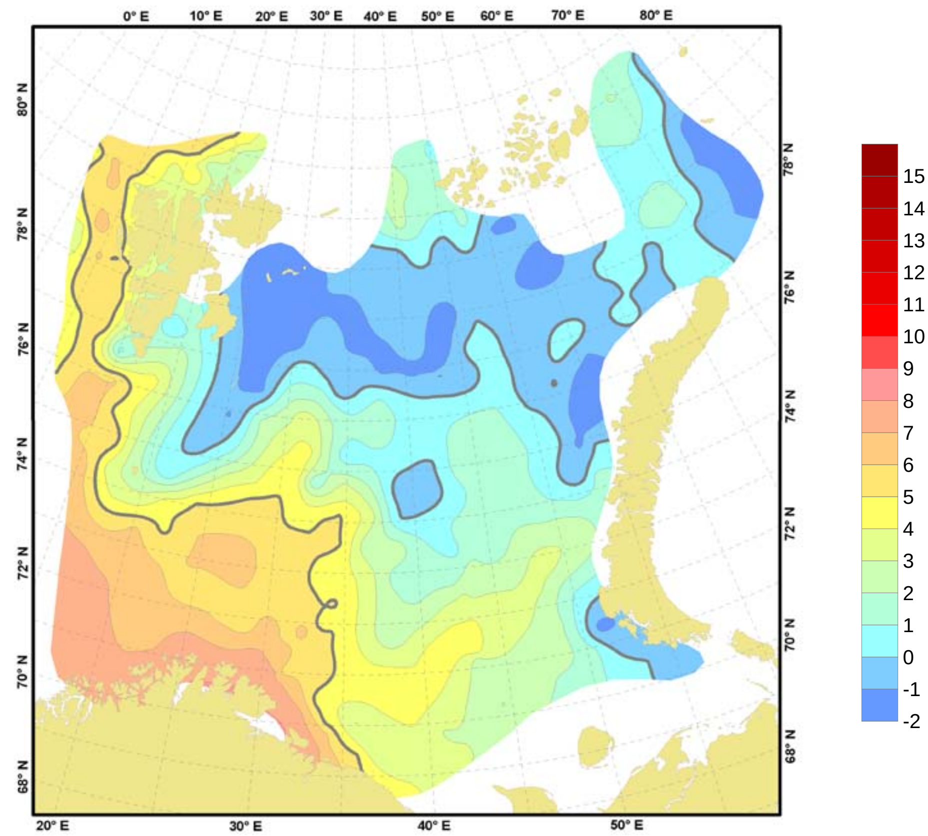


Figure 2.1.11 Distribution of temperature (°C) at the 100 m depth, August-September 2009

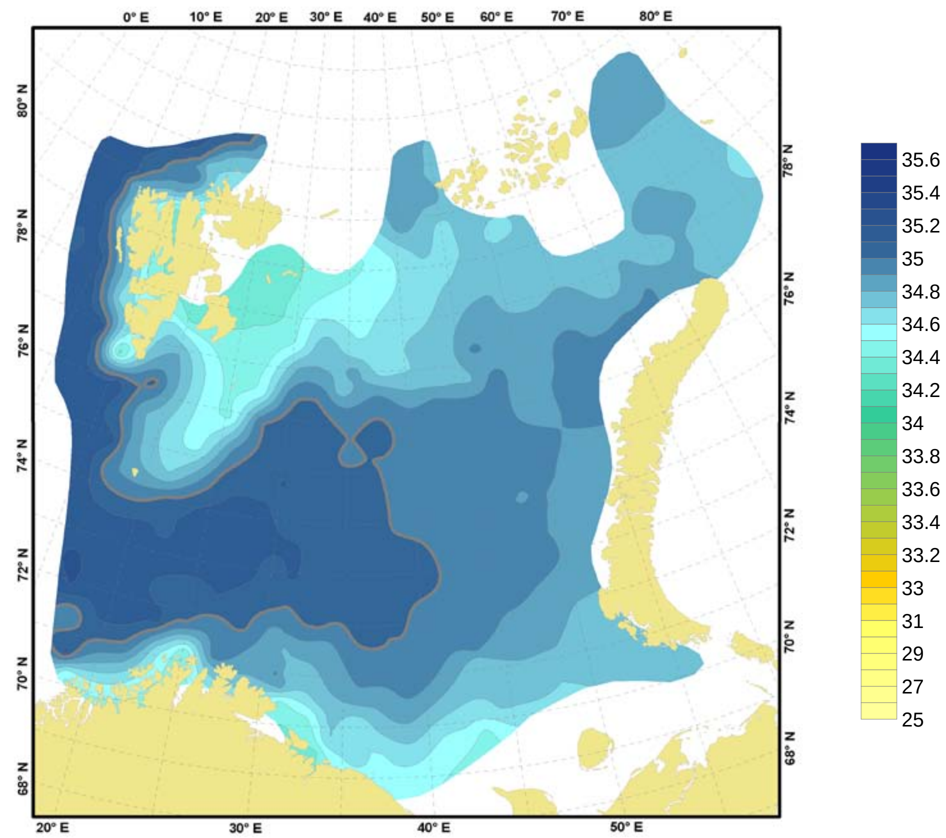


Figure 2.1.12 Distribution of salinity at the 100 m depth, August-September 2009

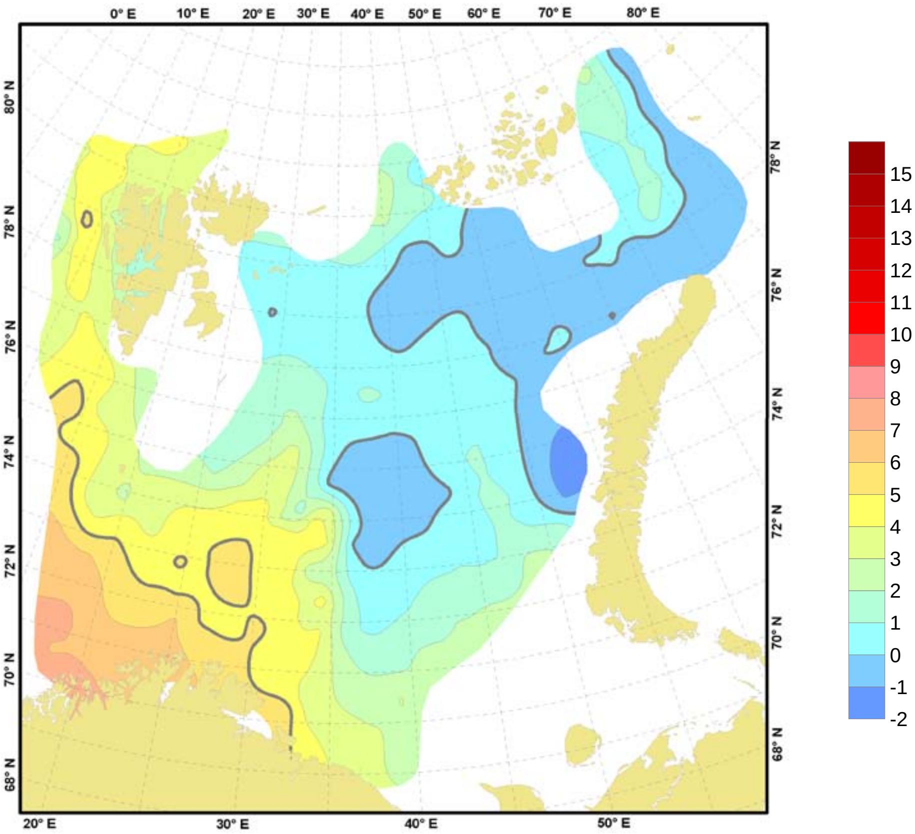


Figure 2.1.13 Distribution of temperature (°C) at the 200 m depth, August-September 2009

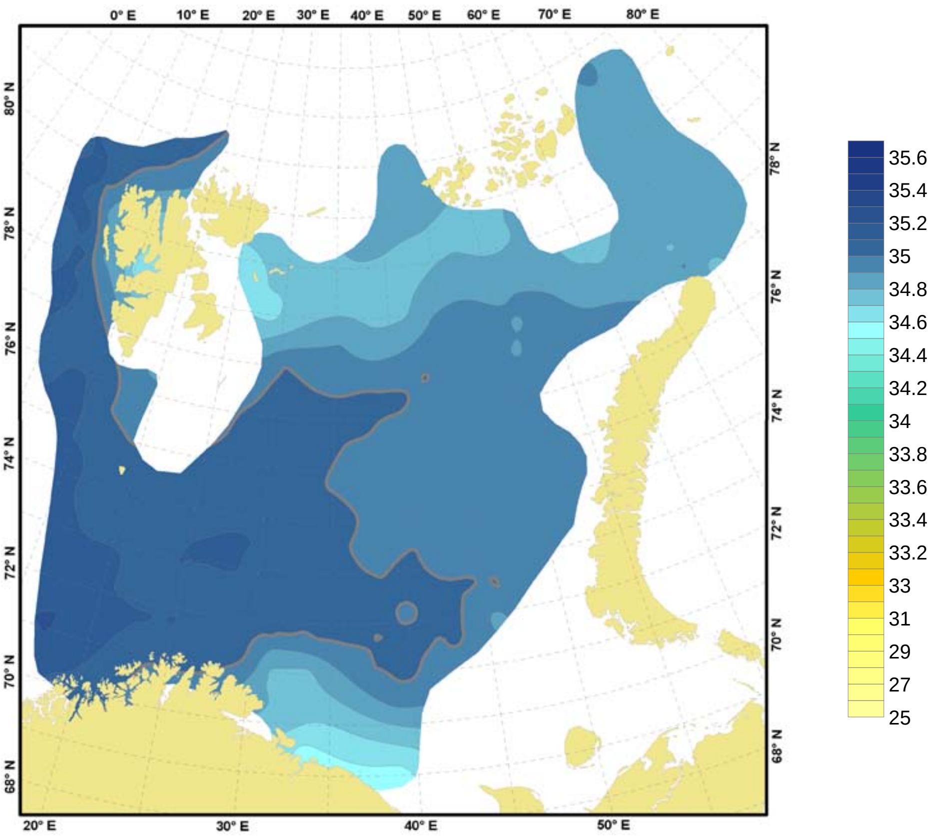


Figure 2.1.14 Distribution of salinity at the 200 m depth, August-September 2009

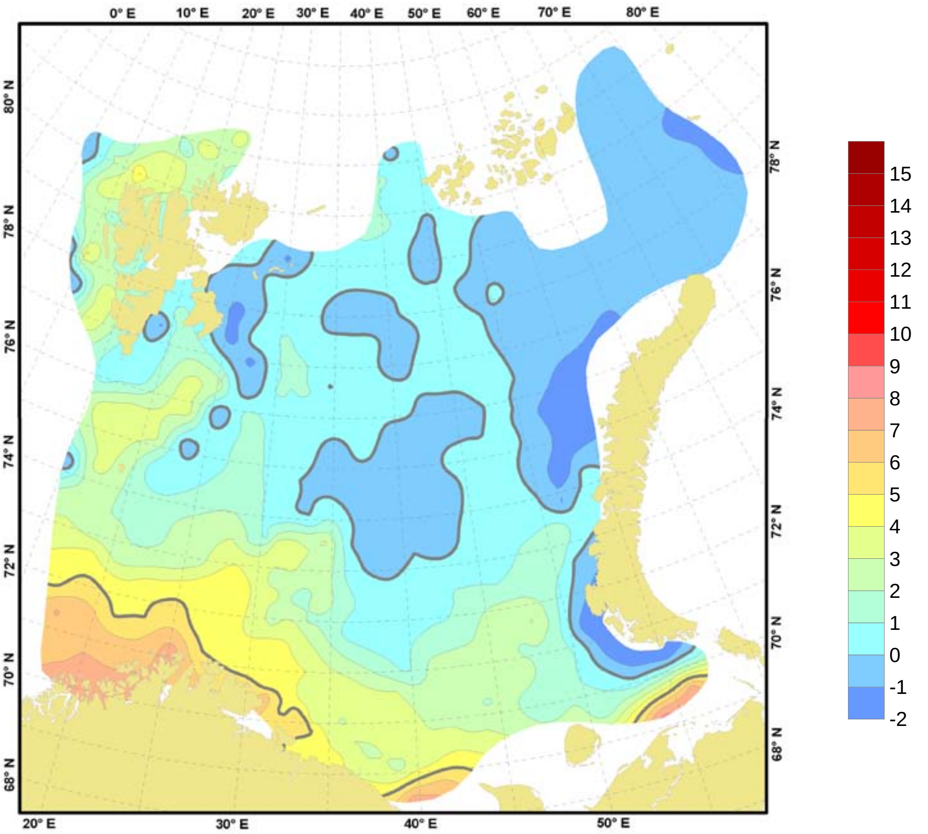


Figure 2.1.15 Distribution of temperature (°C) at the bottom, August-September 2009

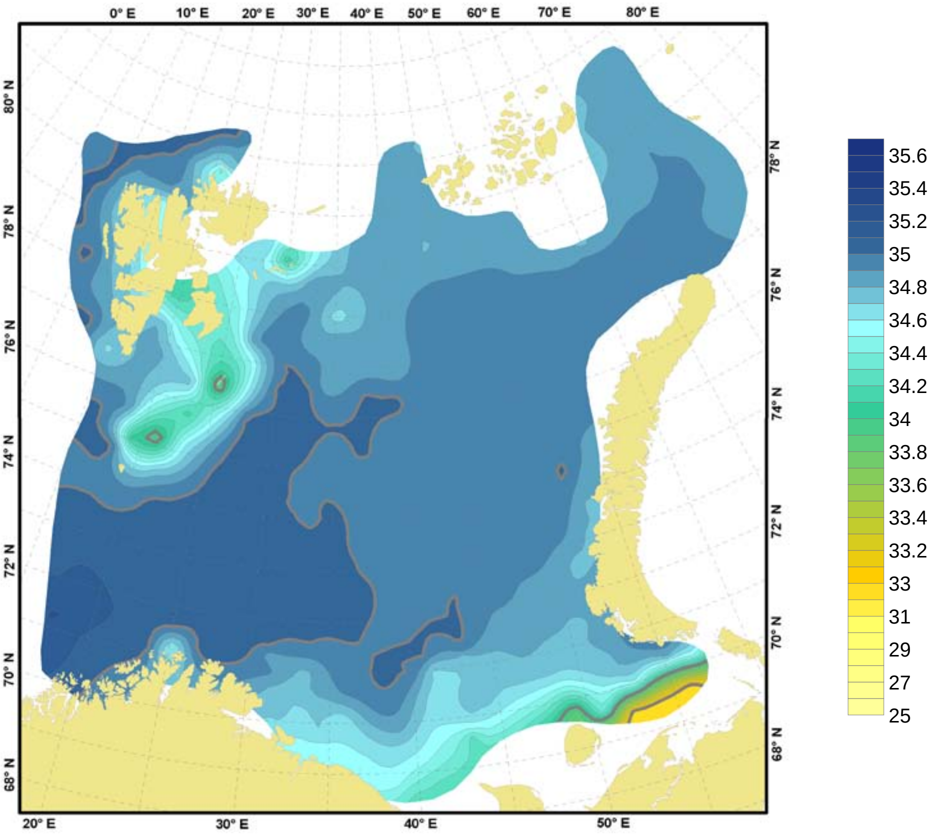


Figure 2.1.16 Distribution of salinity at the bottom, August-September 2009

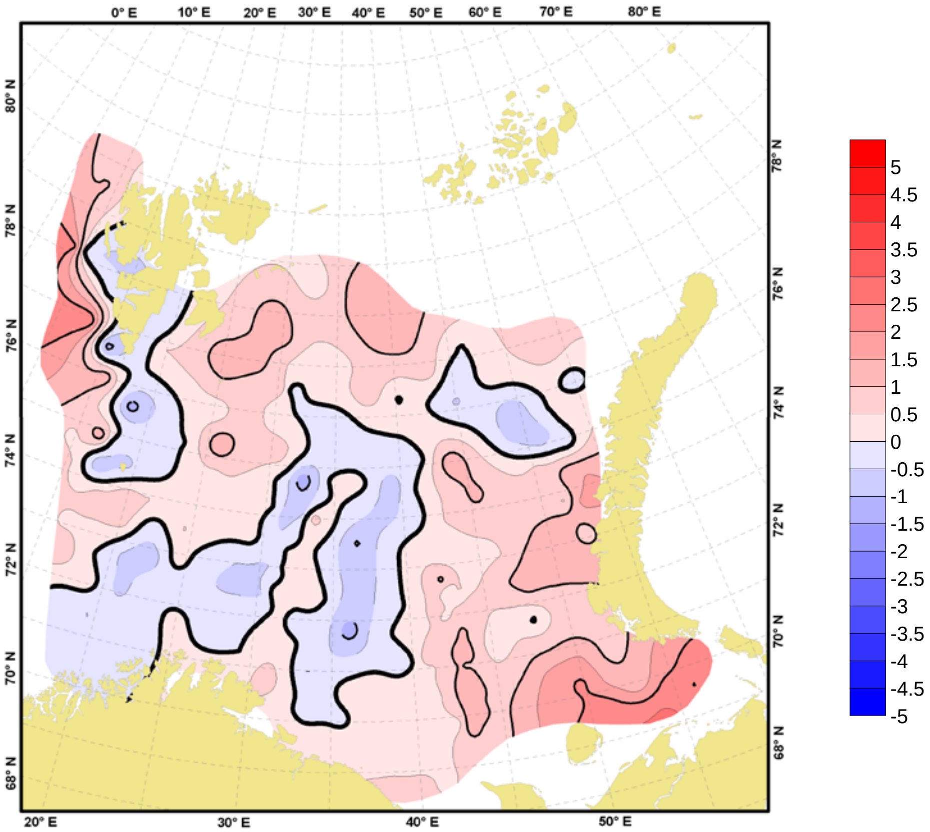


Figure 2.1.17 Surface temperature anomalies (°C), August-September 2009

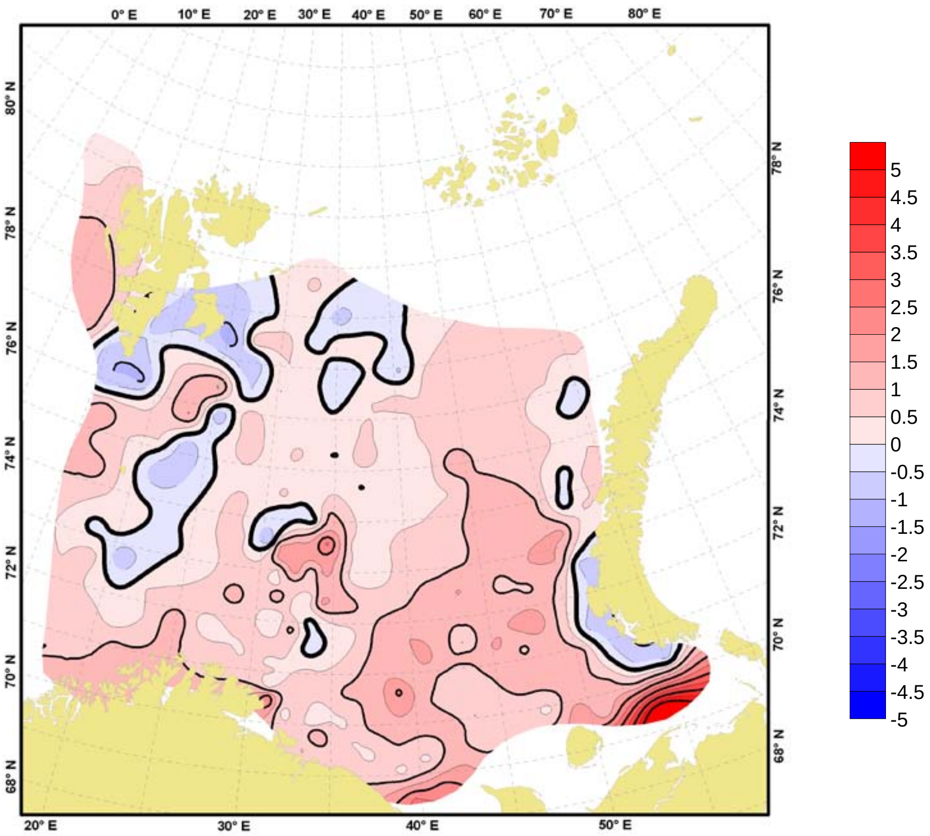


Figure 2.1.18 Temperature anomalies (°C) at the bottom, August-September 2009

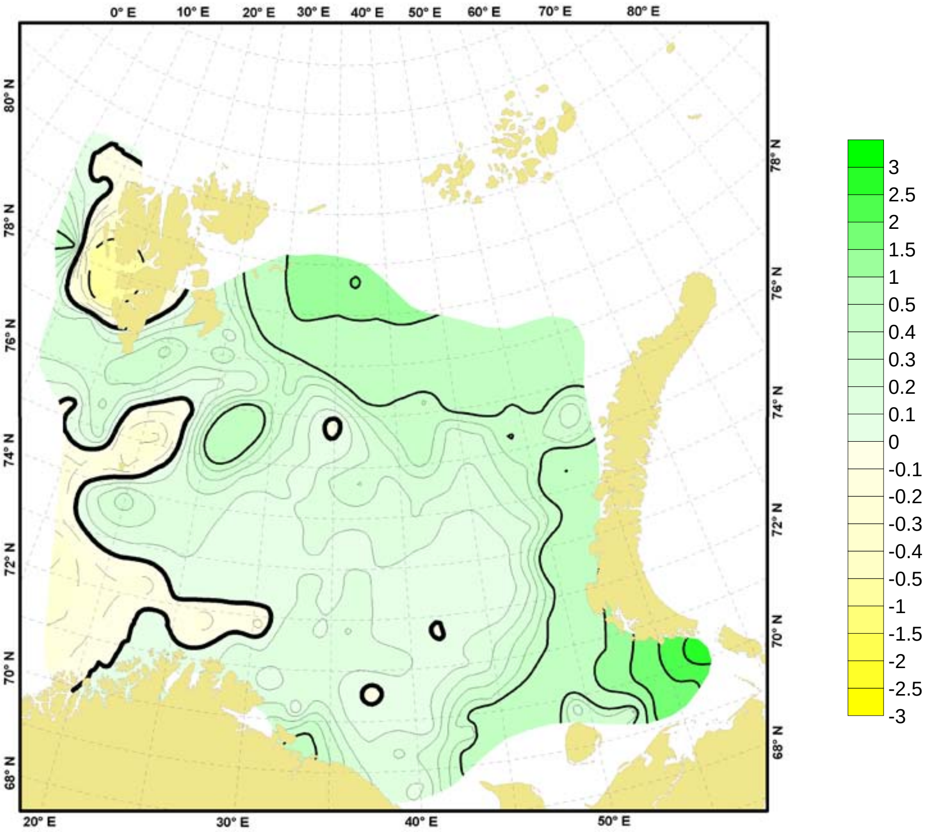


Figure 2.1.19 Surface salinity anomalies, August-September 2009

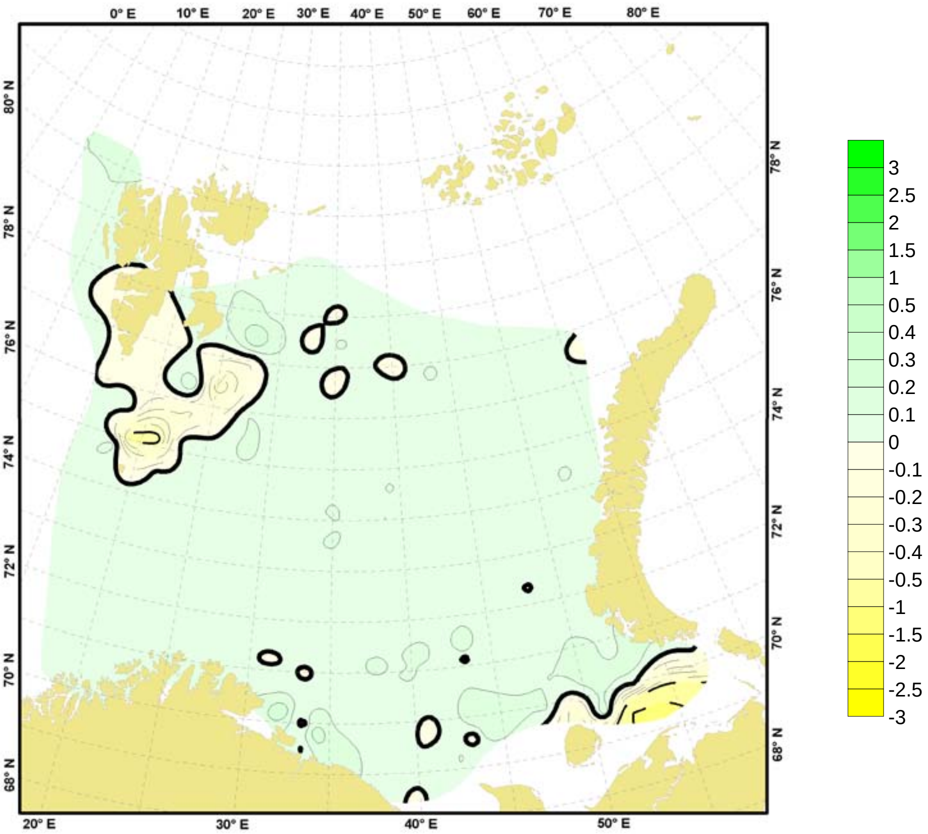


Figure 2.1.20 Salinity anomalies at the bottom, August-September 2009

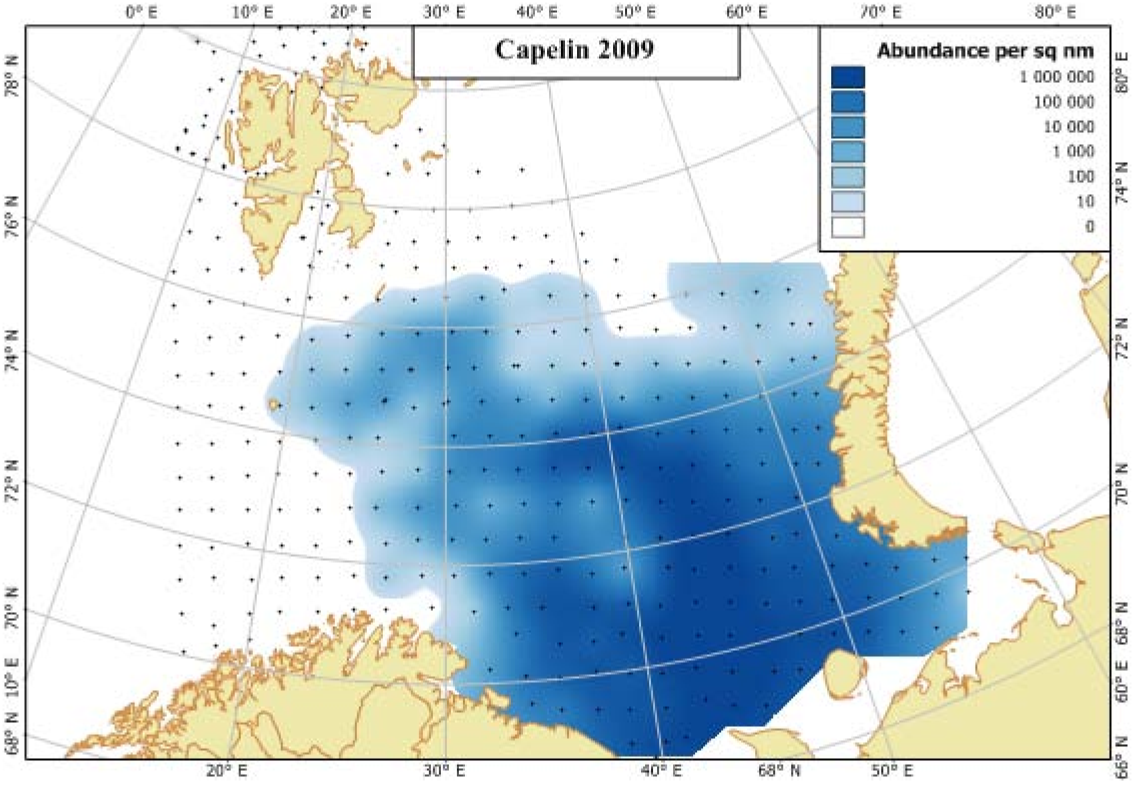


Figure 2.2.1 Distribution of 0-group capelin, August-October 2009

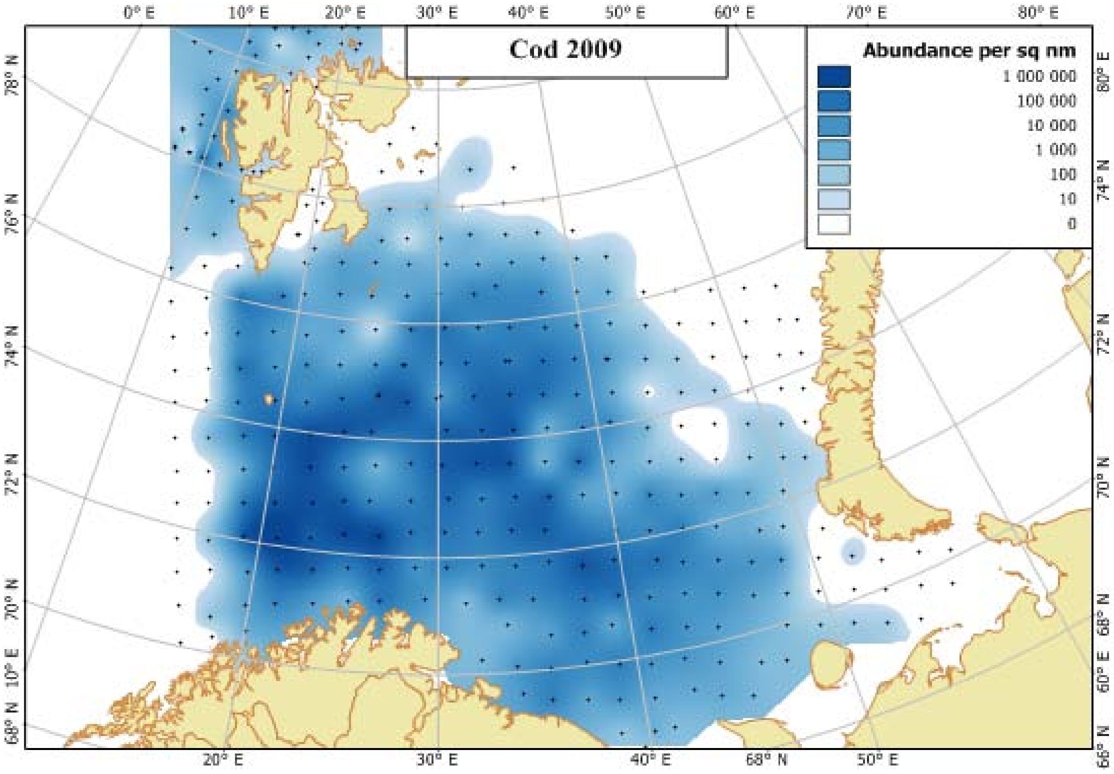


Figure 2.2.2 Distribution of 0-group cod, August-October 2009

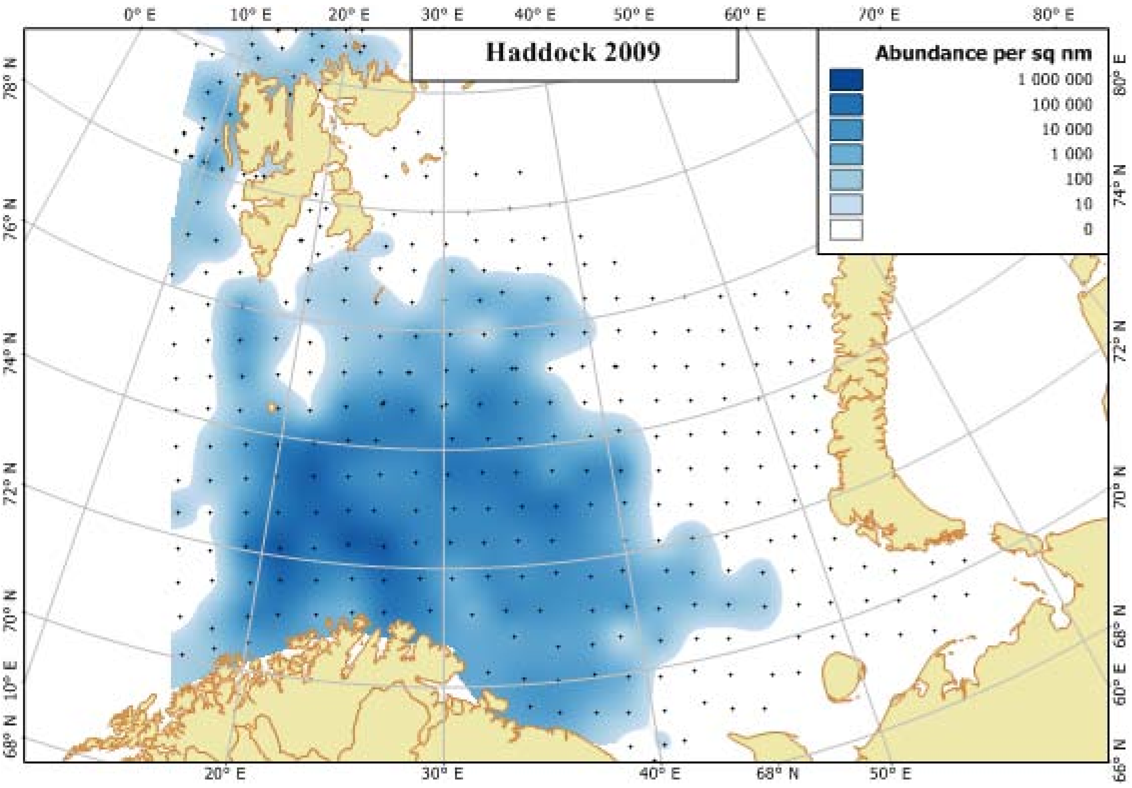


Figure 2.2.3 Distribution of 0-group haddock, August-October 2009

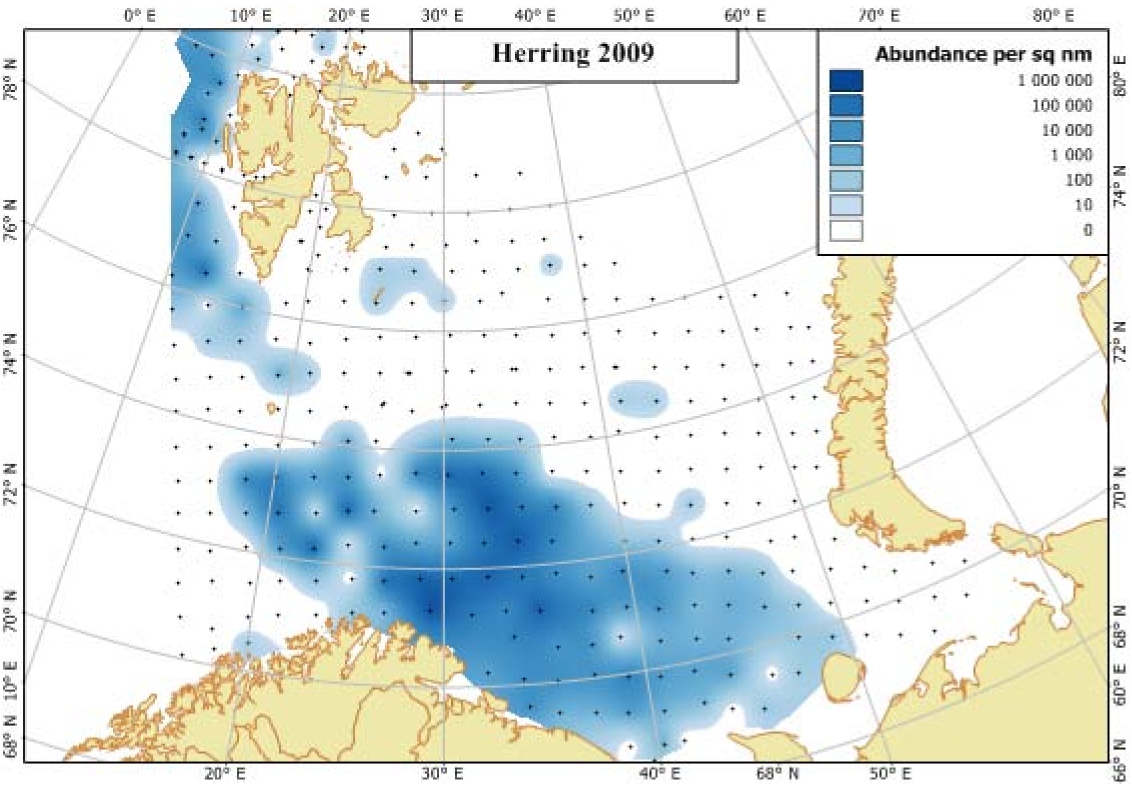


Figure 2.2.4 Distribution of 0-group herring, August-October 2009

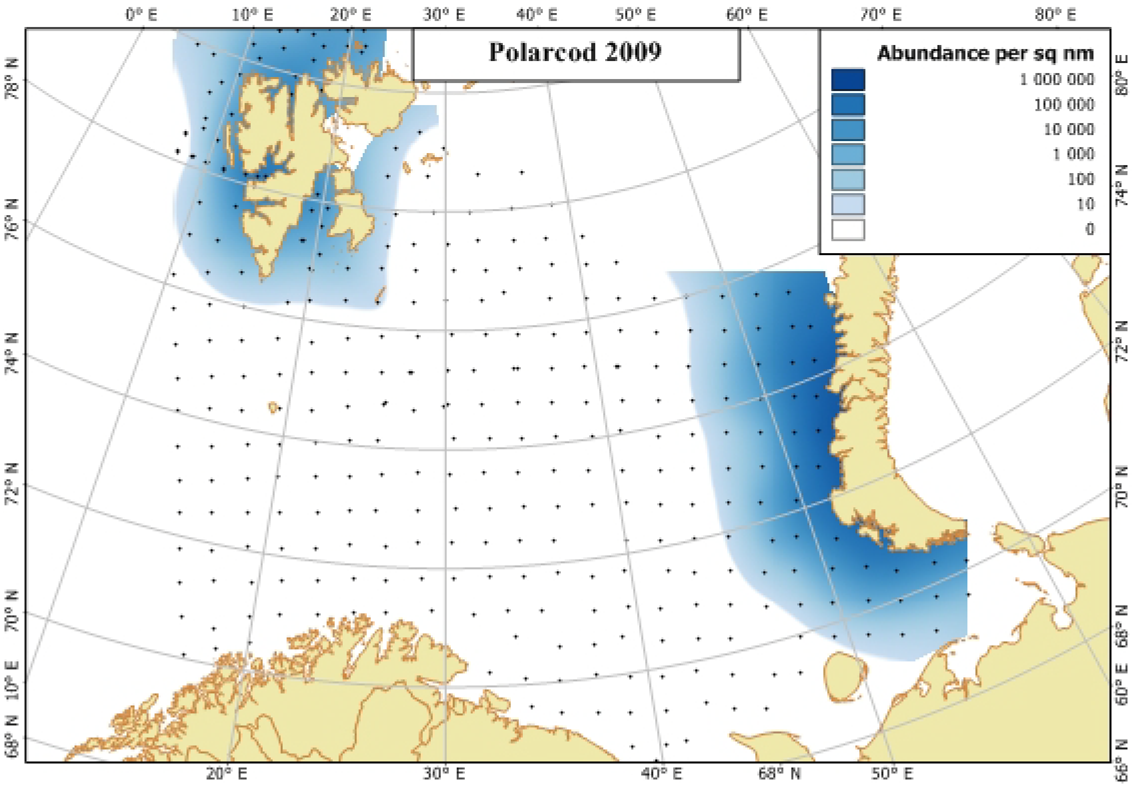


Figure 2.2.5 Distribution of 0-group polar cod, August-October 2009

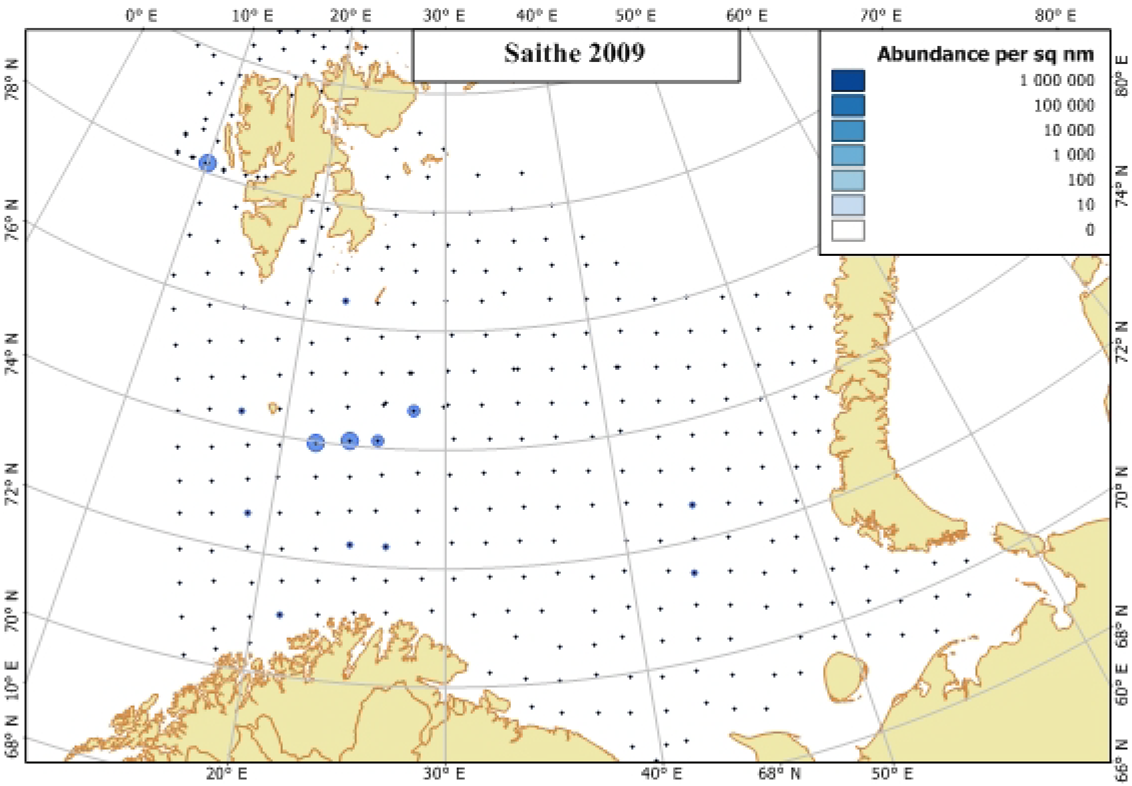


Figure 2.2.6 Distribution of 0-group saithe, August-October 2009

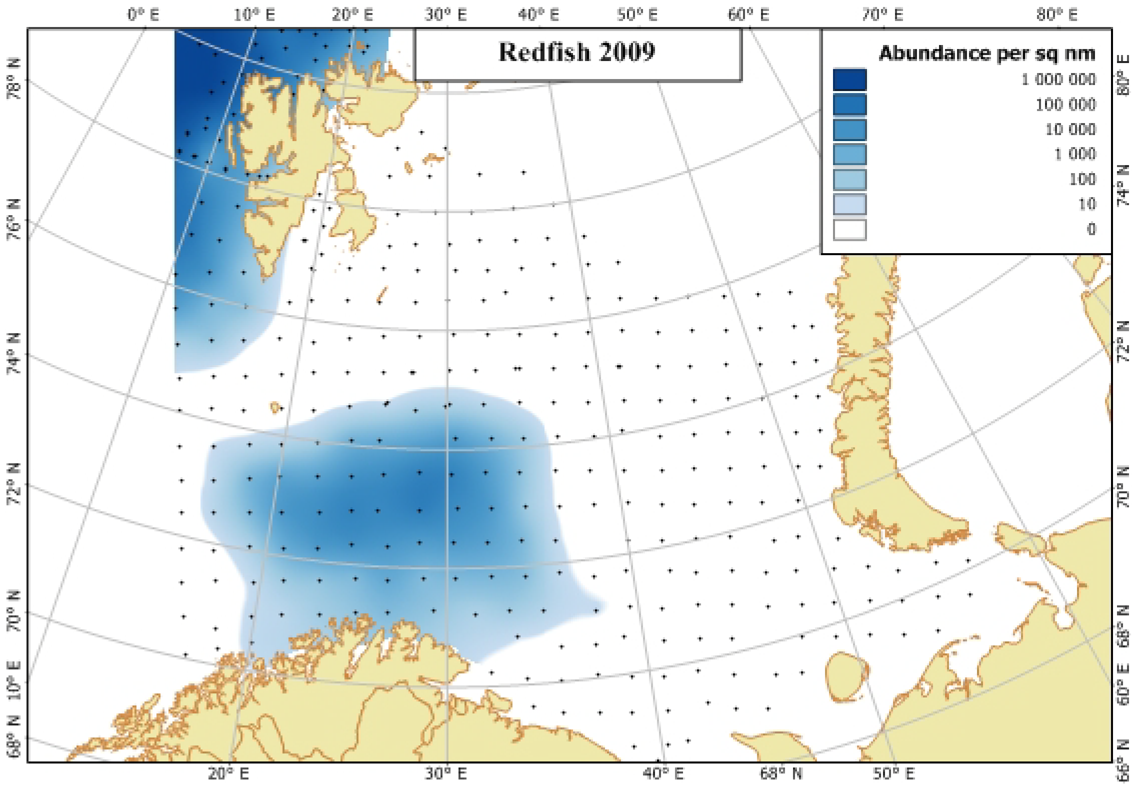


Figure 2.2.7 **Distribution of 0-group redfish, August-October 2009**

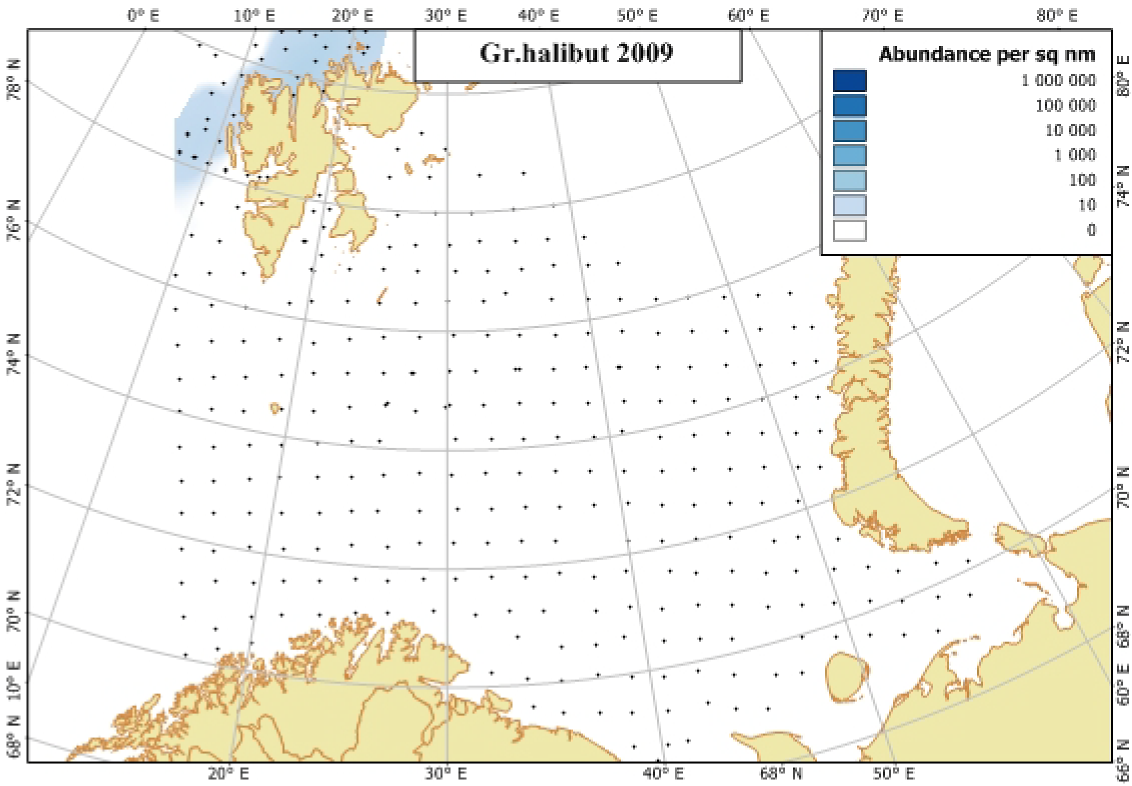


Figure 2.2.8 **Distribution of 0-group Greenland halibut, August-October 2009**

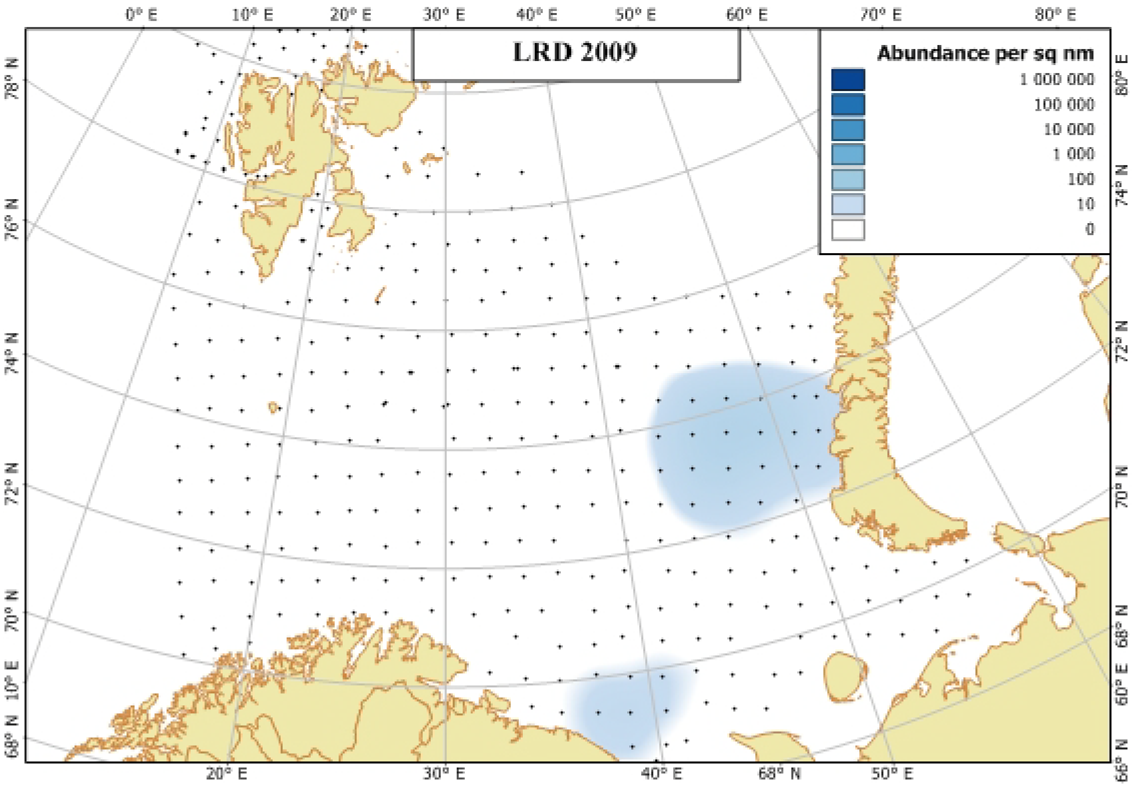


Figure 2.2.9 Distribution of 0-group long rough dab, August-October 2009

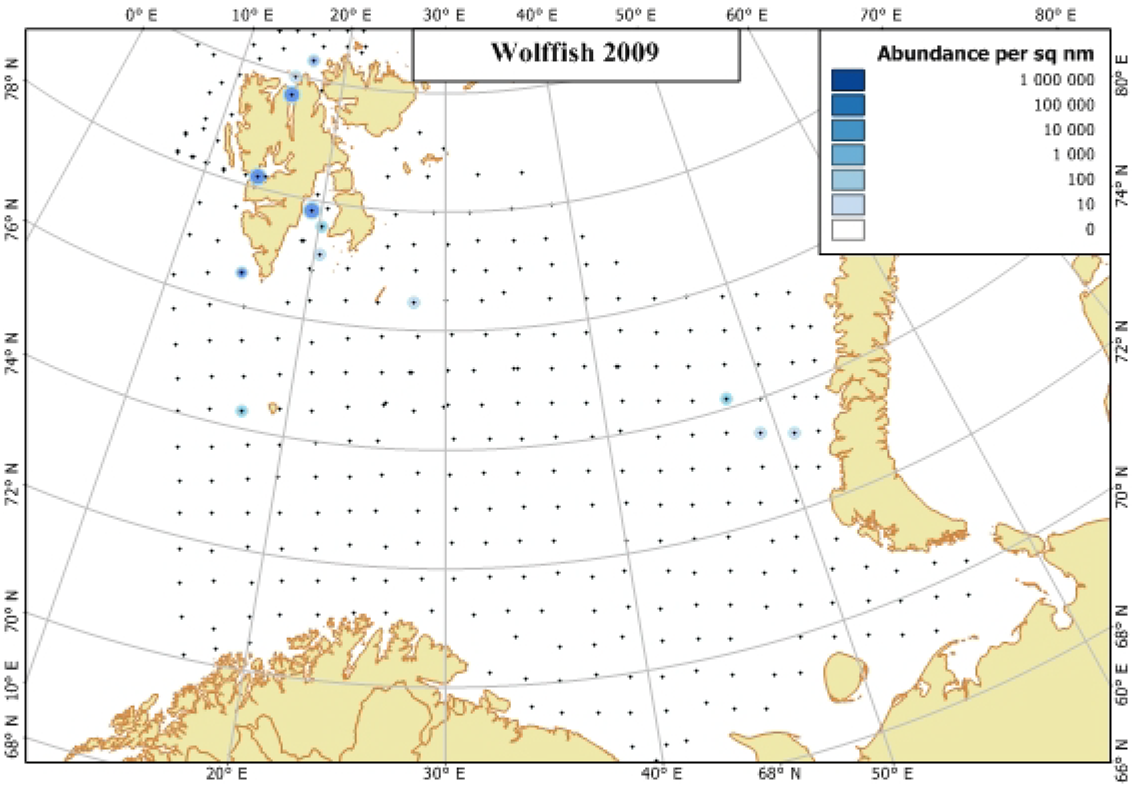


Figure 2.2.10 Distribution of 0-group wolffish, August-October 2009

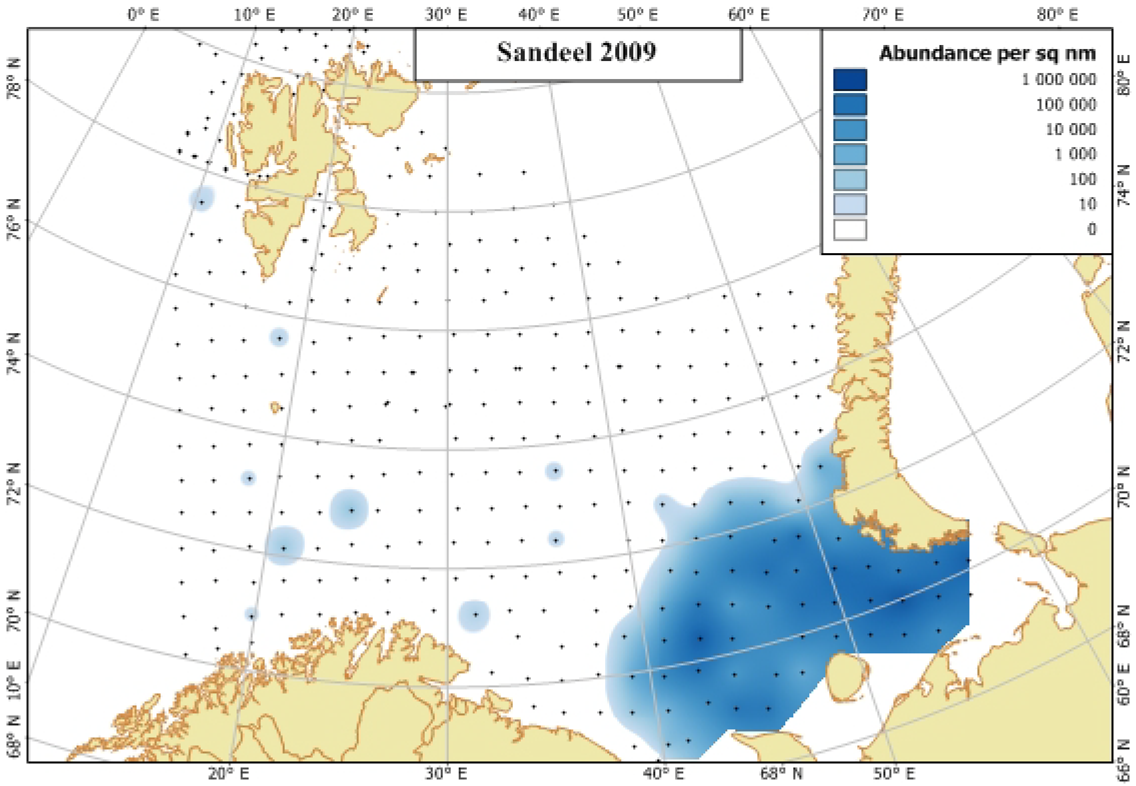


Figure 2.2.11 Distribution of 0-group sandeel, August-October 2009

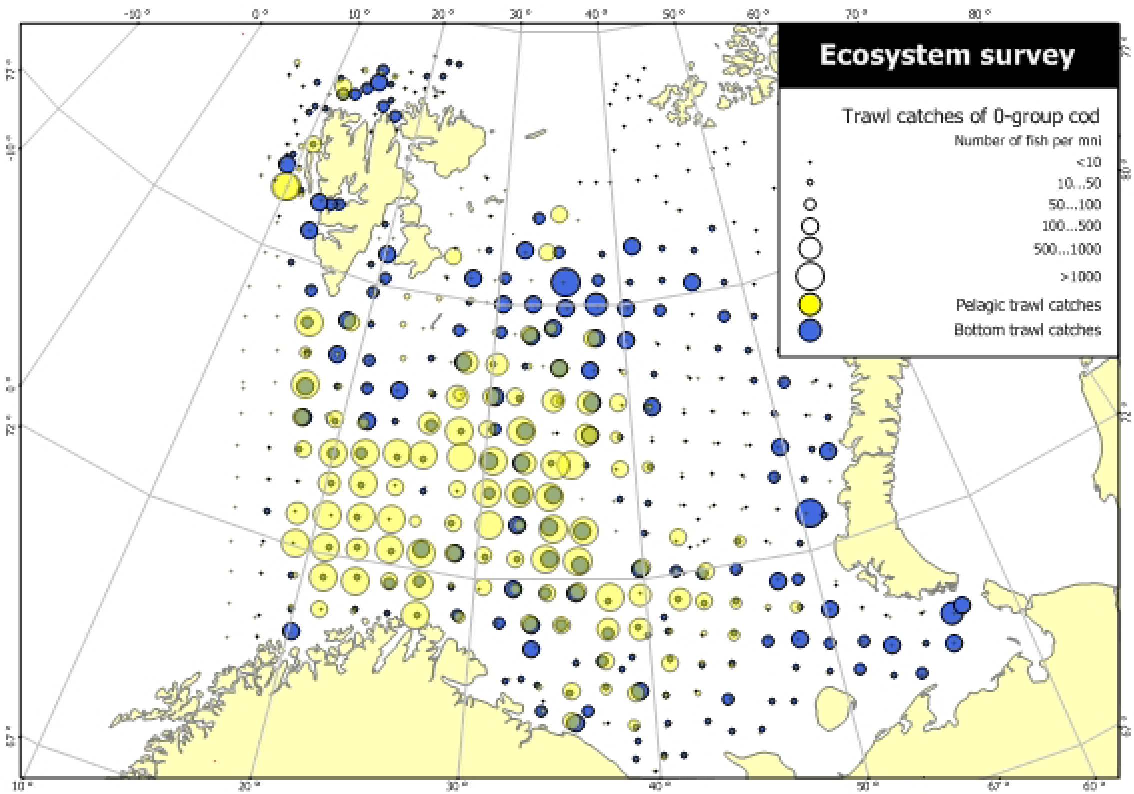


Figure 2.2.12 Catch of 0-group cod in pelagic and bottom trawls (cod settlement processing), September 2009

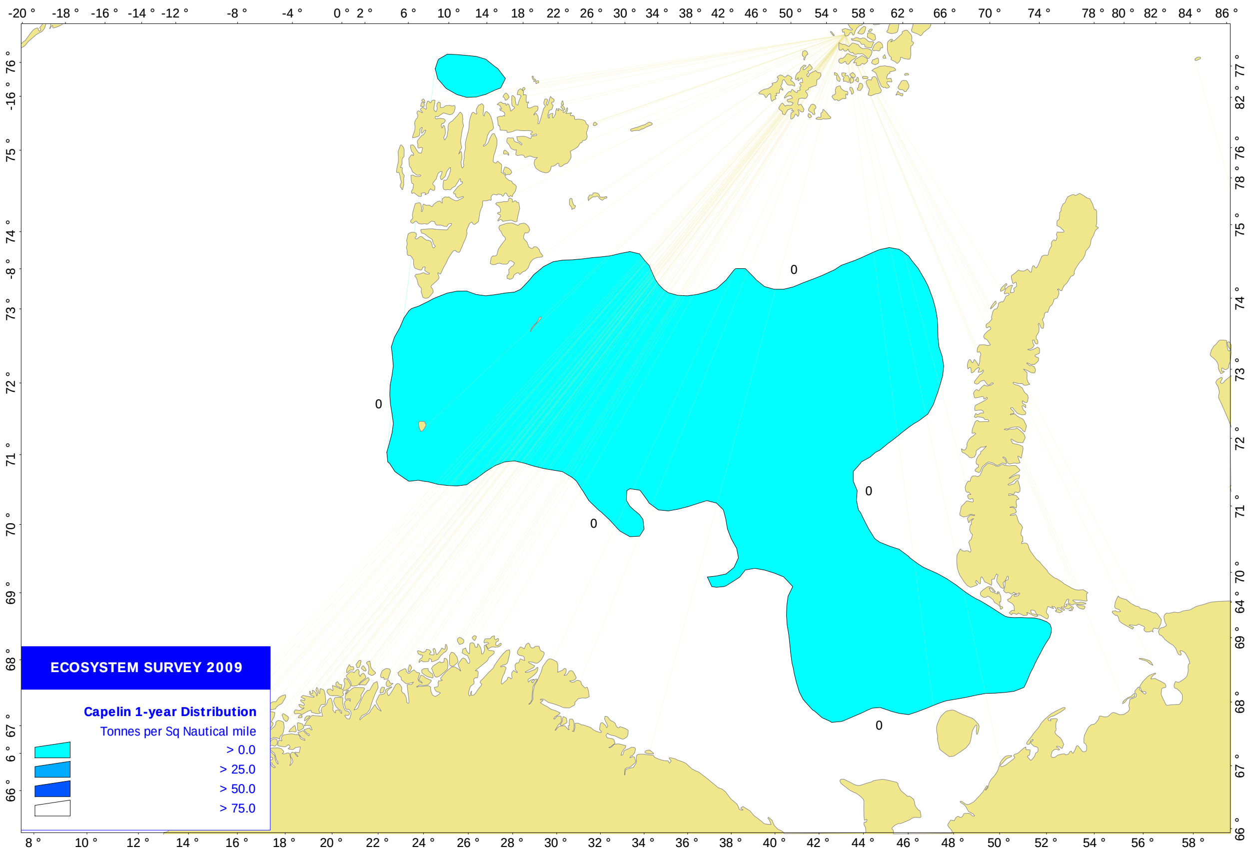


Figure 2.3.1 Estimated density distribution of one-year-old capelin (t/nautical mile^2), August- October 2009

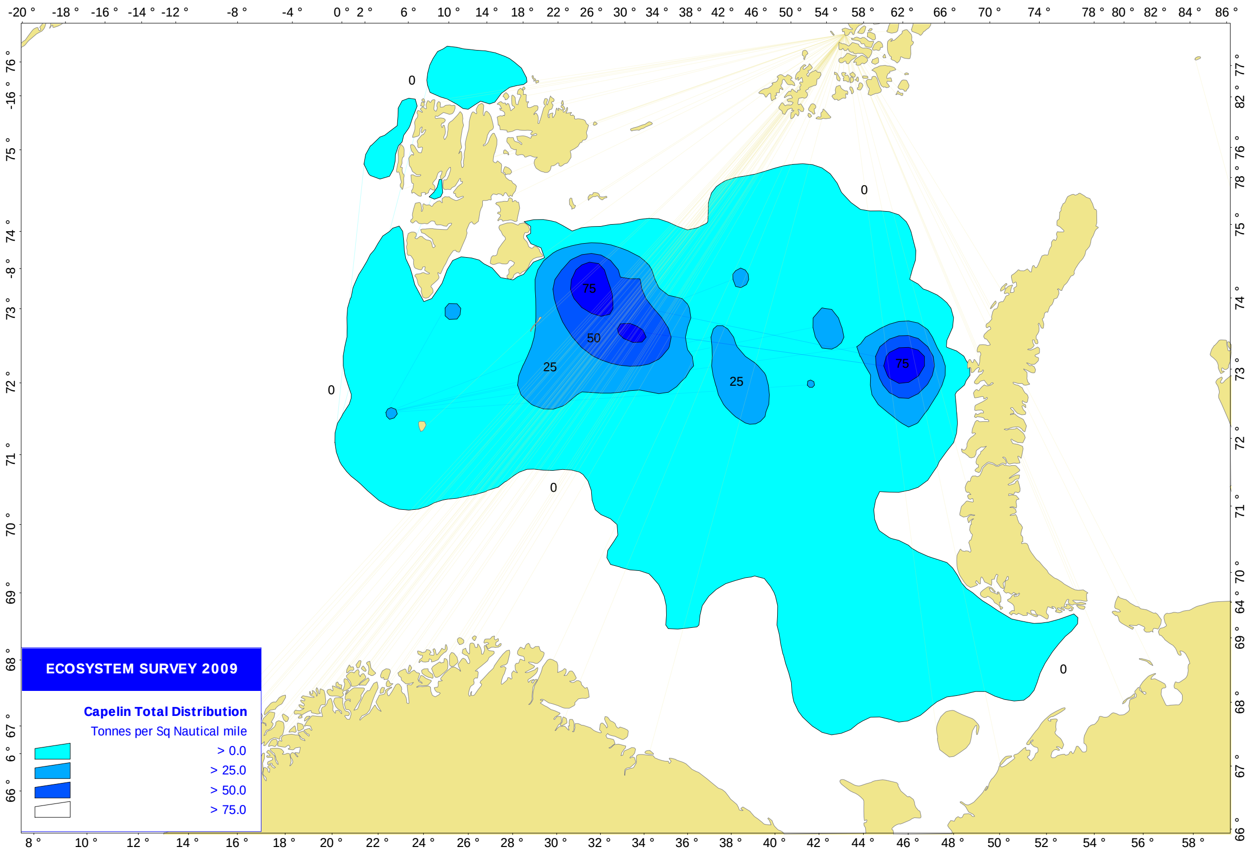


Figure 2.3.2 Estimated total density distribution of capelin (t/nautical mile^2), August- October 2009

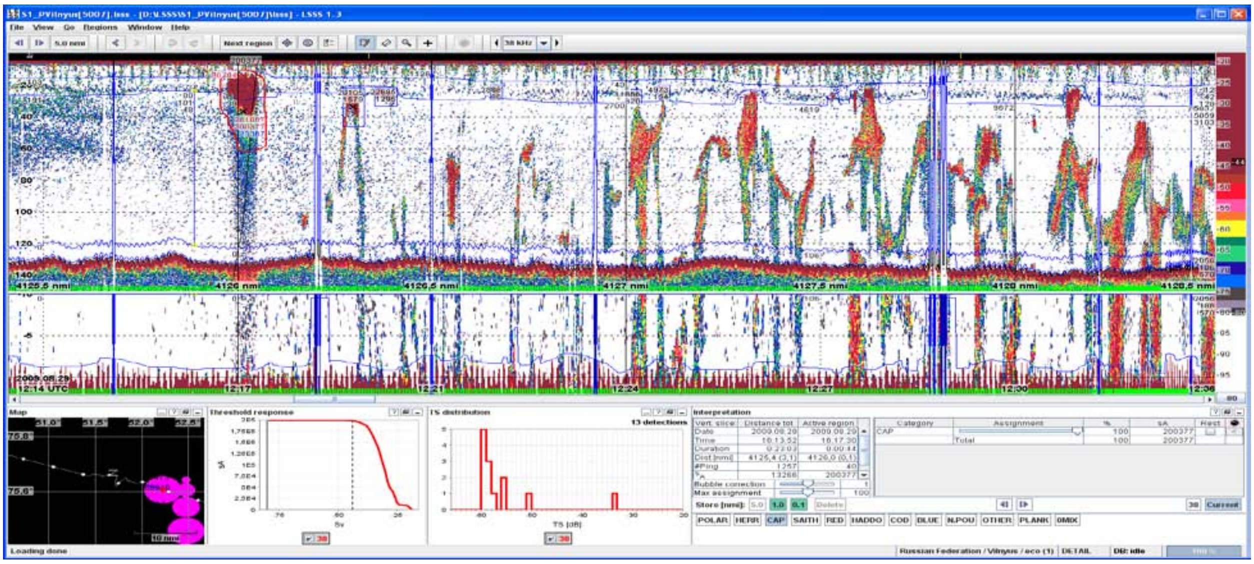


Figure 2.3.3 Echo-records of capelin, 29.08.2009 (75º36′ N, 52º15′ E)

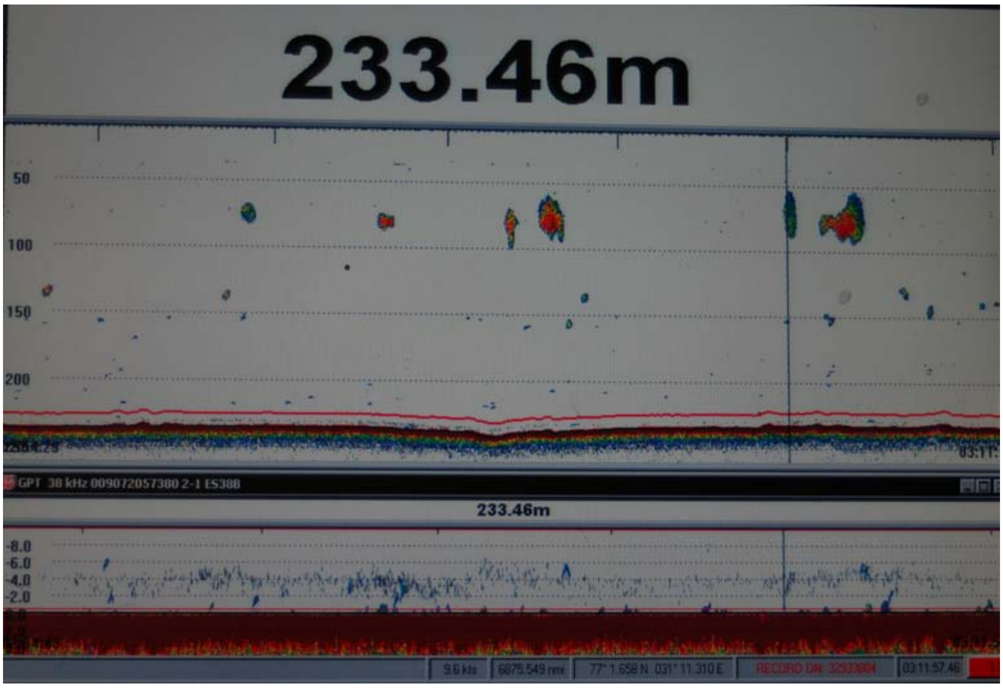


Figure 2.3.4 Echo-records of capelin, 05.09.2009 (77°10' N, 31°11' E)

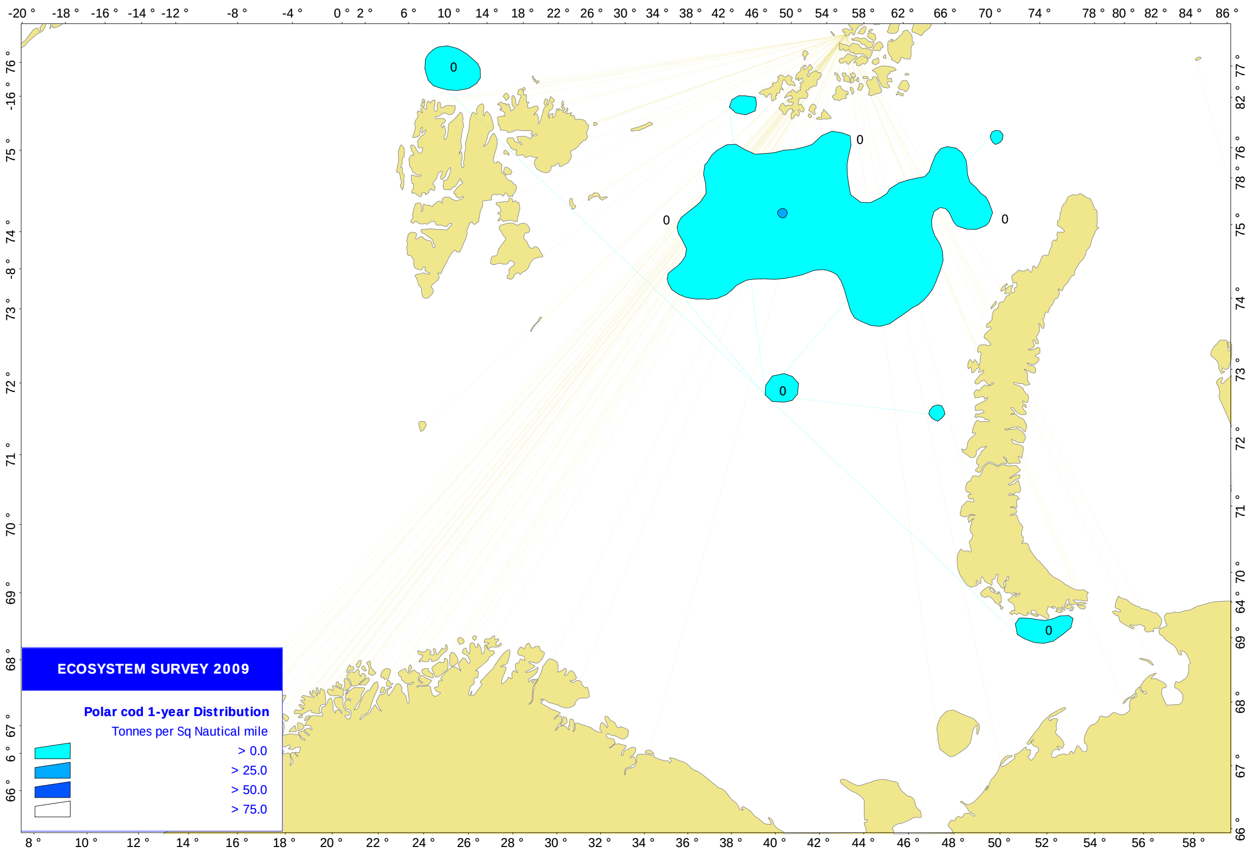


Figure 2.3.5 Estimated density distribution of one year old polar cod (t/nautical mile^2), August-October 2009

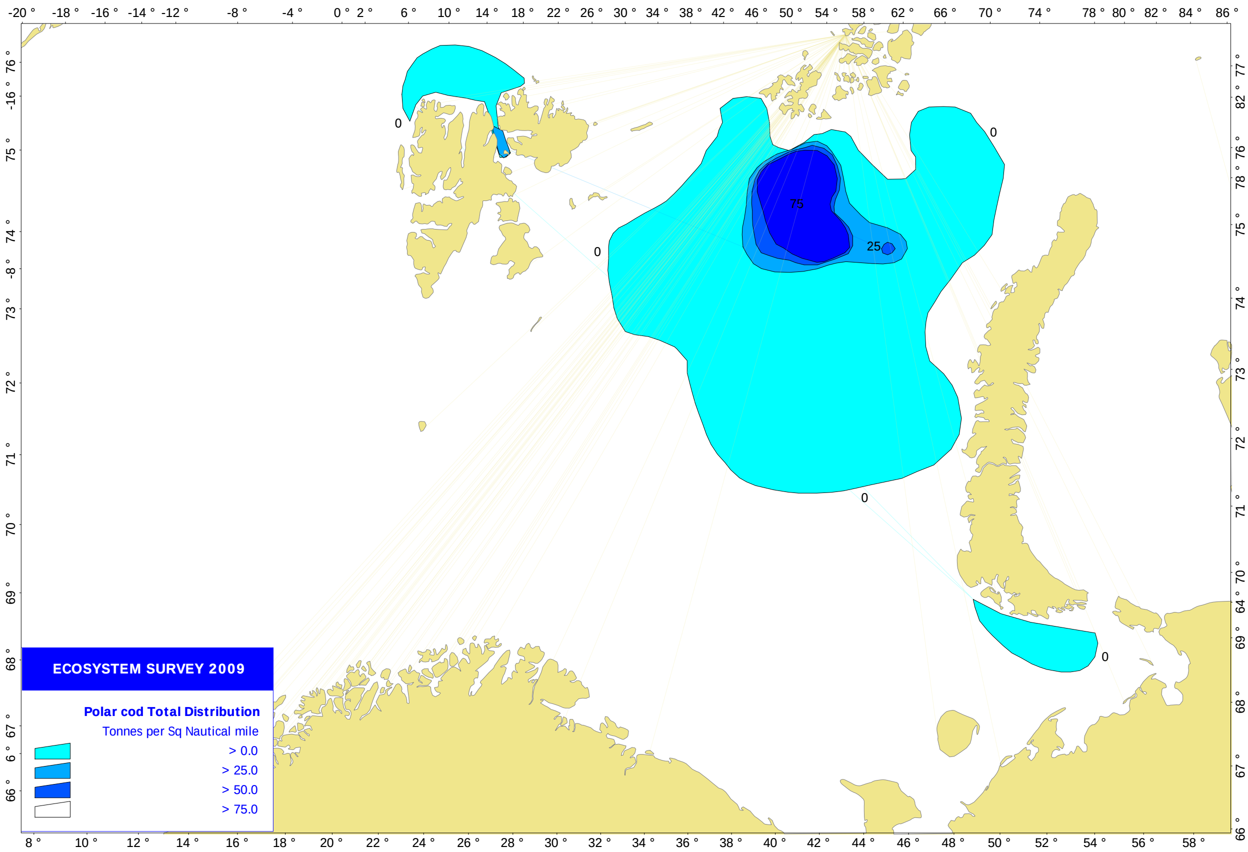


Figure 2.3.6 Estimated total density distribution of polar cod (t/nautical mile^2), August-October 2009

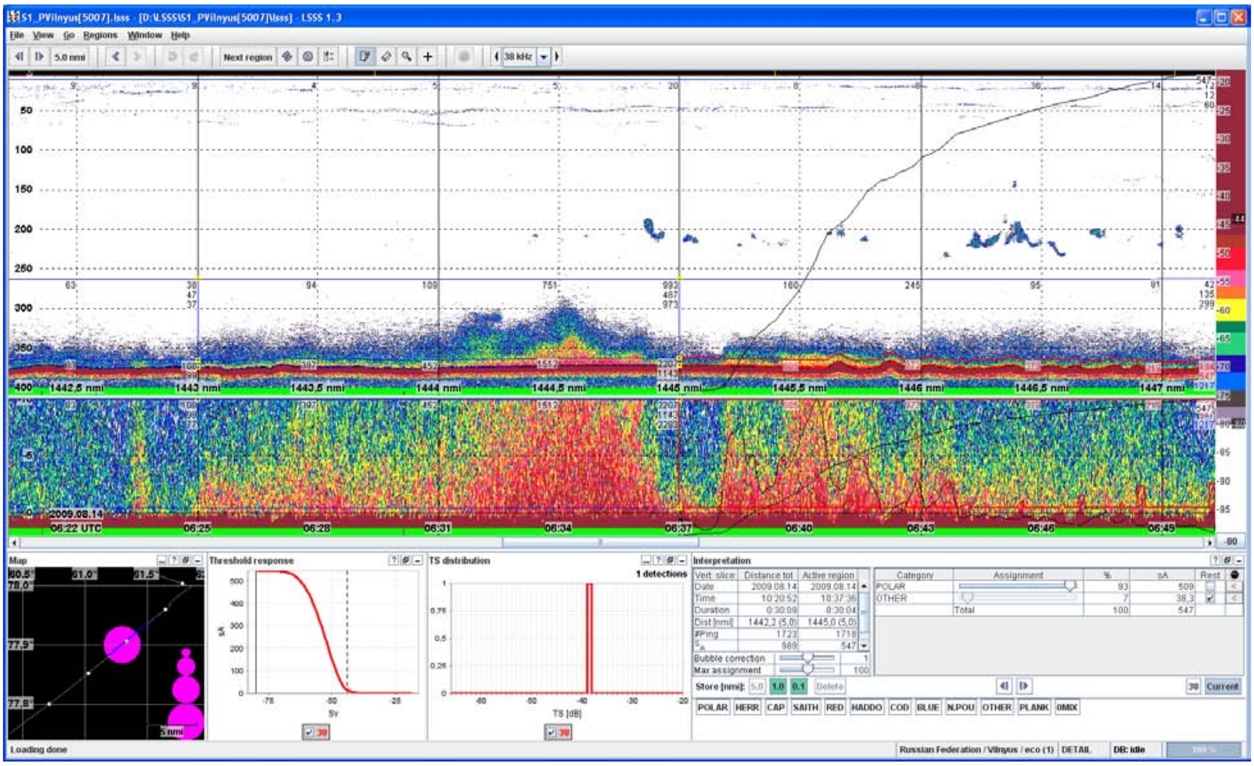


Figure 2.3.7 **Typical echo-records of polar cod in north-eastern Barents Sea, 14.08.2009 (78º00´ N, 61º40´ E)**

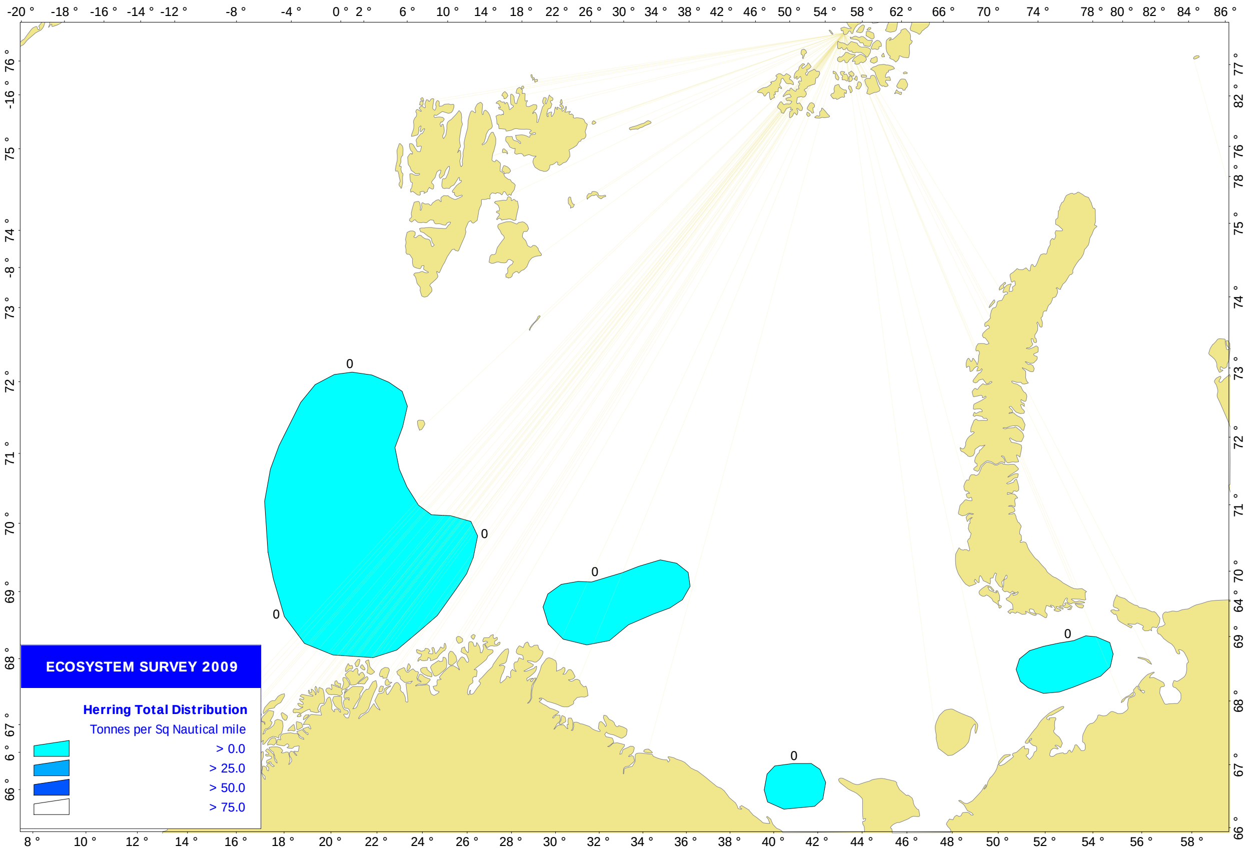


Figure 2.3.8 **Estimated total density distribution of herring (t/nautical mile²), August-October 2009**

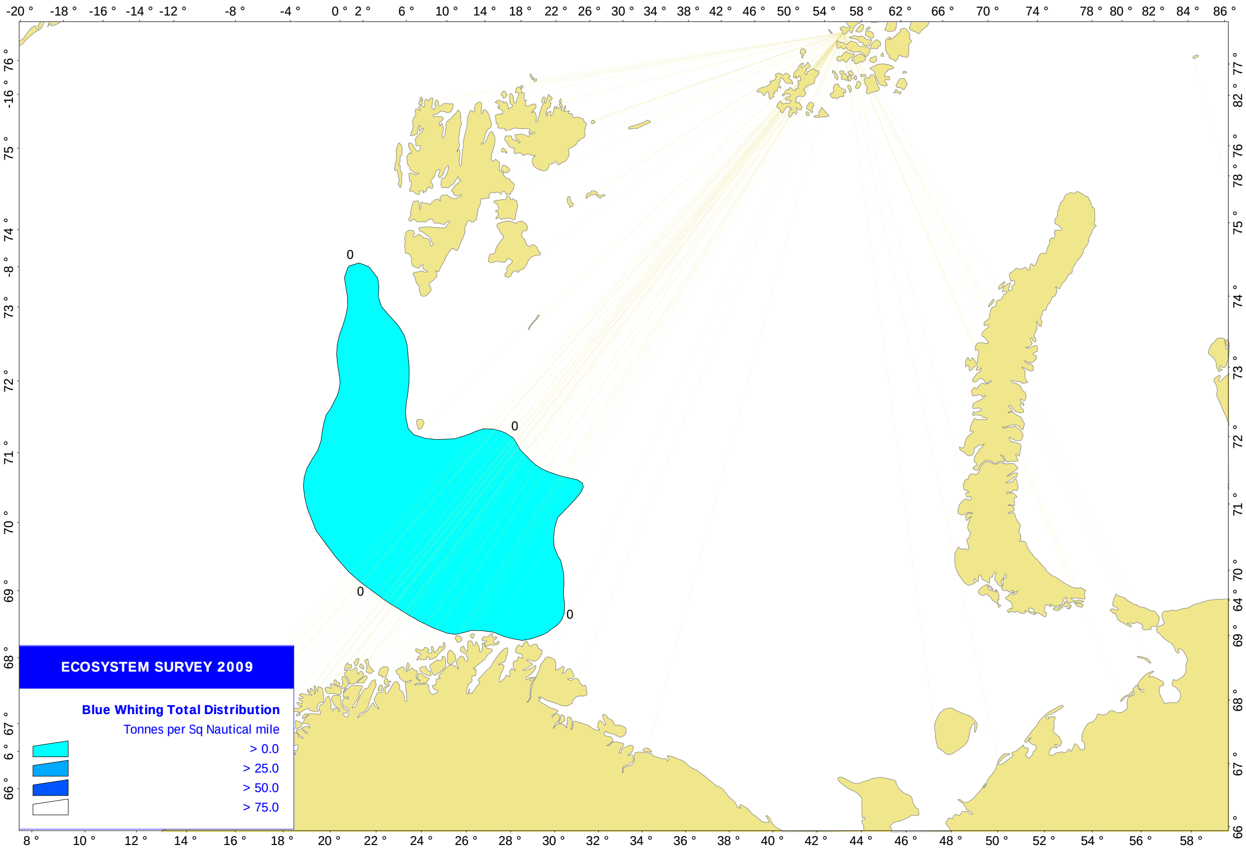


Figure 2.3.9 Estimated total density distribution of blue whiting (t/nautical mile^2), August-October 2009

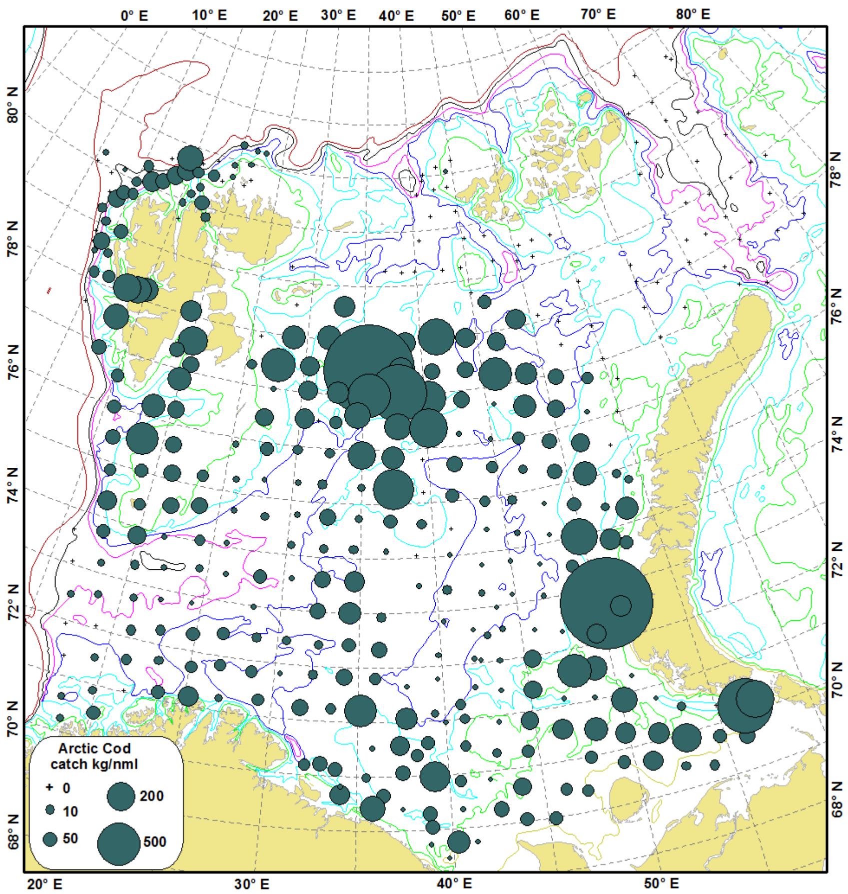


Figure 2.4.1 Distribution of cod *(Gadus morhua morhua)*, August-October 2009

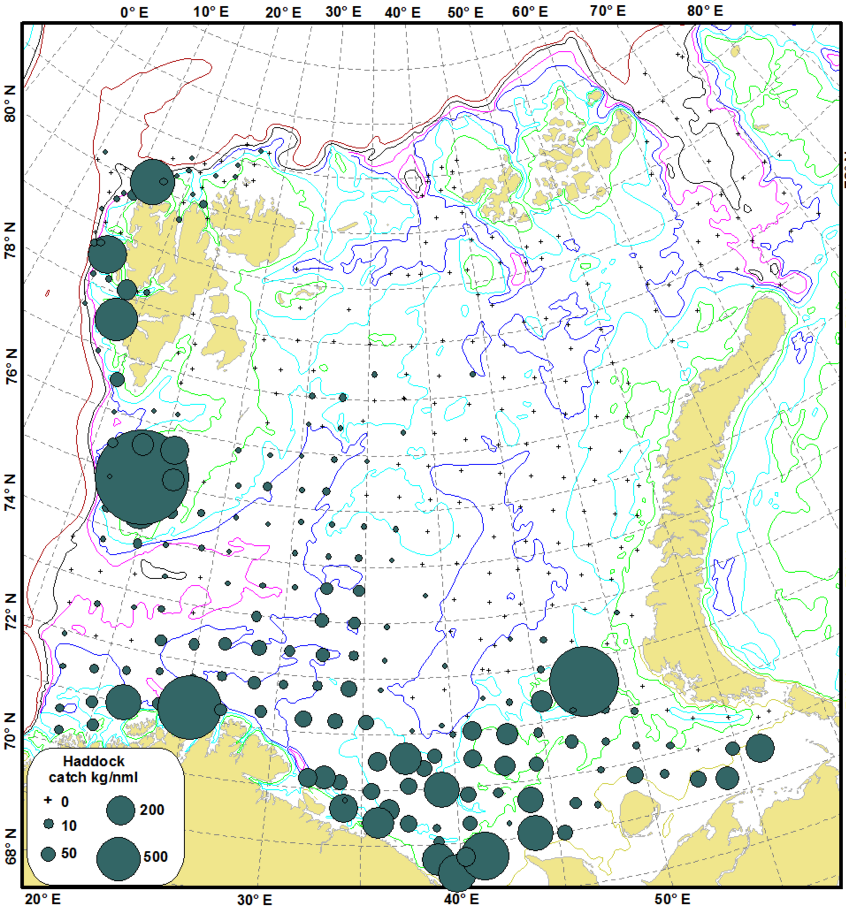


Figure 2.4.2 Distribution of haddock *(Melanogrammus aeglefinus)*, August-October 2009

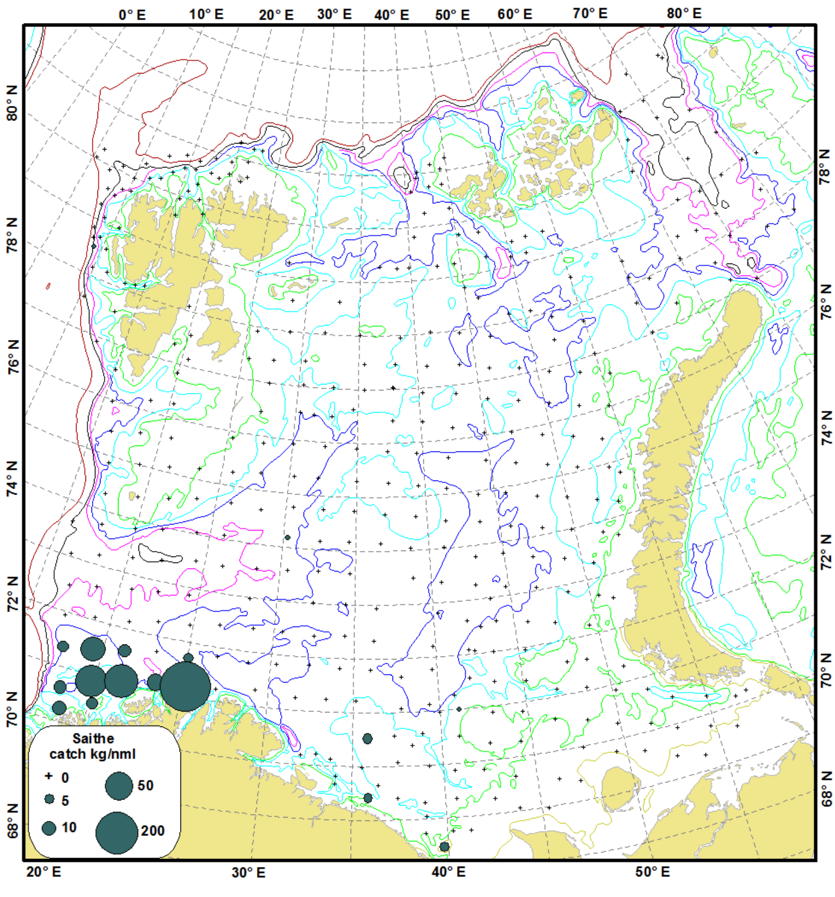


Figure 2.4.3 Distribution of saithe *(Pollachius virens)*, August-October 2009

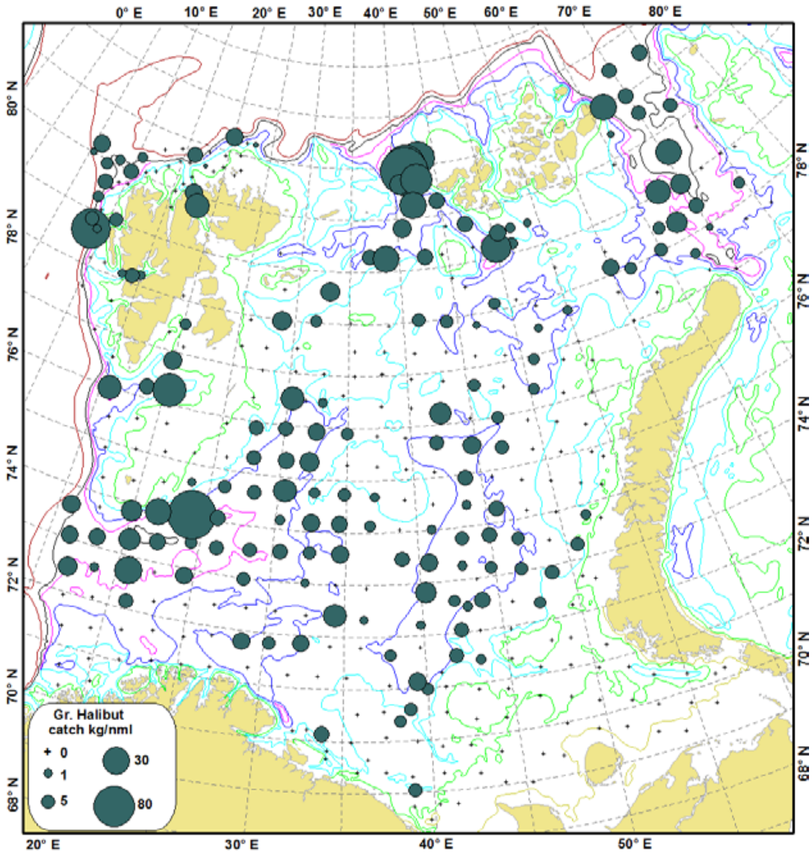


Figure 2.4.4 Distribution of Greenland halibut *(Reinhardtius hippoglossoides)* (WCPUE, based on weight of fish), August- October 2009

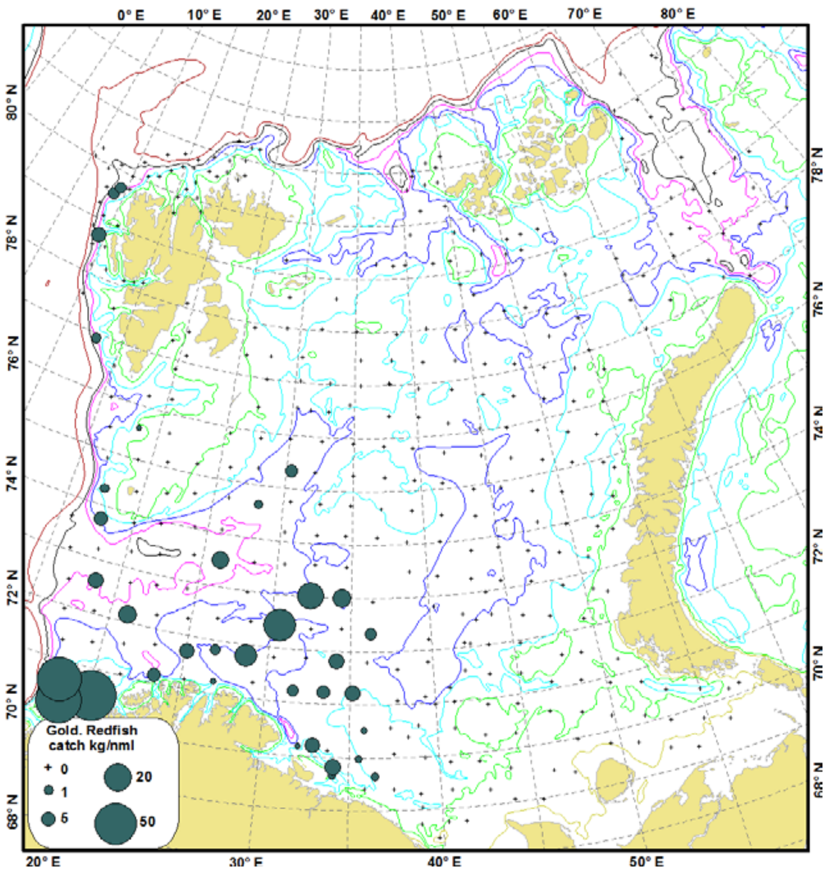


Figure 2.4.5 Distribution of golden redfish (*Sebastes marinus)*, August-October 2009

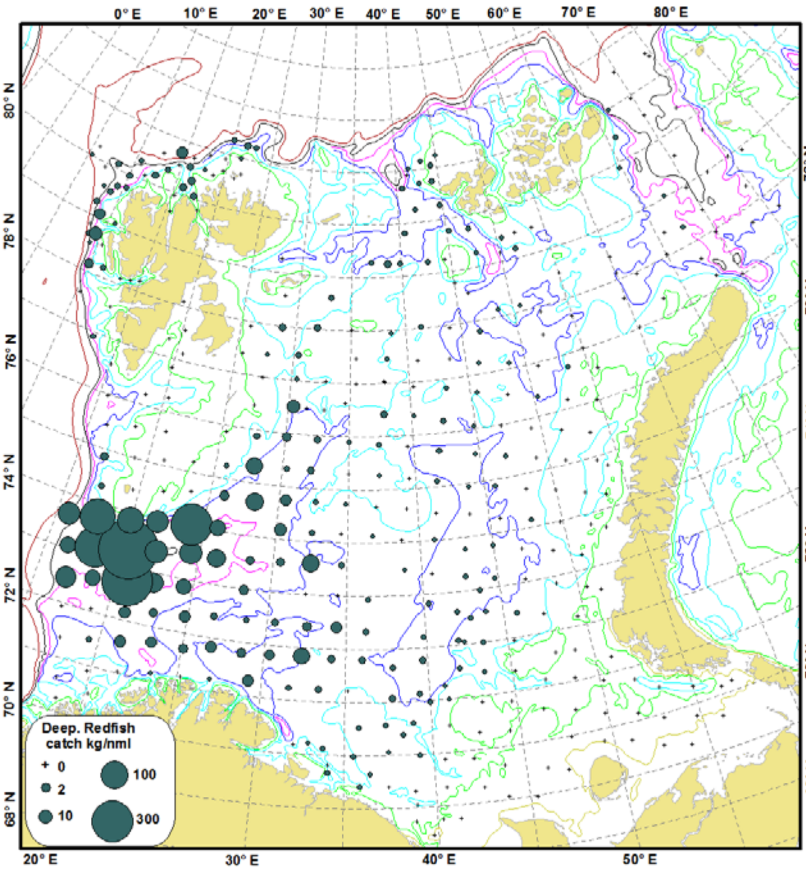


Figure 2.4.6 Distribution of deep-water redfish *(Sebastes mentella)*, August-October 2009

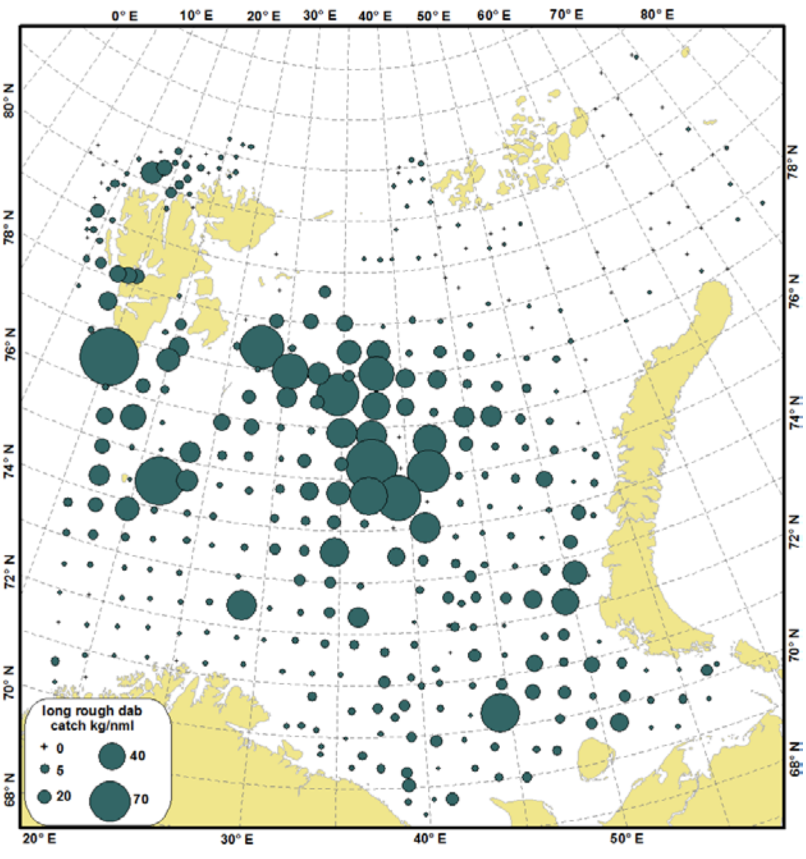


Figure 2.4.7 Distribution of long rough dab *(Hippoglossoides platessoides)*, August-October 2009

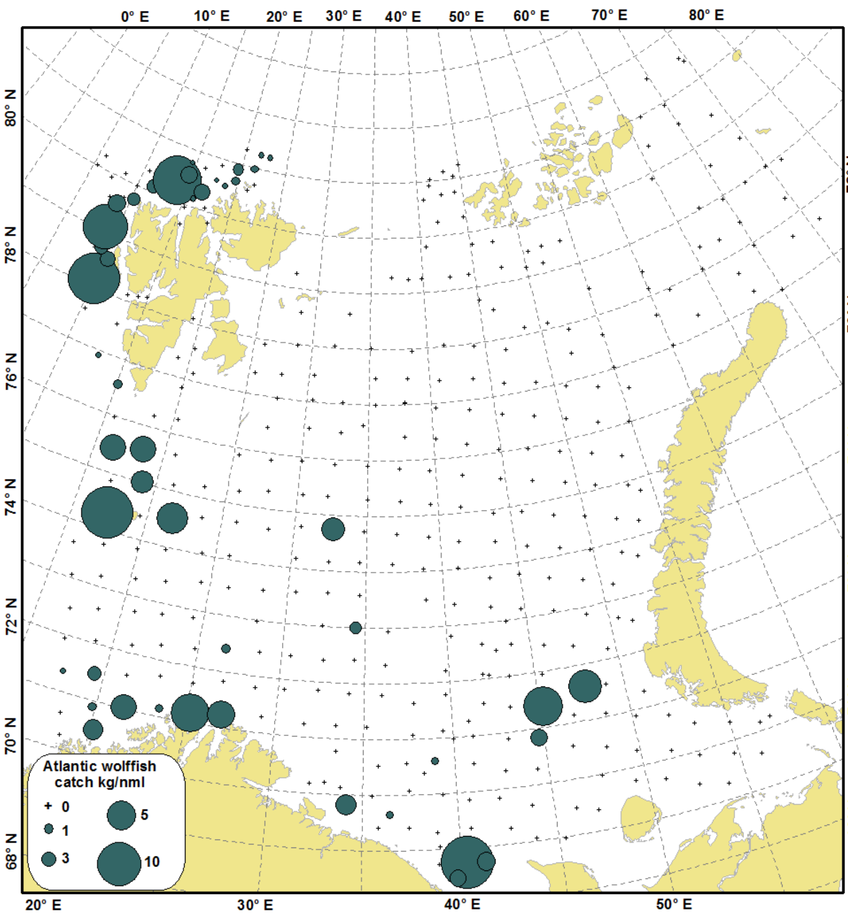


Figure 2.4.8 Distribution of Atlantic wolffish (*Anarhichas lupus*), August-October 2009

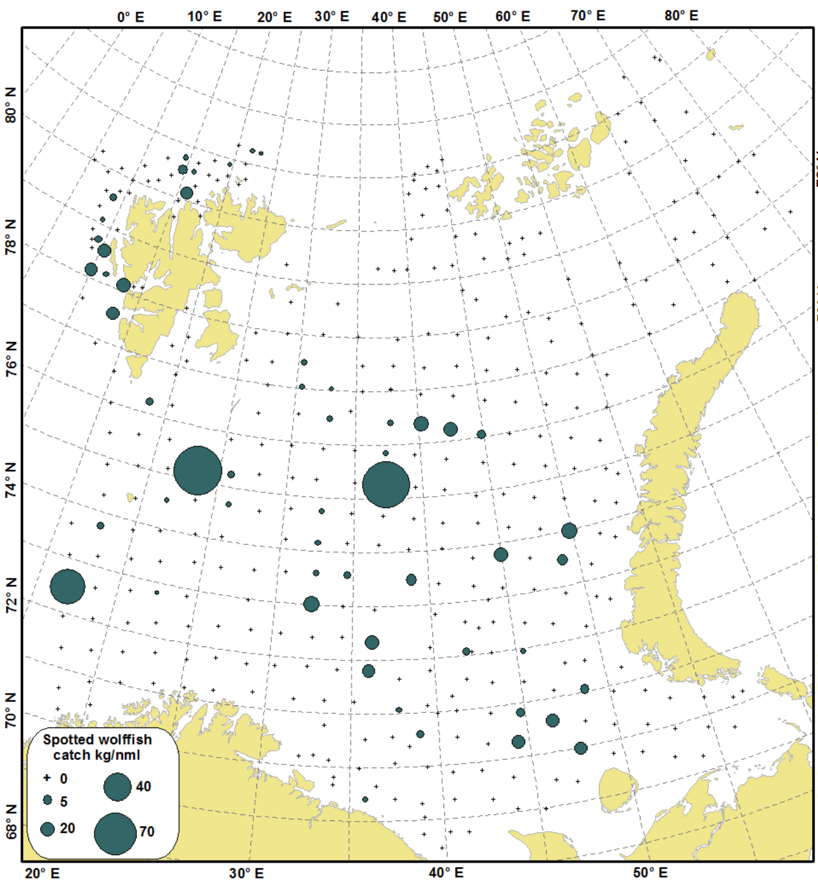


Figure 2.4.9 Distribution of spotted wolffish (*Anarhichas minor*), August-October 2009

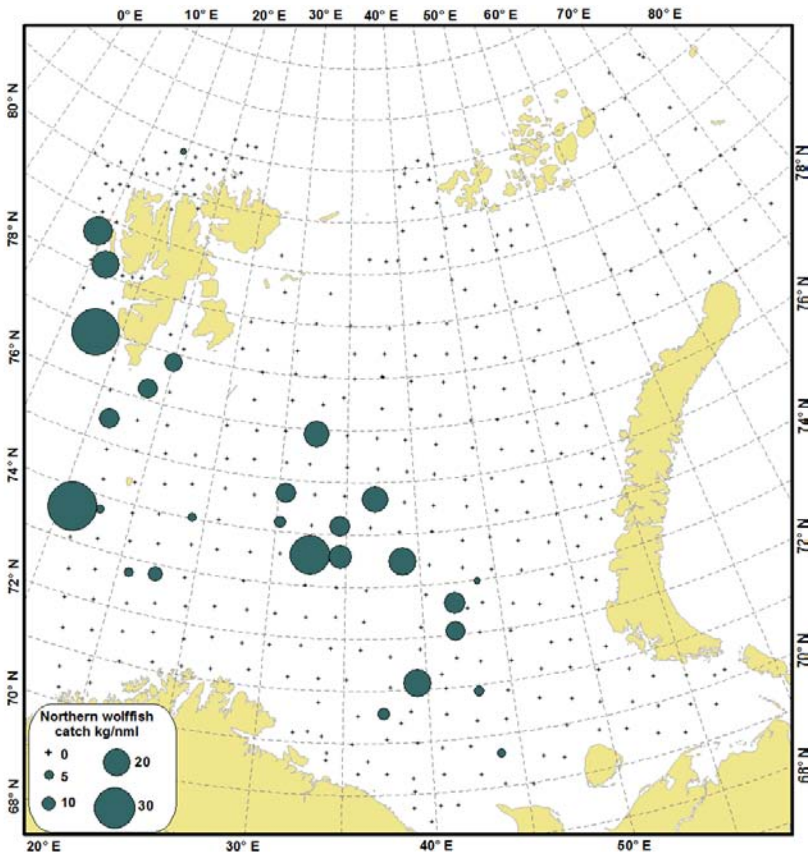


Figure 2.4.10 Distribution of northern wolfish (*Anarhichas denticulatus*), August-October 2009

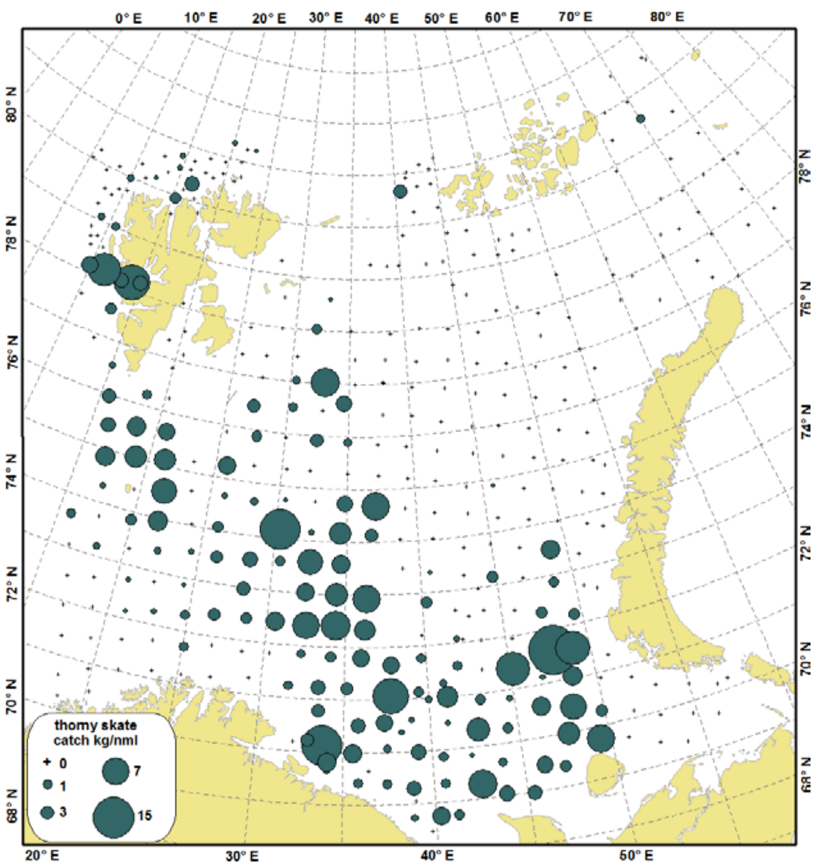


Figure 2.5.1 Distribution of thorny skate (*Amblyraja radiata*), August-October 2009

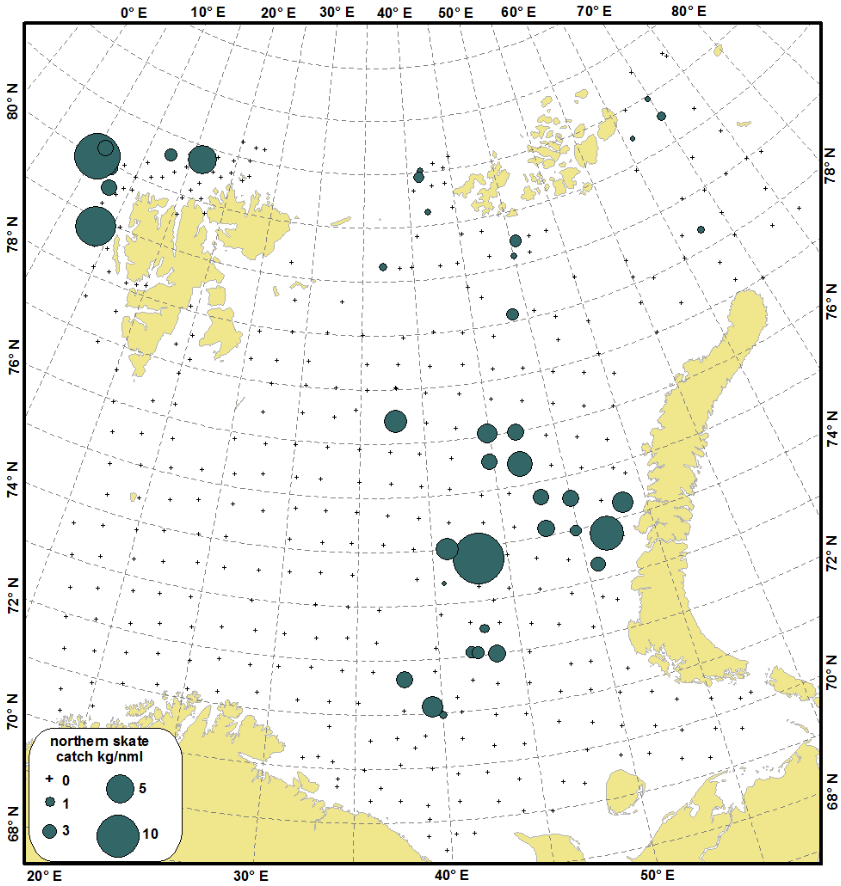


Figure 2.5.2 Distribution of northern skate (*Amblyraja hyperborea*), August-October 2009

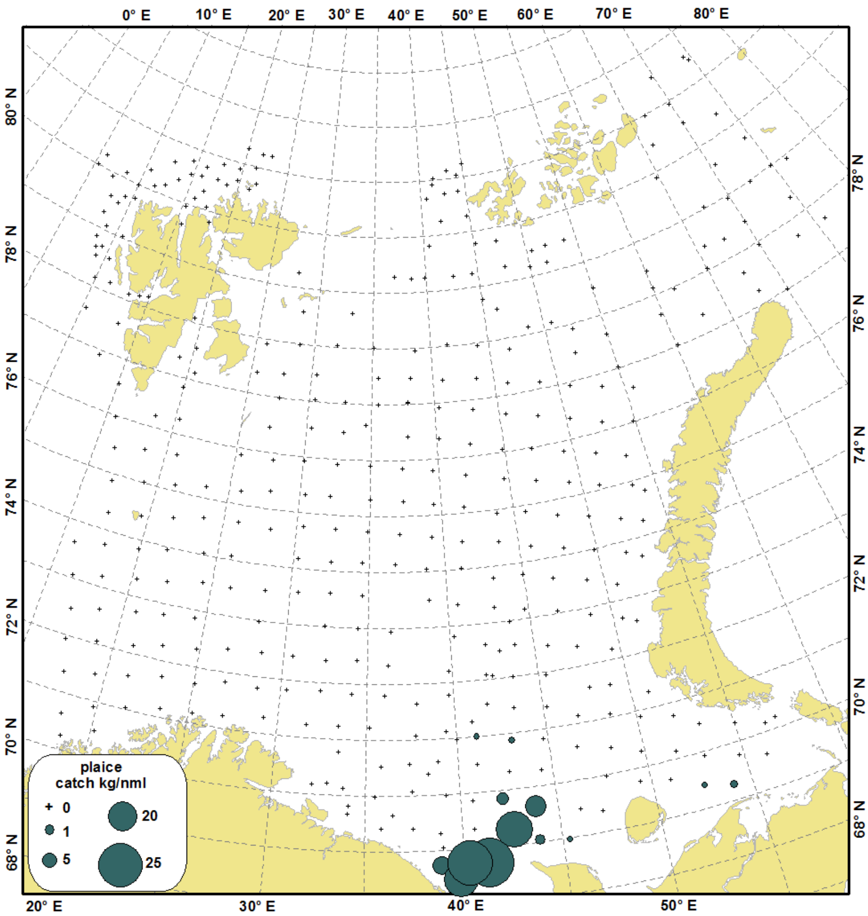
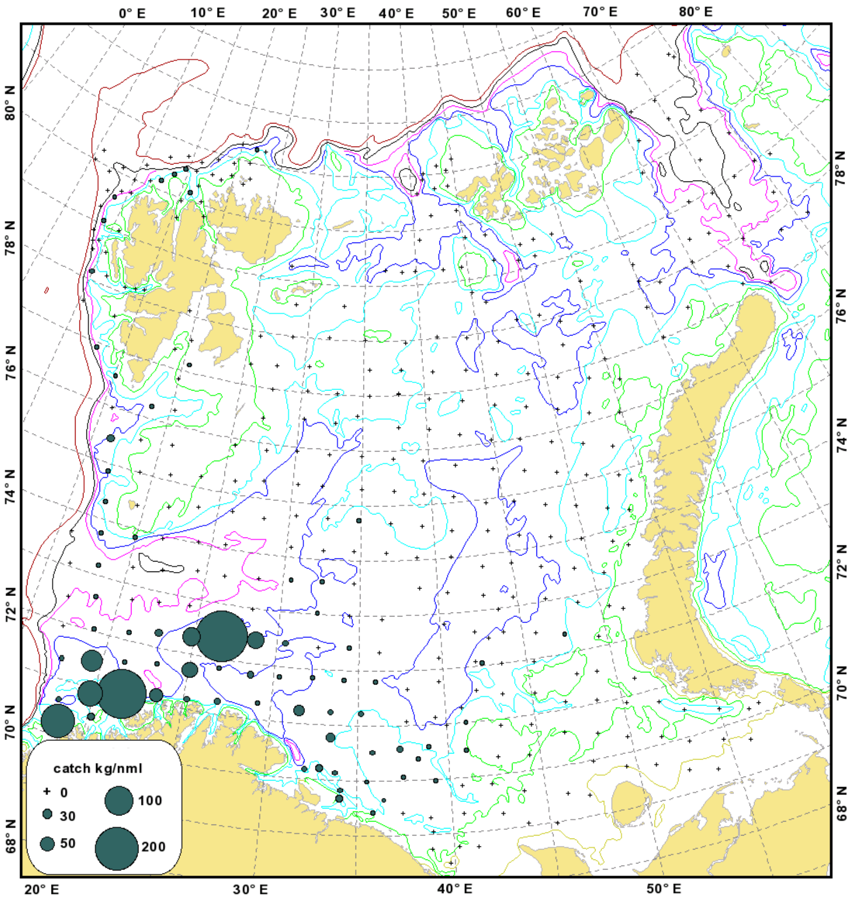


Figure 2.5.3 Distribution of plaice (*Pleuronectes platessa*), August-October 2009



2.5.4 Distribution of Norway pout *(Trisopterus Esmarkii)*, August-October 2009

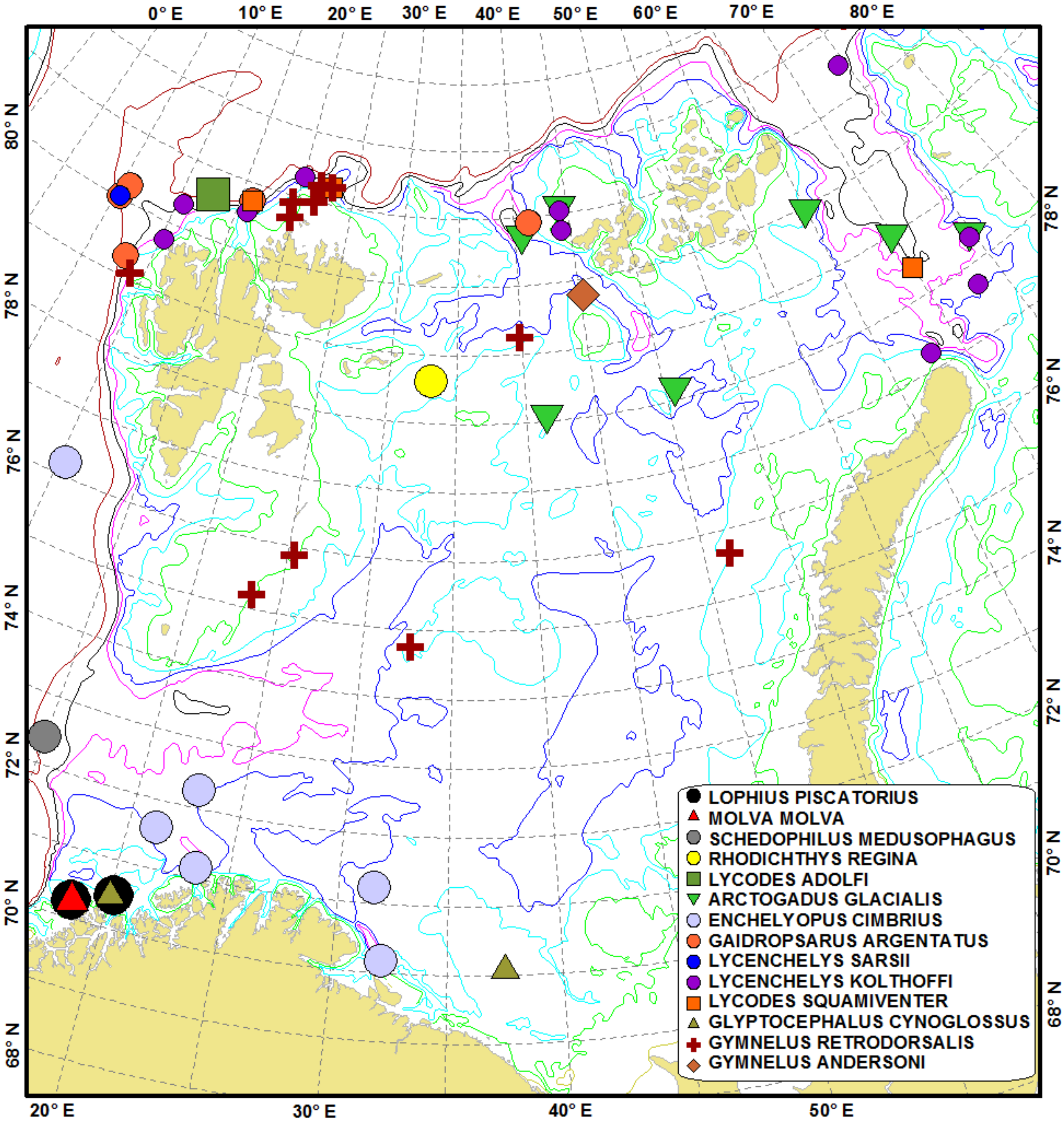


Figure 2.5.5 Distribution of some rare species in the survey area, August-October 2009.

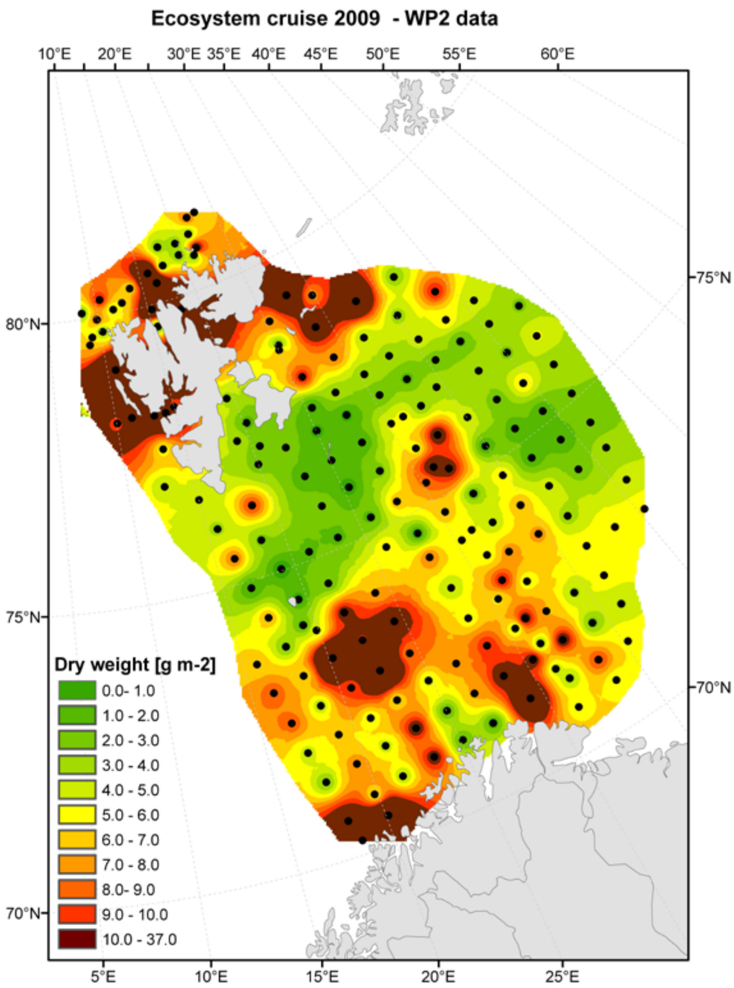


Figure 2.7.1 Zooplankton biomass during the Barents Sea Ecosystem cruise in August-October 2009, combined from WP2 (bottom-0 m).

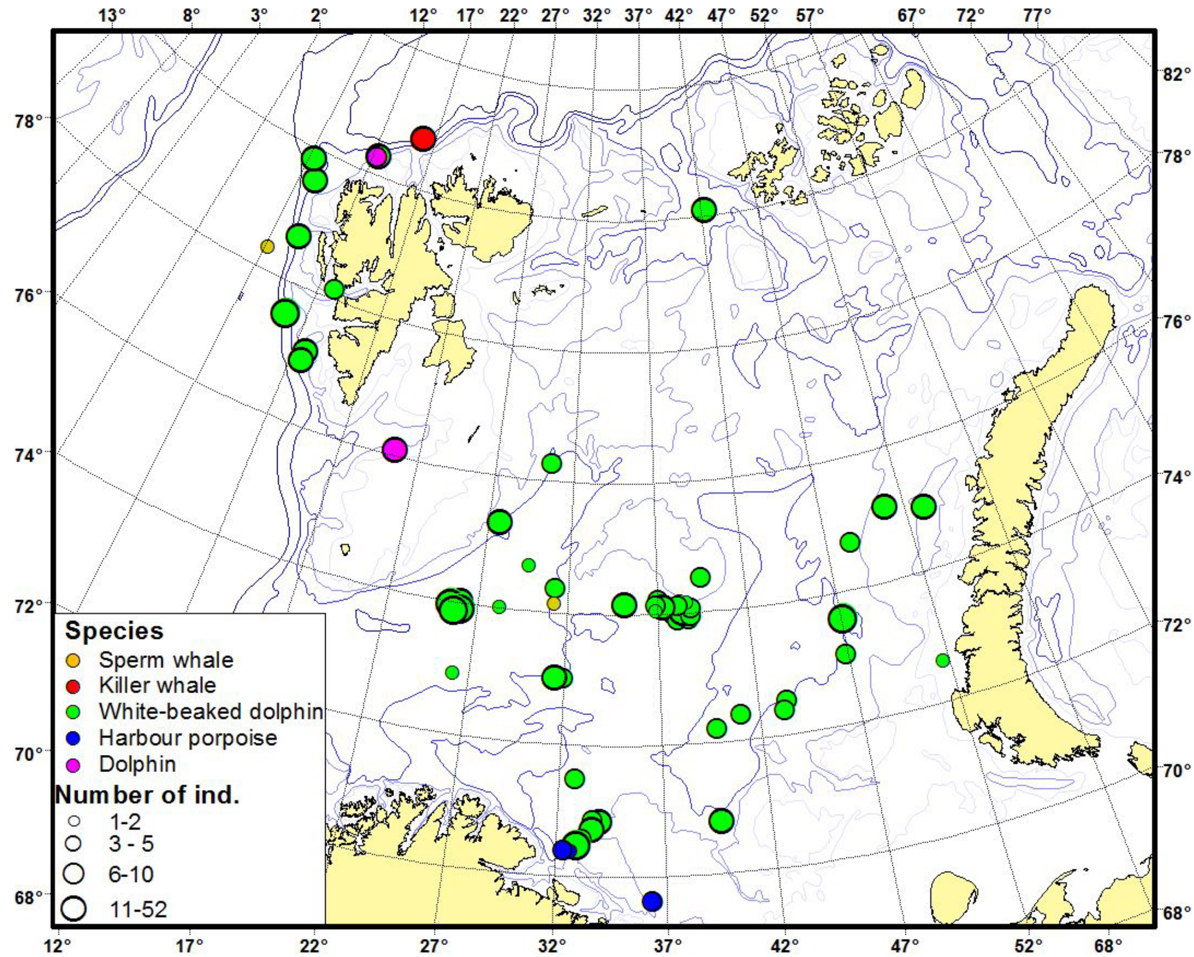


Figure 2.8.1 Distribution of toothed whales observed in August-September 2009

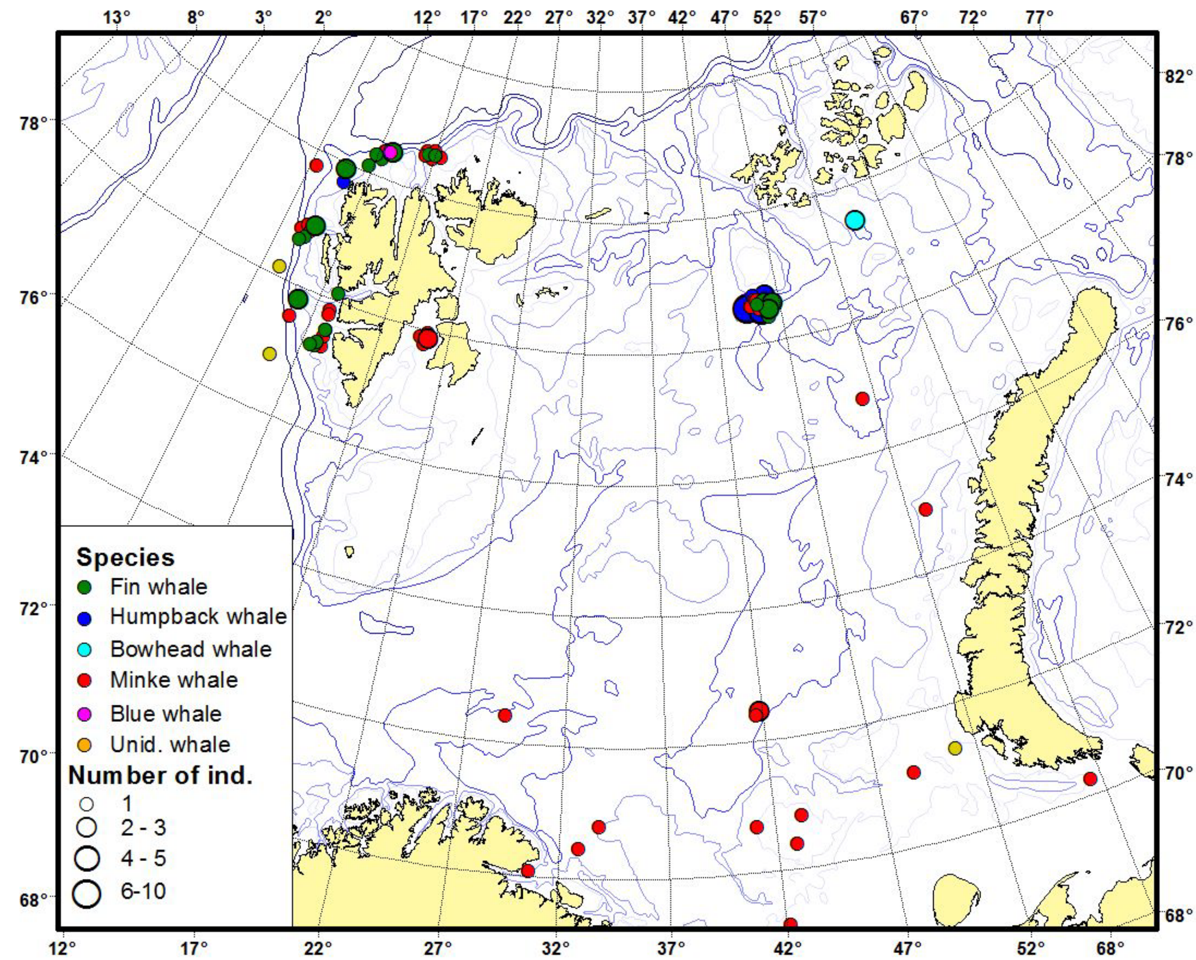


Figure 2.8.2 Distribution of baleen whales observed in August-September 2009

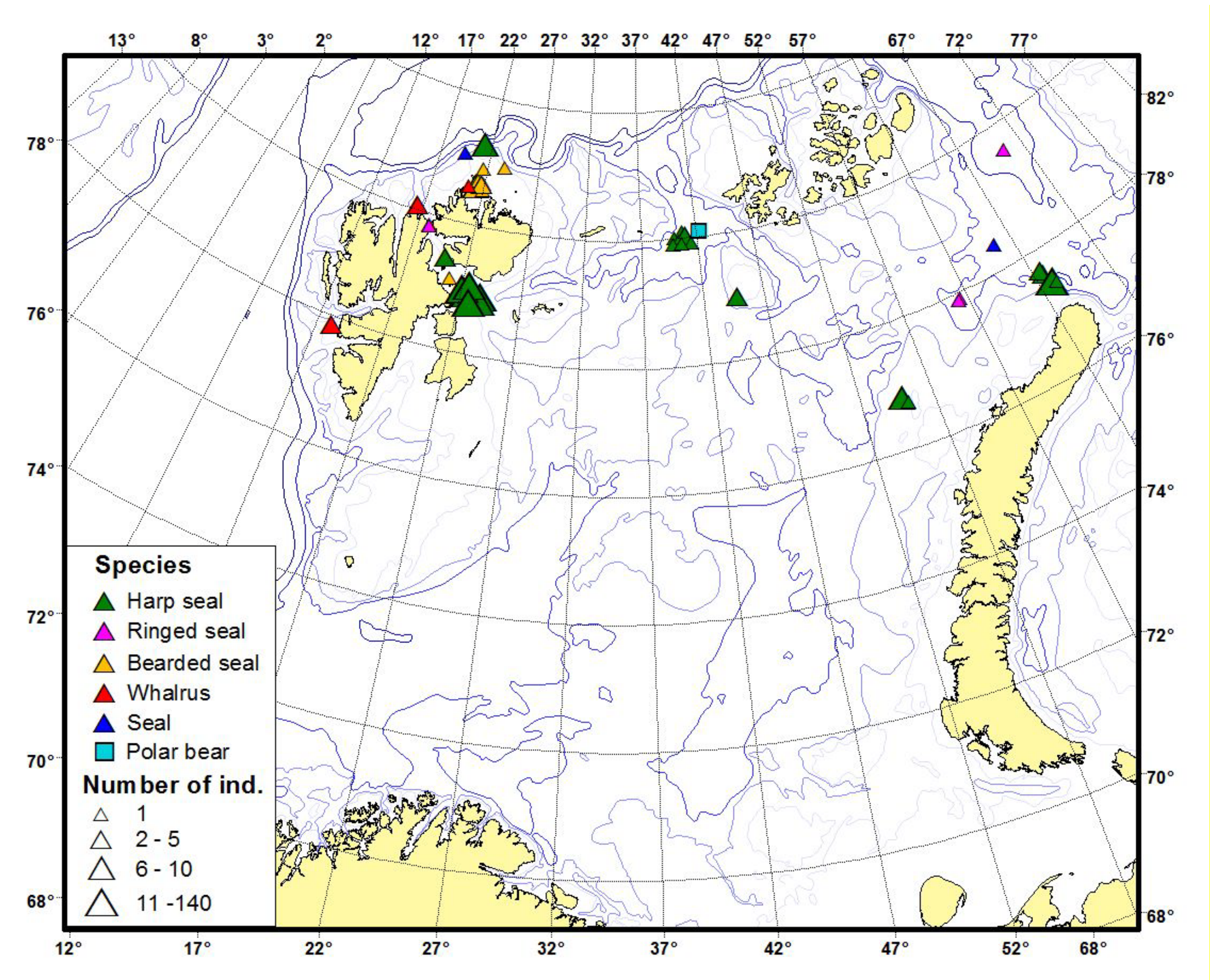


Figure 2.8.3 Distribution of seals observed in August-September 2009

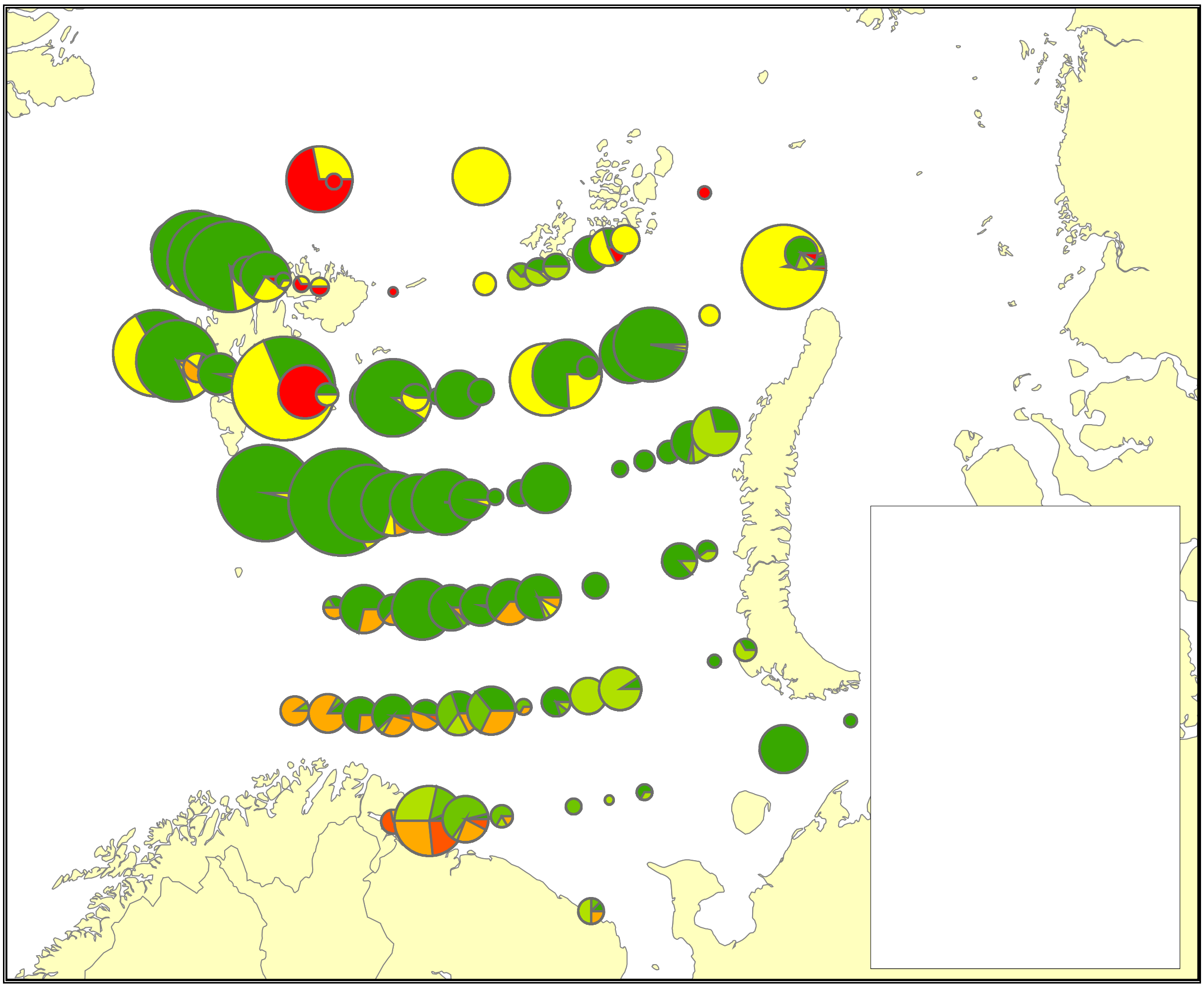


Figure 2.8.4 Distribution of alcid seabirds observed during the Joint Norwegein/Russian Ecosystem Survey 2009

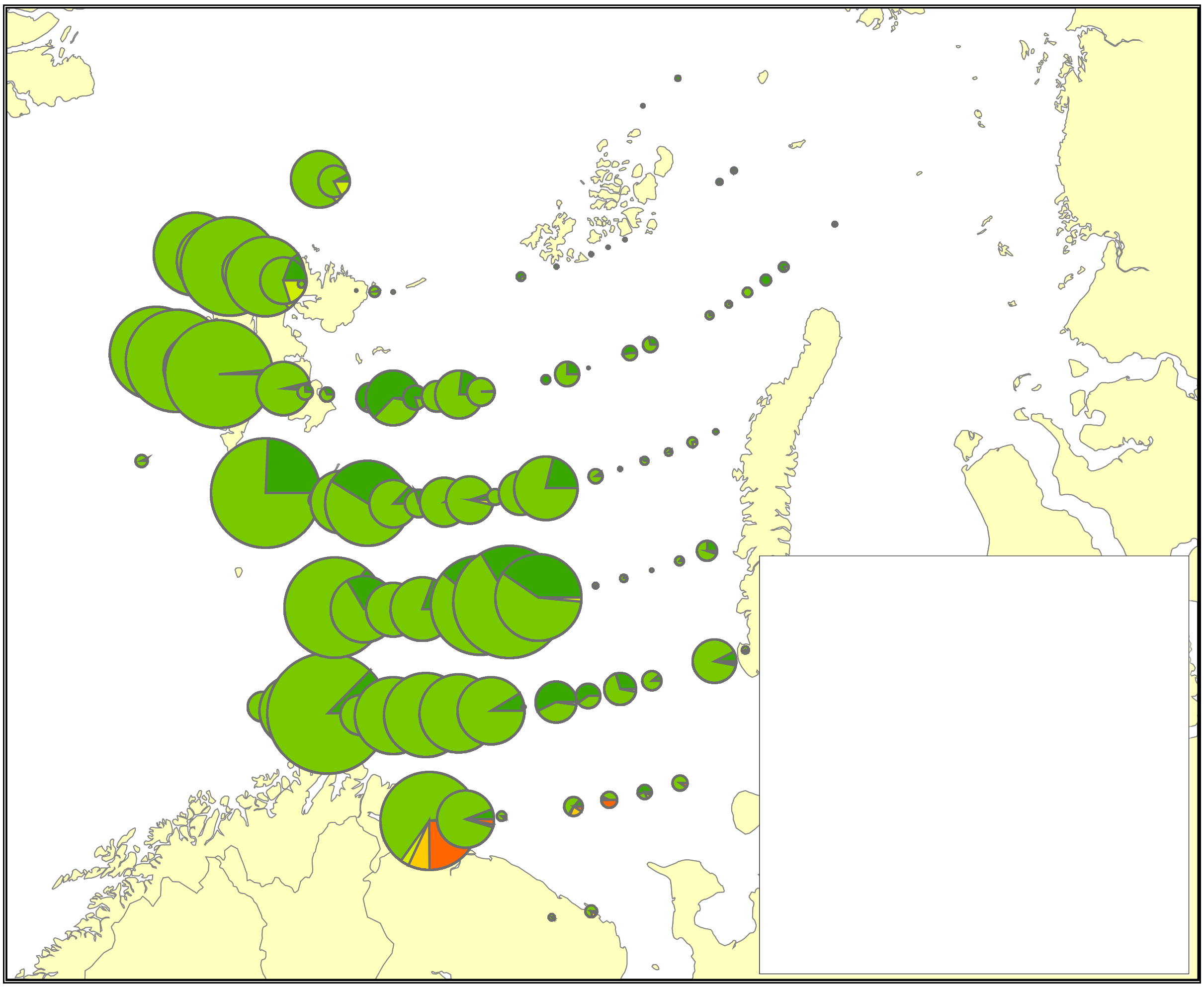


Figure 2.8.5 Distribution of fulmars and gulls observed during the Joint Norwegein/Russian Ecosystem Survey 2009

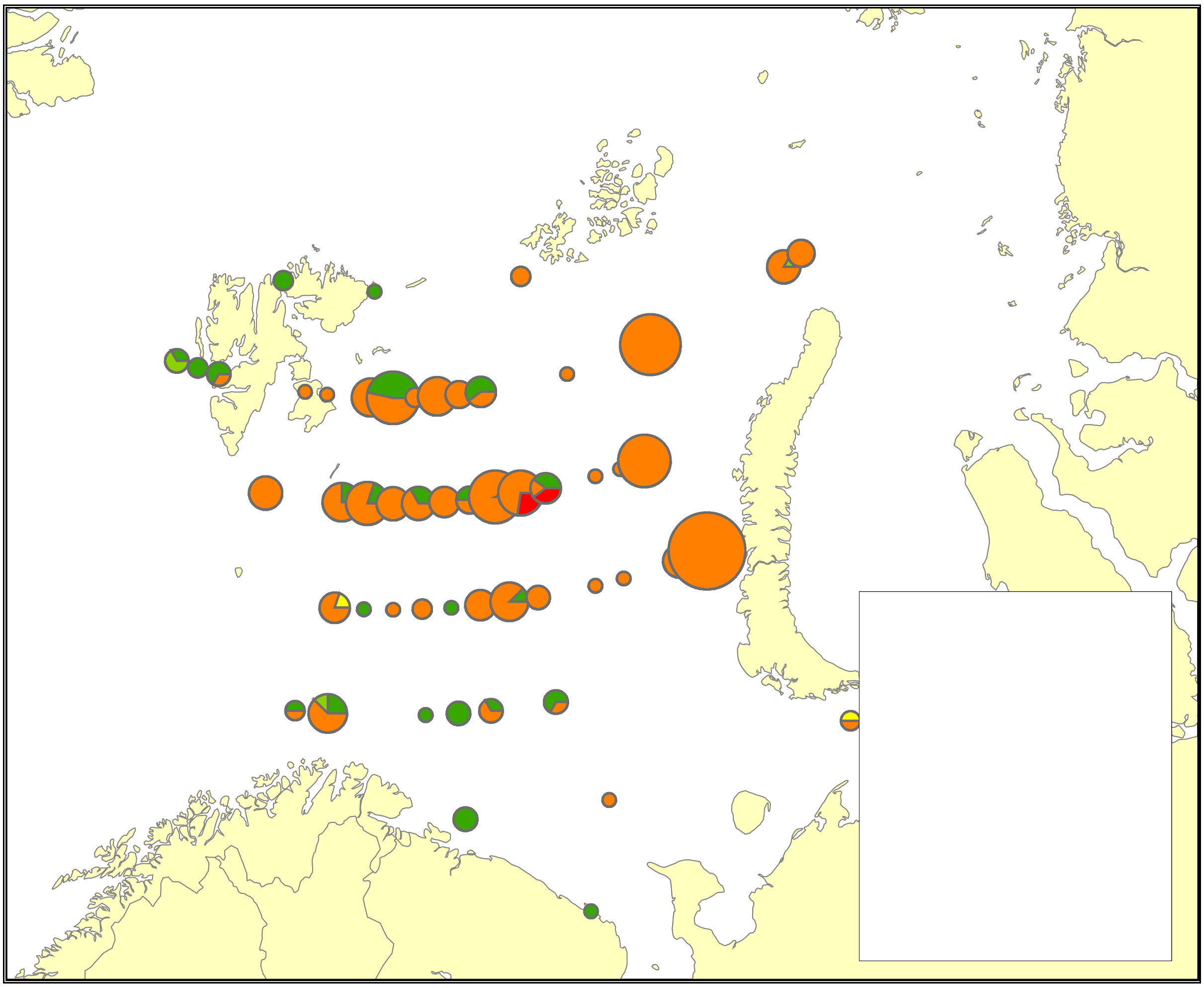


Figure 2.8.6 Distribtuion of skuas observed during the Joint Norwegein/Russian Ecosystem Survey 2009

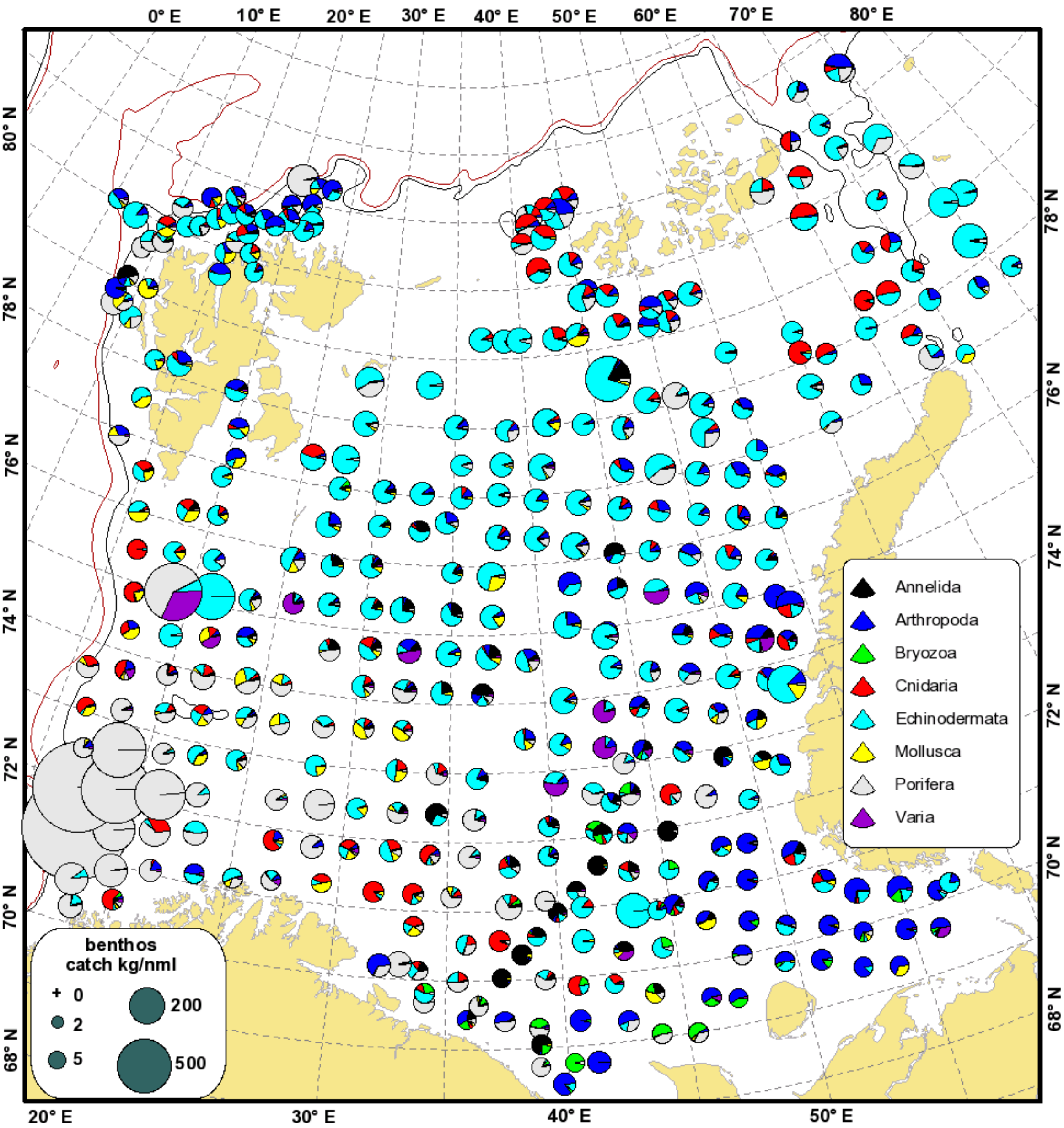


Figure 2.9.1 The total biomass of all registered bottom living evertebrate bycatch (except Nothern shrimp *(Pandalus borealis*) registered in Ecosystem Survey in August-September 2009

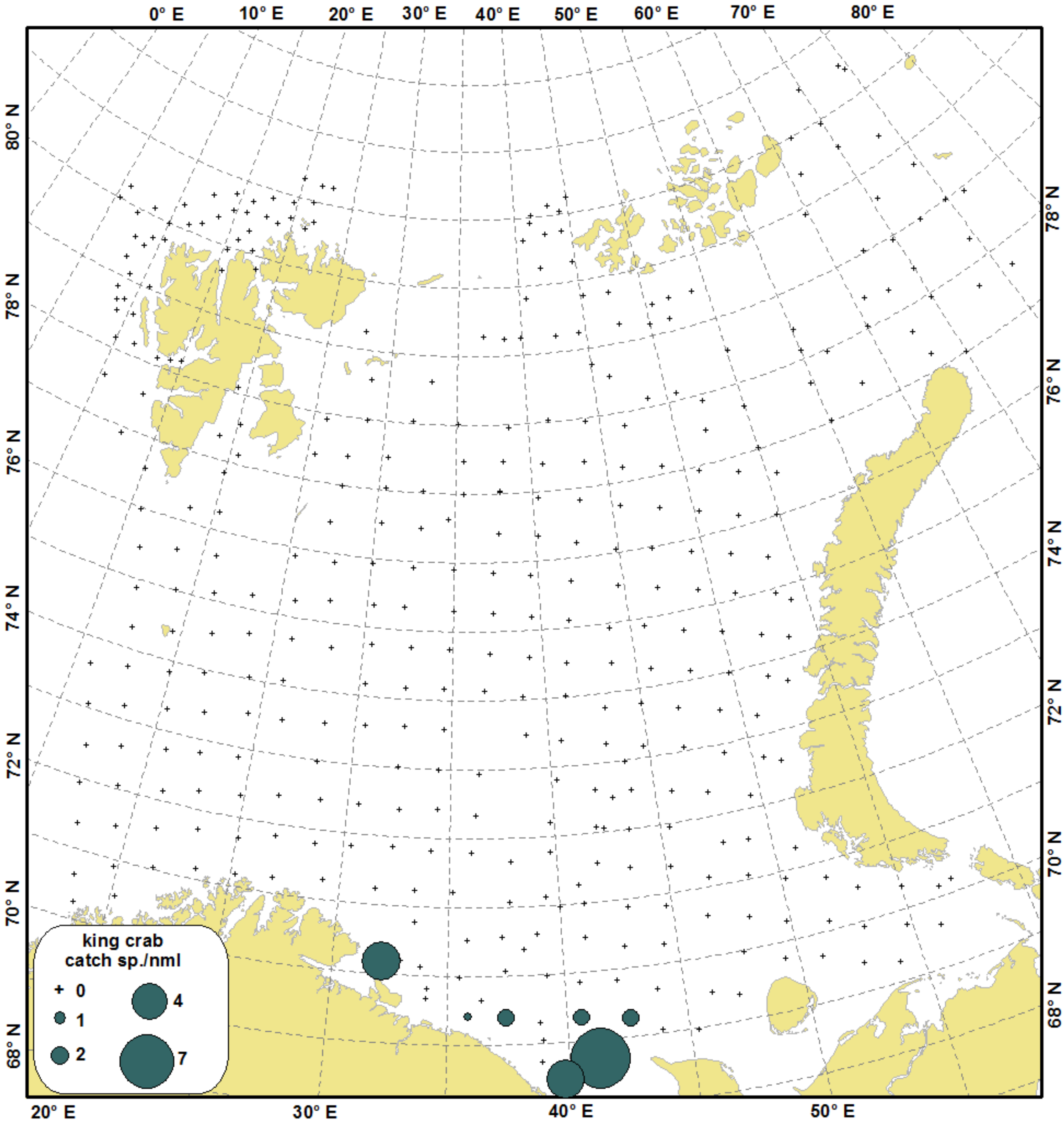


Figure 2.9.2 Distribution of king crab (*Paralithodes camtschaticus*) in Campelen bottom trawl. Standardized to numbers/1 nm, August-October 2009

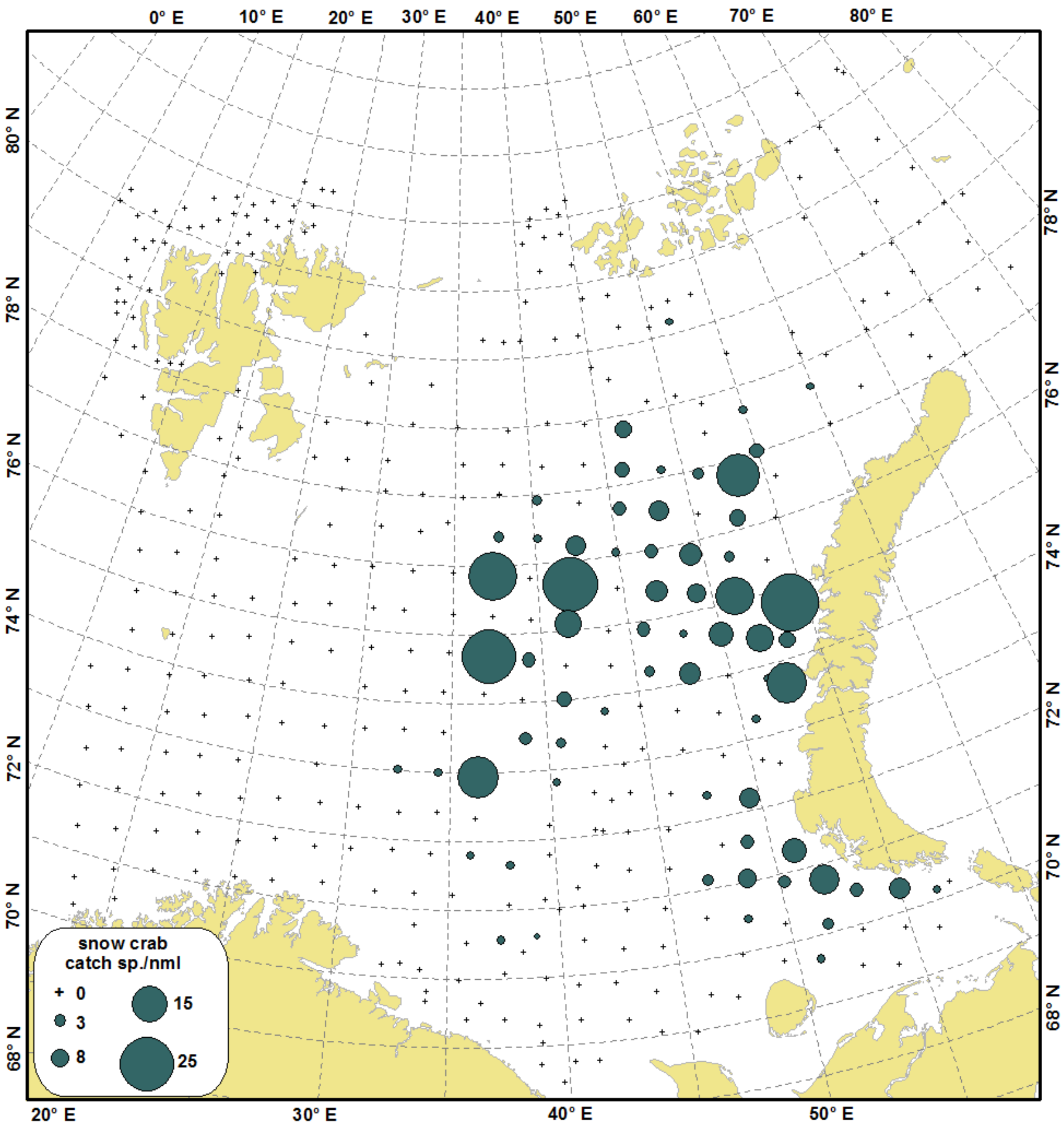


Figure 2.9.3 Distribution of snow crab (*Chionoecetes opilio*) in Campelen bottom trawl. Standardized to numbers/1 nm August-October 2009

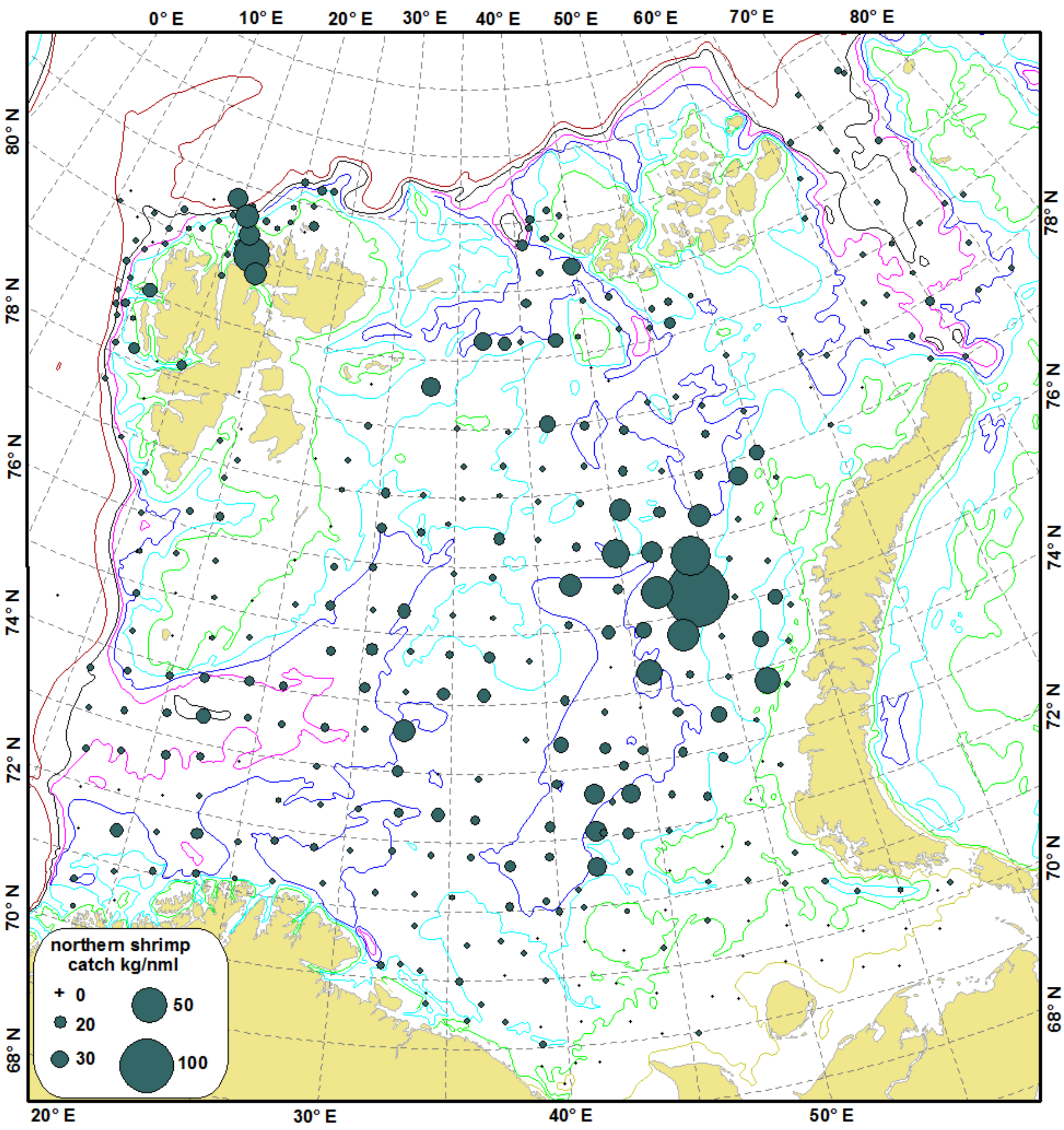


Figure 2.9.4 Distribution of northern shrimp (*Pandalus borealis*) in Campelen bottom trawl, August-October 2009

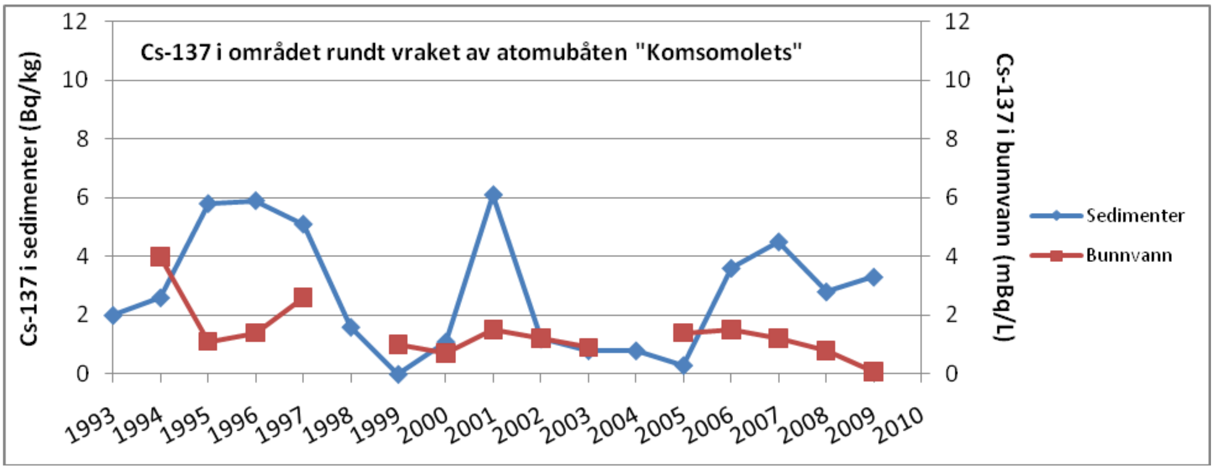


Figure 2.10.1. Levels of Cs-137 in sediments (left Y-axis, blue line) and bottom water (right Y-axis, red line) in the vicinity of the sunken Russian submarine "Komsomolets". The submarine rests at a depth of about 1700 m southwest of the Bear Island.

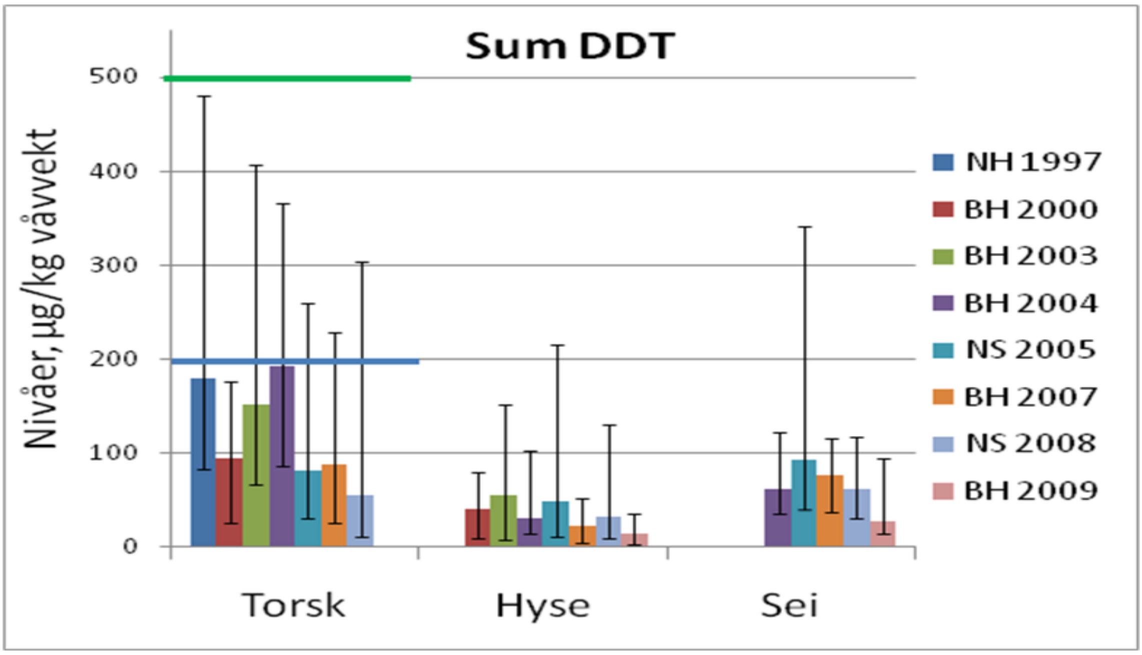


Figure 2.10.2. Levels of Sum DDT in fish liver from Norwegian marine areas. NH – Norwegian Sea, BH – Barents Sea, NS – North Sea. The coloured bars give mean values while the whole concentration range for individual samples is shown with black straight lines. KliF condition classes for cod liver are shown with coloured lines: blue – class I "insignificantly/little contaminated"; green – class II ("moderately contaminated").

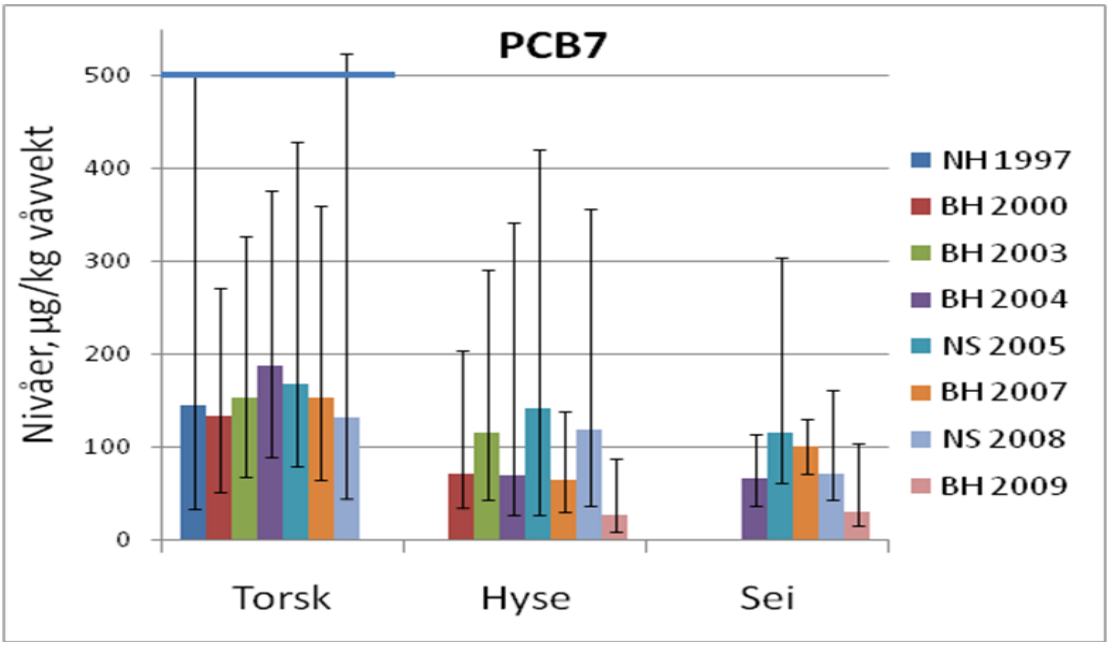


Figure 2.10.3. Levels of PCB7 in fish liver from Norwegian marine areas. NH – Norwegian Sea, BH – Barents Sea, NS – North Sea. The coloured bars give mean values while the whole concentration range for individual samples is shown with black straight lines. KliF condition classes for cod liver are shown with coloured lines: blue – class I ”insignificantly/little contaminated”; green – class II (”moderately contaminated”).

A B

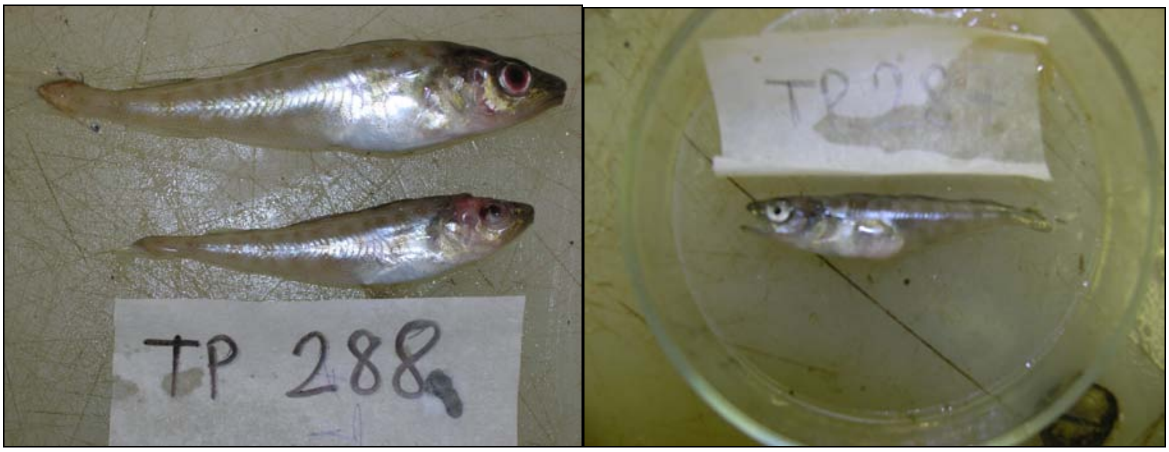


Figure 1.11.1 Pathologies of cod fingerlings: A - red eye syndrome; B - tumor of abdominal wall, August-September 2009

A B

Figure 1.11.2 Pathology “red eye syndrome” in polar cod (A) and haddock (B)

6 APPENDIX

Appendix 1

Ecosystem survey 2009

Survey coordinators: *Russian side -Dmitrij Prozorkevich*

Norwegian side- Elena Eriksen

Research vessel	Participants
"Vilnus" (07.08-29.09)	A.Yu. Astakhov, A.N. Benzik, I.I. Dolgolenko, J.N. Kalashnikov, S.N. Kharlin, P.V. Krivosheya, N.N. Lukin, P.A. Murashko, **D.V. Prozorkevich (cruise leader)**, A.V. Semenov, I.S. Tretyakov, A.G. Trofimov, D.V. Zakharov.
"G.O. Sars" (20.08-05.09)	**J. Alvarez (cruise leader)**, A. Fuglevik, J. Gwynn, T. Haugland, C. Irgens, M. Kleiven, Jan de Lange, F. Midtøy, H. Mjanger, M. Mjanger, A. Nalbandyan, G. Richardsen, J. Røttingen, Th. Sivertsen, L. Solbakken.
"J. Hjort" (23.08-03.10)	**Part 1 (23.08-16.09):** O.O. Arnøy, J. Erices, T. Haugland, E. Holm, K.-E. Karlsen, **S. Mehl (cruise leader),** A. V. Morov, S. Murray, J. H. Nilsen, T. A. Prokhorova, B. Skjold, K. Tveit, K. Westerheim. **Part 2 (16.09-03.10):** J. Alvarez, **E. Eriksen (cruise leader)**, H. Gill, T.-I. Halland, L. Heggebakken, H.E. Heldal, Y. Hunt, M. Johannessen, G. Lien, G. McCallum, A.V. Morov, S. Murray, T. A. Prokhorova, L. Rey, B. Røttingen, J. F. Wilhelmsen.
"Jan Mayen" (10.09-27.09)	A.-K. Abrahamsen, O. Blinova, A. L. Brungot, A. Golikov, E. Grønningsæter, E. Hermansen, A. L. Johnsen, B. Kvinge, H. Langøy, H. Larsen, S. Lemvig, S. G. Rodrigues, J. Rønning, T. Sivertsen, J. Vedholm, **T. de L. Wenneck (cruise leader).**

Appendix 2

Ecosystem survey 2009

SPHERE CALIBRATION OF ECHOSOUNDERS, ER60,
(on copper sphere CU60, TS=33,6 dB, at frequency 38 kHz)

Research vessel	G.O. Sars	Johan Hjort	Jan-Mayen	Vilnyus
Type of echosounder	ER60	ER60	ER60	ER60 (2.1.2)
Date		23.11.2009	10.02.2009	08.08.2008
Place	Grönfjorden	Ugglandfjord	Kirkenes, Dampskipskaia	69°12.3/35°15.6
Bottom depth (m)	45	232	30	31
Depth to sphere (m)	16-22	21-28	15-20	19
Temperature (ºC)				8.57
Salinity (‰)				33.4
TS of sphere (dB)	-33.6	-33.6	-33.6	-33.6
Transducer type	ES38B	ES38B	ES38B	ES38B
Transducer depth (m)	6	5	6.0	0
Real sphere depth (m)				19
Sound velocity (m/sec)	1477.2	1488.0	1465,4	1482
Absorption coefficient (dB/km)	10.1	0.2	20.200	9.8
Pulse length (Short/Med./Long, ms)	1.024	0.256	1.024	1.024
Bandwidth (Wide/Narrow)	2.43	3.68		2.43 kHz
Maximum power (W)	2000	2000	2000	2000
Transmit power (W)	2000	2000	2000	2000
Angle sensitivity	21.90	21.90	21.90	21.9
2-way Beam Angle (10lgY , dB)	-20.8	-20.6	-20.6	-20.60
Adjusted Sv Transducer Gain (dB)	-0.60	-0.74	-0.72	-0.65
Adjusted TS Transducer Gain (dB)	25.55	25.10	26.10	26.26
3-dB Beamwidth Alongship (deg.)	7.14	7.17	7.010	7.07
3-dB Beamwidth Athwartship (deg.)	6.98	7.25	7.23 deg	7.03
Alongship (fore/aft.) Offset (deg.)	-0.10	-0.05	-0.03	-0.05
Athwartship Offset (deg.)	-.018	-0.01	-0.02	-0.04
Theoretical Sa (m /nm)				
Measured Sa (m /nm)				
$Sa=s*1852^2/(r^2Y)$ $s=4p*10^{0,1\ TS}$				

Appendix 3

Sampling of fish in ecosystem survey 2009

Family	Latin name/ English name	**Norwegian vessels**	**Russian vessels**	**Sum**
Agonidae	**Leptagonus decagonus/ Atlantic poacher**			
	No of stations with samples	84	127	211
	Nos. length measured	517	1138	1655
	Nos. aged	-	64	64
Agonidae	**Ulcina olrikii/ Arctic alligatorfish**			
	No of stations with samples	1	31	32
	Nos. length measured	1	416	417
	Nos. aged	-	-	-
Ammodytidae	**Ammodytes marinus/ Lesser sandeel**			
	No of stations with samples	9	-	9
	Nos. length measured	119	-	119
	Nos. aged	-	-	-
Ammodytidae	**Ammodytes tobianus/ Small sandeel**			
	No of stations with samples	14	69	83
	Nos. length measured	25	1637	1662
	Nos. aged	-	-	-
Anarhichadidae	**Anarhichas denticulatus/ Northern wolffish**			
	No of stations with samples	21	8	29
	Nos. length measured	28	8	36
	Nos. aged	-	7	7
Anarhichadidae	**Anarhichas lupus/ Atlantic wolffish**			
	No of stations with samples	51	17	68
	Nos. length measured	325	31	356
	Nos. aged	-	4	4
Anarhichadidae	**Anarhichas minor/ Spotted wolffish**			
	No of stations with samples	40	15	55
	Nos. length measured	73	18	91
	Nos. aged	-	13	13
Argentinidae	**Argentina silus/ Greater argentine**			
	No of stations with samples	23	-	23
	Nos. length measured	412	-	412
	Nos. aged	-	-	-
Belonidae	**Belone belone/ Garfish**			
	No of stations with samples	1	-	1
	Nos. length measured	2	-	2
	Nos. aged	-	-	-
Centrolophidae	**Centrolophus niger/ Blackfish**			
	No of stations with samples	1	-	1
	Nos. length measured	1	-	1
	Nos. aged	-	-	-
Centrolophidae	**Schedophilus medusophagus/ Brown ruff**			
	No of stations with samples	1	-	1
	Nos. length measured	1	-	1
	Nos. aged	-	-	-
Chimaeridae	**Chimaera monstrosa/ Rabbit fish**			
	No of stations with samples	3	-	3
	Nos. length measured	11	-	11
	Nos. aged	-	-	-
Clupeidae	**Clupea harengus/ Atlantic herring**			
	No of stations with samples	111	50	161
	Nos. length measured	4599	1083	5682
	Nos. aged	236	21	257
Clupeidae	**Clupea harengus/ Kanin herring**			
	No of stations with samples	-	3	3
	Nos. length measured	-	110	110
	Nos. aged	-	87	87
Cottidae	**Artediellus atlanticus/ Atlantic hookear sculpin**			
	No of stations with samples	167	113	280

	Nos. length measured	4603	1176	5779
	Nos. aged	-	15	15
Cottidae	**Artediellus scaber/ Rough hamecon**			
	No of stations with samples	-	3	3
	Nos. length measured	-	31	31
	Nos. aged	-	-	-
Cottidae	**Gymnocanthus tricuspis/ Arctic staghorn sculpin**			
	No of stations with samples	7	11	18
	Nos. length measured	88	104	192
	Nos. aged	-	23	23
Cottidae	**Icelus bicornis/ Twohorn sculpin**			
	No of stations with samples	19	15	34
	Nos. length measured	76	34	110
	Nos. aged	-	-	-
Cottidae	**Icelus spatula/ Twohorn sculpin**			
	No of stations with samples	1	51	52
	Nos. length measured	3	340	343
	Nos. aged	-	19	19
Cottidae	**Myoxocephalus aenaenus/ Little sculpin**			
	No of stations with samples	-	1	1
	Nos. length measured	-	1	1
	Nos. aged	-	-	-
Cottidae	**Myoxocephalus quadricuspis/ Four-horned sculpin**			
	No of stations with samples	1	-	1
	Nos. length measured	2	-	2
	Nos. aged	-	-	-
Cottidae	**Myoxocephalus scorpius/ Shorthhorn sculpin**			
	No of stations with samples	8	1	9
	Nos. length measured	84	1	85
	Nos. aged	-	-	-
Cottidae	**Triglops murrayi/ Moustache sculpin**			
	No of stations with samples	44	8	52
	Nos. length measured	501	14	515
	Nos. aged	-	2	2
Cottidae	**Triglops nybelini/ Bigeye sculpin**			
	No of stations with samples	36	82	118
	Nos. length measured	555	2975	3530
	Nos. aged	-	102	102
Cottidae	**Triglops pingeli/ Ribbed sculpin**			
	No of stations with samples	20	24	44
	Nos. length measured	107	106	213
	Nos. aged	-	13	13
Cyclopteridae	**Cyclopterus lumpus/ Lumpsucker**			
	No of stations with samples	89	40	129
	Nos. length measured	200	60	260
	Nos. aged	-	3	3
Cyclopteridae	**Eumicrotremus derjugini/ Leatherfin lumpsucker**			
	No of stations with samples	-	1	1
	Nos. length measured	-	1	1
	Nos. aged	-	-	-
Cyclopteridae	**Eumicrotremus spinosus/ Atlantic spiny lumpsucker**			
	No of stations with samples	13	4	17
	Nos. length measured	91	22	113
	Nos. aged	-	5	5
Gadidae	**Arctogadus glacialis/ Arctic cod**			
	No of stations with samples	-	7	7
	Nos. length measured	-	10	10
	Nos. aged	-	-	-
Gadidae	**Boreogadus saida/ Polar cod**			
	No of stations with samples	150	186	336
	Nos. length measured	7106	27700	34806

	Nos. aged	1165	486	1651
Gadidae	**Eleginus nawaga/ Atlantic navaga**			
	No of stations with samples	-	1	1
	Nos. length measured	-	99	99
	Nos. aged	-	50	50
Gadidae	**Gadiculus argenteus/ Silvery pout**			
	No of stations with samples	19	1	20
	Nos. length measured	232	1	233
	Nos. aged	-	-	-
Gadidae	**Gadus morhua/ Atlantic cod**			
	No of stations with samples	404	281	685
	Nos. length measured	21159	9253	30412
	Nos. aged	1168	2042	3210
Gadidae	**Melanogrammus aeglefinus/ Haddock**			
	No of stations with samples	292	132	424
	Nos. length measured	9947	9127	19074
	Nos. aged	404	1014	1418
Gadidae	**Merlangius merlangius/ Whiting**			
	No of stations with samples	3	-	3
	Nos. length measured	7	-	7
	Nos. aged	-	-	-
Gadidae	**Micromesistius poutassou/ Blue whiting**			
	No of stations with samples	55	-	55
	Nos. length measured	1826	-	1826
	Nos. aged	184	-	184
Gadidae	**Molva molva/ Ling**			
	No of stations with samples	1	-	1
	Nos. length measured	1	-	1
	Nos. aged	1	-	1
Gadidae	**Pollachius virens/ Saithe**			
	No of stations with samples	25	6	31
	Nos. length measured	165	7	172
	Nos. aged	2	4	6
Gadidae	**Trisopterus esmarkii/ Norway pout**			
	No of stations with samples	114	30	144
	Nos. length measured	2288	1072	3360
	Nos. aged	5	119	124
Gasterosteidae	**Gasterosteus aculeatus/ Three-spined stickleback**			
	No of stations with samples	7	34	41
	Nos. length measured	103	282	385
	Nos. aged	-	-	-
Liparidae	**Careproctus microps/**			
	No of stations with samples	-	7	7
	Nos. length measured	-	10	10
	Nos. aged	-	1	1
Liparidae	**Careproctus ranula/ Scotian snailfish**			
	No of stations with samples	-	8	8
	Nos. length measured	-	19	19
	Nos. aged	-	-	-
Liparidae	**Careproctus reinhardii/ Sea tadpole**			
	No of stations with samples	56	35	91
	Nos. length measured	118	89	207
	Nos. aged	-	19	19
Liparidae	**Liparis fabricii/ Gelatinous snailfish**			
	No of stations with samples	11	88	99
	Nos. length measured	22	1846	1868
	Nos. aged	-	20	20
Liparidae	**Liparis gibbus/ Variagated snailfish**			
	No of stations with samples	10	21	31
	Nos. length measured	14	84	98
	Nos. aged	-	20	20
Liparidae	**Liparis liparis/ Striped sea snail**			
	No of stations with samples	7	-	7
	Nos. length measured	19	-	19
	Nos. aged	-	-	-

Liparidae	**Liparis montague/ Montagu's sea snail**			
	No of stations with samples	-	1	1
	Nos. length measured	-	1	1
	Nos. aged	-	-	-
Liparidae	**Paraliparis bathybius/ Threadfin seasnail**			
	No of stations with samples	4	-	4
	Nos. length measured	9	-	9
	Nos. aged	-	-	-
Liparidae	**Rhodichthys regina/ Black seasnail**			
	No of stations with samples	1	-	1
	Nos. length measured	1	-	1
	Nos. aged	-	-	-
Lophiidae	**Lophius piscatorius/ Anglerfish**			
	No of stations with samples	2	-	2
	Nos. length measured	3	-	3
	Nos. aged	-	-	-
Lotidae	**Brosme brosme/ Cusk**			
	No of stations with samples	14	-	14
	Nos. length measured	48	-	48
	Nos. aged	37	-	37
Lotidae	**Enchelyopus cimbrius/ Fourbeard rockling**			
	No of stations with samples	5	1	6
	Nos. length measured	17	1	18
	Nos. aged	-	1	1
Lotidae	**Gaidropsarus argentatus /Arctic rockling**			
	No of stations with samples	4	1	5
	Nos. length measured	11	1	12
	Nos. aged	-	1	1
Lotidae	**Gaidropsarus vulgaris/ Three-bearded rockling**			
	No of stations with samples	1	-	1
	Nos. length measured	2	-	2
	Nos. aged	-	-	-
Myctophidae	**Myctophidae/ Lantern fishes**			
	No of stations with samples	9	-	9
	Nos. length measured	119	-	119
	Nos. aged	-	-	-
Macrouridae	**Macrourus berglax/ Rough rattail**			
	No of stations with samples	5	-	5
	Nos. length measured	12	-	2
	Nos. aged	-	-	-
Myctophidae	**Benthosema glaciale / Glacier lanternfish**			
	No of stations with samples	1	32	33
	Nos. length measured	4	71	75
	Nos. aged	-	-	-
Myctophidae	**Myctophum punctatum / Spotted lanternfish**			
	No of stations with samples	-	1	1
	Nos. length measured	-	1	1
	Nos. aged	-	-	-
Osmeridae	**Mallotus villosus/ Capelin**			
	No of stations with samples	308	458	766
	Nos. length measured	16953	13868	30821
	Nos. aged	3546	1142	4688
Osmeridae	**Osmerus eperlanus/ European smelt**			
	No of stations with samples	-	1	1
	Nos. length measured	-	3	3
	Nos. aged	-	3	3
Pleuronectidae	**Glyptocephalus cynoglossus/ Witch**			
	No of stations with samples	1	1	2
	Nos. length measured	1	1	2
	Nos. aged	-	1	1
Pleuronectidae	**Hippoglossoides platessoides/ Long rough dab**			
	No of stations with samples	180	458	638

	Nos. length measured	5844	8789	14633
	Nos. aged	-	1140	1140
Pleuronectidae	**Limanda limanda/ Dab**			
	No of stations with samples	-	4	4
	Nos. length measured	-	31	31
	Nos. aged	-	16	16
Pleuronectidae	**Microstomus kitt/ Lemon sole**			
	No of stations with samples	5	-	5
	Nos. length measured	10	-	10
	Nos. aged	-	-	-
Pleuronectidae	**Pleuronectes platessa/ Europeian plaice**			
	No of stations with samples	-	14	14
	Nos. length measured	-	158	158
	Nos. aged	-	116	116
Pleuronectidae	**Reinhardtius hippoglossoides/ Greenland halibut**			
	No of stations with samples	163	146	309
	Nos. length measured	628	1702	2330
	Nos. aged	452	865	1317
Psychrolutidae	**Cottunculus microps/ Polar sculpin**			
	No of stations with samples	24	14	38
	Nos. length measured	33	50	83
	Nos. aged	-	30	30
Psychrolutidae	**Cottunculus sadko/ Sadko sculpin**			
	No of stations with samples	2	3	5
	Nos. length measured	3	3	6
	Nos. aged	-	3	3
Rajidae	**Amblyraja hyperborean/ Arctic skate**			
	No of stations with samples	11	35	46
	Nos. length measured	41	39	80
	Nos. aged	-	-	-
Rajidae	**Amblyraja radiate/ Thorny skate**			
	No of stations with samples	84	89	173
	Nos. length measured	247	190	437
	Nos. aged	-	-	-
Rajidae	**Bathyraja spinicauda/ Spinetail ray**			
	No of stations with samples	6	-	6
	Nos. length measured	6	-	6
	Nos. aged	-	-	-
Rajidae	**Rajella fyllae/ Round ray**			
	No of stations with samples	9	1	10
	Nos. length measured	13	1	14
	Nos. aged	-	-	-
Salmonidae	**Salmo salar/ Salmon**			
	No of stations with samples	2	-	2
	Nos. length measured	2	-	2
	Nos. aged	-	-	-
Scombridae	**Scomber scombrus/ Mackerel**			
	No of stations with samples	1	-	1
	Nos. length measured	2	-	2
	Nos. aged	-	-	-
Scorpaenidae	**Sebastes marinus/ Golden redfish**			
	No of stations with samples	28	10	34
	Nos. length measured	166	18	184
	Nos. aged	126	18	144
Scorpaenidae	**Sebastes mentella/ Deepwater redfish**			
	No of stations with samples	262	91	353
	Nos. length measured	12347	888	13235
	Nos. aged	383	200	583
Scorpaenidae	**Sebastes viviparus/ Norway redfish**			
	No of stations with samples	20	-	20
	Nos. length measured	152	-	152
	Nos. aged	-	-	-
Sternoptychidae	**Arctozenus risso/ Ribbon barracudina**			
	No of stations with samples	19	3	22
	Nos. length measured	34	3	37

	Nos. aged	-	-	-
Sternoptychidae	**Maurolicus muelleri/ Pearlside**			
	No of stations with samples	9	2	11
	Nos. length measured	31	4	35
	Nos. aged	-	-	-
Stichaeidae	**Anisarchus medius/ Stout eelblenny**			
	No of stations with samples	9	3	12
	Nos. length measured	71	20	91
	Nos. aged	-	-	-
Stichaeidae	**Leptoclinus maculates/ Daubed shanny**			
	No of stations with samples	141	167	308
	Nos. length measured	2269	1501	3770
	Nos. aged	-	-	-
Stichaeidae	**Lumpenus lampretaeformis/Snake blenny**			
	No of stations with samples	75	23	98
	Nos. length measured	619	60	679
	Nos. aged	-	11	11
Triglidae	**Eutrigla gurnardus/ Grey gurnard**			
	No of stations with samples	1	-	1
	Nos. length measured	1	-	1
	Nos. aged	-	-	-
Zoarcidae	**Gymnelus andersoni/**			
	No of stations with samples	-	1	1
	Nos. length measured	-	2	2
	Nos. aged	-	-	-
Zoarcidae	**Gymnelus retrodorsalis/ Aurora unernak**			
	No of stations with samples	9	2	11
	Nos. length measured	10	2	12
	Nos. aged	-	-	-
Zoarcidae	**Lycodes adolfi/**			
	No of stations with samples	1	-	1
	Nos. length measured	5	-	5
	Nos. aged	-	-	-
Zoarcidae	**Lycodes gracilis/ Vahl's eelpout**			
	No of stations with samples	66	10	76
	Nos. length measured	394	28	422
	Nos. aged	-	14	14
Zoarcidae	**Lycodes esmarkii/ Esmark's eelpout**			
	No of stations with samples	8	8	16
	Nos. length measured	49	23	72
	Nos. aged	-	5	5
Zoarcidae	**Lycodes eudipleurostictus/ Double line eelpout**			
	No of stations with samples	19	2	21
	Nos. length measured	89	5	94
	Nos. aged	-	2	2
Zoarcidae	**Lycodes pallidus/ Pale eelpout**			
	No of stations with samples	29	43	72
	Nos. length measured	144	193	337
	Nos. aged	-	11	11
Zoarcidae	**Lycodes polaris/ Canadian eelpout**			
	No of stations with samples	-	8	8
	Nos. length measured	-	138	138
	Nos. aged	-	15	15
Zoarcidae	**Lycodes reticulates/ Arctic eelpout**			
	No of stations with samples	19	26	45
	Nos. length measured	36	151	187
	Nos. aged	-	51	51
Zoarcidae	**Lycodes rossi/ Threespot eelpout**			
	No of stations with samples	19	13	32
	Nos. length measured	105	32	137
	Nos. aged	-	3	3
Zoarcidae	**Lycodes seminudus/ Longear eelpout**			
	No of stations with samples	11	28	39
	Nos. length measured	25	91	116
	Nos. aged	-	13	13

Zoarcidae	**Lycodes squamiventer/ Scalebelly eelpout**			
	No of stations with samples	2	1	3
	Nos. length measured	3	2	5
	Nos. aged	-	-	-
Zoarcidae	**Lycenchelys kolthoffi/ Checkered wolfeel**			
	No of stations with samples	5	6	11
	Nos. length measured	7	8	15
	Nos. aged	-	-	-
Zoarcidae	**Lychenchelus sarsii/ Sars wolf eel**			
	No of stations with samples	2	-	2
	Nos. length measured	4	-	4
	Nos. aged	-	-	-

Length measurements include 0-group samples. Demersal fishes will be aged after the survey.

Appendix 4

Sampling of fish stomachs in ecosystem survey 2009

Family	Latin name/ English name	**Norwegian vessels**	**Russian vessels**	**Sum**
Agonidae	**Leptagonus decagonus/ Atlantic poacher**			
	No of stations with samples		15	
	Nos. stomachs sampled		64	
Anarhichadidae	**Anarhichas denticulatus/ Northern wolffish**			
	No of stations with samples		7	
	Nos. stomachs sampled		7	
Anarhichadidae	**Anarhichas lupus/ Atlantic wolffish**			
	No of stations with samples		4	
	Nos. stomachs sampled		4	
Anarhichadidae	**Anarhichas minor/ Spotted wolffish**			
	No of stations with samples		9	
	Nos. stomachs sampled		13	
Clupeidae	**Clupea harengus/ Atlantic herring**			
	No of stations with samples		3	
	Nos. stomachs sampled		21	
Clupeidae	**Clupea harengus/ Kanin herring**			
	No of stations with samples		3	
	Nos. stomachs sampled		87	
Cottidae	**Artediellus atlanticus/ Atlantic hookear sculpin**			
	No of stations with samples		2	
	Nos. stomachs sampled		15	
Cottidae	**Gymnocanthus tricuspis/ Arctic staghorn sculpin**			
	No of stations with samples		2	
	Nos. stomachs sampled		23	
Cottidae	**Icelus bicornis/ Twohorn sculpin**			
	No of stations with samples		3	
	Nos. stomachs sampled		19	
Cottidae	**Triglops murrayi/ Moustache sculpin**			
	No of stations with samples		2	
	Nos. stomachs sampled		2	
Cottidae	**Triglops nybelini/ Bigeye sculpin**			
	No of stations with samples		12	
	Nos. stomachs sampled		102	
Cottidae	**Triglops pingelii/ Ribbed sculpin**			
	No of stations with samples		2	
	Nos. stomachs sampled		13	
Cyclopteridae	**Cyclopterus lumpus/ Lumpsucker**			
	No of stations with samples		2	
	Nos. stomachs sampled		3	
Cyclopteridae	**Eumicrotremus spinosus/ Atlantic spiny lumpsucker**			
	No of stations with samples		1	

	Nos. stomachs sampled		5	
Gadidae	**Boreogadus saida/ Polar cod**			
	No of stations with samples		11	
	Nos. stomachs sampled		518	
Gadidae	**Eleginus nawaga/ Atlantic navaga**			
	No of stations with samples		1	
	Nos. stomachs sampled		50	
Gadidae	**Gadus morhua/ Atlantic cod**			
	No of stations with samples	142	120	262
	Nos. stomachs sampled	1095	1958	3053
Gadidae	**Melanogrammus aeglefinus/ Haddock**			
	No of stations with samples	51	59	110
	Nos. stomachs sampled	299	964	1263
Gadidae	**Micromesistius poutassou/ Blue whiting**			
	No of stations with samples			
	Nos. length measured			
	Nos. aged			
Gadidae	**Pollachius virens/ Saithe**			
	No of stations with samples		3	
	Nos. stomachs sampled		4	
Gadidae	**Trisopterus esmarkii/ Norway pout**			
	No of stations with samples		9	
	Nos. stomachs sampled		119	
Liparidae	**Careproctus microps/**			
	No of stations with samples		1	
	Nos. stomachs sampled		1	
Liparidae	**Careproctus reinhardii/ Sea tadpole**			
	No of stations with samples		12	
	Nos. stomachs sampled		19	
Liparidae	**Liparis fabricii/ Gelatinous snailfish**			
	No of stations with samples		2	
	Nos. stomachs sampled		20	
Liparidae	**Liparis gibbus/ Variagated snailfish**			
	No of stations with samples		5	
	Nos. stomachs sampled		20	
Lotidae	**Enchelyopus cimbrius/ Fourbeard rockling**			
	No of stations with samples		1	
	Nos. stomachs sampled		1	
Lotidae	**Gaidropsarus argentatus /Arctic rockling**			
	No of stations with samples		1	
	Nos. stomachs sampled		1	
Osmeridae	**Mallotus villosus/ Capelin**			
	No of stations with samples	111	33	144
	Nos. stomachs sampled	1110	1092	2202
Osmeridae	**Osmerus eperlanus/ European smelt**			
	No of stations with samples		1	
	Nos. stomachs sampled		3	
Pleuronectidae	**Glyptocephalus cynoglossus/ Witch**			
	No of stations with samples		1	
	Nos. stomachs sampled		1	
Pleuronectidae	**Hippoglossoides platessoides/ Long rough dab**			
	No of stations with samples		69	
	Nos. stomachs sampled		1140	
Pleuronectidae	**Limanda limanda/ Dab**			
	No of stations with samples		1	
	Nos. stomachs sampled		16	
Pleuronectidae	**Pleuronectes platessa/ Europeian plaice**			
	No of stations with samples		10	
	Nos. stomachs sampled		104	
Pleuronectidae	**Reinhardtius hippoglossoides/ Greenland halibut**			
	No of stations with samples		74	
	Nos. stomachs sampled		865	
Psychrolutidae	**Cottunculus microps/ Polar sculpin**			

	No of stations with samples		6	
	Nos. stomachs sampled		30	
Psychrolutidae	**Cottunculus sadko/ Sadko sculpin**			
	No of stations with samples		3	
	Nos. stomachs sampled		3	
Rajidae	**Amblyraja hyperborean/ Arctic skate**			
	No of stations with samples		27	
	Nos. stomachs sampled		35	
Rajidae	**Amblyraja radiate/ Thorny skate**			
	No of stations with samples		80	
	Nos. stomachs sampled		149	
Rajidae	**Rajella fyllae/ Round ray**			
	No of stations with samples		1	
	Nos. stomachs sampled		1	
Scorpaenidae	**Sebastes marinus/ Golden redfish**			
	No of stations with samples		7	
	Nos. stomachs sampled		18	
Scorpaenidae	**Sebastes mentella/ Deepwater redfish**			
	No of stations with samples		32	
	Nos. stomachs sampled		201	
Scorpaenidae	**Sebastes viviparus/ Norway redfish**			
	No of stations with samples			
	Nos. length measured			
	Nos. aged			
Stichaeidae	**Lumpenus lampretaeformis/Snake blenny**			
	No of stations with samples		2	
	Nos. stomachs sampled		11	
Zoarcidae	**Lycodes gracilis/ Vahl's eelpout**			
	No of stations with samples		6	
	Nos. stomachs sampled		14	
Zoarcidae	**Lycodes rossi/ Threespot eelpout**			
	No of stations with samples		2	
	Nos. stomachs sampled		3	
Zoarcidae	**Lycodes esmarkii/ Esmark's eelpout**			
	No of stations with samples		1	
	Nos. stomachs sampled		5	
Zoarcidae	**Lycodes eudipleurostictus/ Double line eelpout**			
	No of stations with samples		1	
	Nos. stomachs sampled		2	
Zoarcidae	**Lycodes pallidus/ Pale eelpout**			
	No of stations with samples		4	
	Nos. stomachs sampled		11	
Zoarcidae	**Lycodes polaris/ Canadian eelpout**			
	No of stations with samples		2	
	Nos. stomachs sampled		15	
Zoarcidae	**Lycodes reticulates/ Arctic eelpout**			
	No of stations with samples		9	
	Nos. stomachs sampled		51	
Zoarcidae	**Lycodes seminudus/ Longear eelpout**			
	No of stations with samples		5	
	Nos. stomachs sampled		13	

Appendix 5

List of identified species of the bottom invertebrates and frequency character at the stations through the Barents sea ecosystem survey in 2009

Phylum	Class	Order	Family	Genus and species	GS	JH	JM	VI
Porifera	Demospongiae	Astrophorida	Geodiidae	Geodia barretti Hentschel, 1929		3	16	
				Geodia macandrewii Bowerbank, 1858		2	12	
				Geodia sp.		1		
			Pachastrellidae	Thenea muricata (Bowerbank, 1858)		8	9	
				Thenea valdiviae Lendenfeld, 1906		2		
			Tetillidae	Tetilla cranium (O.F. Mueller, 1776)			14	
				Tetilla infrequens (Carter, 1876)			1	
				Tetilla polyura Schmidt, 1870		12	6	4
		Hadromerida	Polymastiidae	Polymastia sp.		2		2
				Polymastia thielei Koltun, 1964		1		
				Polymastia uberrima (Schmidt, 1870)		2	1	16
				Polymastiidae g. sp.				1
				Radiella grimaldi (Topsent, 1913)		22	8	18
				Radiella hemisphaericum (Sars, 1872)		6	4	
				Sphaerotylus aff. Borealis (Swarchevsky, 1906)			2	
				Sphaerotylus borealis (Swarchevsky, 1906)			1	
				Tentorium semisuberites (Schmidt, 1870)		4	1	
			Stylocordylidae	Stylocordyla borealis (Loven, 1866)		1	8	
			Suberitidae	Suberites ficus (Johnston, 1842)			6	2
			Tethyidae	Tethya aurantium (Pallas, 1766)			7	
				Tethya norvegica Bowerbank, 1872			13	
		Halichondrida	Axinelliidae	Phakellia sp.			8	2
			Halichondriidae	Halichondria panicea (Pallas, 1766)			3	
				Halichondria sp.			1	
		Haplosclerida	Haliclonidae	Haliclona sp.			9	
				Haliclona ventilabrum (Fristedt, 1887)			5	1
		Poecilosclerida	Cladorhizidae	Asbestopluma pennatula (Schmidt, 1875)		4		
				Chondrocladia gigantea (Hansen, 1885)			3	
			Grellidae	Grayella pyrula (Carter, 1876)		1		
			Hamacanthidae	Hamacantha implicans Lundbeck, 1902.			2	
			Myxillidae	Lissodendoryx indistincta (Fristedt, 1887)			1	
				Myxilla brunnea Hansen, 1885		1		
				Myxilla incrustans (Johnston, 1842)			10	
			Tedaniidae	Tedania suctoria Schmidt, 1870		2	5	
				Porifera g. sp.	2	52		17
Cnidaria	Anthozoa	Actiniaria	Actiniidae	Urticina felina (L., 1767)		14	20	
			Actinostolidae	Glandulactis spetsbergensis (Carlgren, 1913)			10	
			Edwardsiidae	Edwardsia vitrea (Danielssen, 1890)			1	
			Hormathiidae	Hormathia digitata (O.F. Mueller, 1776)		23	33	21
			Metridiidae	Metridium senile (L., 1767)		5		

				Actiniaria g. sp.	31	52		99
		Alcyonacea	Nephteidae	Drifa glomerata (Verrill, 1869)		39	30	89
				Duva florida (Rathke, 1806)		9	8	20
				Gersemia fruticosa (M. Sars, 1860)		16	3	1
				Gersemia rubiformis (Ehrenberg, 1834)		19	23	38
				Gersemia sp.		1		3
				Alcyonacea g. sp.	7			30
		Pennatulacea	Umbellulidae	Umbellula encrinus (L., 1758)			2	34
		Stolonifera	Clavulariidae?	Clavularia arctica (M. Sars, 1860)		1		
		Zoanthacea	Epizoanthidae	Epizoanthus incrustatus (Dueben & Koren, 1847)			8	
				Epizoanthus sp.		3	2	22
				Anthozoa g. sp.				5
	Hydrozoa	Athecata	Tubulariidae	Tubularia larynx Ellis & Solander, 1786			1	
				Tubularia sp.			2	
		Limnomedusae	Monobrachiidae	Monobrachium parasitum Mereschkowsky, 1877			1	
		Thecaphora	Campanulinidae	Tetrapoma quadridentata (Hincks, 1874)			1	
			Haleciidae	Halecium beanii (Johnston, 1838)			1	
				Halecium muricatum (Ellis & Solander, 1786)			3	
			Lafoeidae	Grammaria immersa Nutting, 1901			1	
				Grammaria sp.			1	
				Lafoea fruticosa (M. Sars, 1850)			5	
			Laodiceidae	Staurophora mertensii Brandt, 1835		1		
			Sertulariidae	Abietinaria abietina (L., 1758)			3	
				Sertularella polyzonias L., 1758			1	
				Sertularia mirabilis (Verrill, 1873)			2	
				Sertularia sp.			1	
				Thuiaria thuja (L., 1758)		3		
				Hydrozoa g. sp.	5	31		
Plathelminthes	Turbellaria			Turbellaria g. sp.		6		3
				Plathelmintes g. sp.				2
Annelida	Polychaeta	Amphinomida	Euphrosinidae	Euphrosine sp.		1		
		Capitellida	Capitellidae	Capitella sp.		7		
		Chaetopterida	Chaetopteridae	Spiochaetopterus typicus M. Sars, 1856		67	35	
		Eunicida	Lumbrineridae	Lumbrineris sp.			7	
				Scoletoma fragilis (Mueller, 1776)			2	
			Onuphidae	Nothria hyperborea (Hansen, 1878)		1	14	
		Flabelligerida	Flabelligeridae	Brada granulata Malmgren, 1867		19		3
				Brada granulosa Hansen, 1880				5
				Brada inhabilis (Rathke, 1843)		46	2	30
				Brada sp.			34	
				Brada villosa (Rathke, 1843)		20		4
				Flabelligera affinis M. Sars, 1829			1	
		Opheliida	Scalibregmidae	Polyphysia sp.			1	
		Phyllodocida	Aphroditidae	Aphrodita aculeata L., 1761			7	
				Aphrodita sp.			1	
			Nephtyidae	Nephtyidae g. sp.				4
				Nephtys caeca (Fabricius, 1780)			2	
				Nephtys ciliata (Mueller, 1779)			1	
				Nephtys sp.		1		

			Phyllodocidae	Eteone spetsbergensis Malmgren, 1865			1	
			Polynoidae	Eucranta villosa (Malmgren, 1865)			3	
				Harmothoe glabra (Malmgren, 1865)			13	
				Harmothoe imbricata (L., 1767)			10	
				Harmothoe sp.		55	13	63
				Harmothoe villosa ?			1	
				Polynoidae g. sp.				1
		Sabellida	Sabellidae	Euchone papillosa (M. Sars, 1851)			3	
				Sabellidae g. sp.		39		1
			Serpulidae	Filograna implexa Berkeley, 1827			8	
			Spirorbidae	Spirorbidae g. sp.		5		
		Terebellida	Ampharetidae	Ampharete finmarchica (M. Sars, 1866)			6	1
				Ampharete sp.			2	1
				Amphicteis gunneri (M. Sars, 1835)			4	4
			Pectinariidae	Pectinaria hyperborea (Malmgren, 1865)		32	5	1
			Terebellidae	Pista maculata (Dalyell, 1853)		2		
				Polychaeta g. sp.	25	64		66
Sipuncula	Sipunculidea	Golfingiiformes	Golfingiidae	Golfingia margaritacea margaritacea (M. Sars, 1851)			1	
				Golfingia sp.			1	
				Golfingia vulgaris vulgaris (de Blainville,1827)		1	7	
				Nephasoma minuta (Keferstein, 1863)			17	
			Phascolionidae	Phascolion strombus strombus (Montagu, 1804)		9		
				Sipunculidea g. sp.	1	6		44
Echiura	Echiurida	Echiuroinea	Bonelliidae	Hamingia arctica Danielssen & Koren, 1881		13	1	5
			Echiuridae	Echiurus echiurus echiurus (Pallas, 1767)				1
Cephaloryncha	Priapulida	Halicryptomorpha	Halycriptidae	Halicriptus spinulosus Siebold, 1849		3		
		Priapulomorpha	Priapulidae	Priapulidae g. sp.	1			
				Priapulopsis bicaudatus (Danielssen, 1868) van der Land, 1970		3		13
				Priapulus caudatus Lamarck, 1816		2	6	
Nemertini	Nemertini			Nemertini g. sp.	2	15		11
Arthropoda	Cirripedia	Thoracica	Balanomorpha	Balanus balanus (L., 1758)			6	
				Balanus sp.				11
				Semibalanus balanoides (L., 1766)		3		
	Malacostraca	Amphipoda	Acanthonotozomatidae	Acanthostepheia malmgreni (Goes, 1866)				8
			Amathillopsidae	Amathillopsis spinigera Heller, 1875			3	11
			Calliopiidae	Cleippides quadricuspis Heller, 1875			2	13
			Epimeriidae	Epimeria loricata G.O. Sars, 1879		17	15	12
				Paramphithoe hystrix (Ross, 1835)		7	19	10
			Eusiridae	Eusirus holmi Hansen, 1887				15
				Rhachotropis aculeata (Lepechin, 1780)		6	4	1
				Rhachotropis sp.				4
			Gammaridae	Gammaridae g. sp.				6
				Gammarus sp.		1		2
			Hyperiidae	Hyperiidae g. sp.				1
				Themisto abyssorum Boeck, 1870			1	
				Themisto libellula (Lichtenstein,1882)		1	8	

			Liljeborgiidae	Lilljeborgia fissicornis (M. Sars, 1858)			9	
			Lysianassidae	Anonyx nugax (Phipps, 1774)			26	
				Anonyx sp.		18		49
				Eurythenes gryllus (Lichtenstein, 1822)			3	
				Orchomenella pinquis Boeck, 1861			1	
				Tmetonyx similis (G.O. Sars, 1891)				1
			Melitidae	Wimvadocus torelli (Goes, 1866)				1
			Oedicerotidae	Rostroculodes longirostris (Goes, 1866)			6	
			Stegocephalidae	Phipsiella similis (G.O. Sars, 1891)			1	
				Stegocephalus inflatus Kroeyer, 1842		22	20	47
				Stegocephalus sp.				2
			Synopiidae	Syrrhoe crenulata Goes,1866			1	
				Amphipoda g. sp.	11	1	1	4
		Cumacea	Diastylidae	Diastylis sp.			1	
		Decapoda	Crangonidae	Pontophilus norvegicus M. Sars, 1861		17	9	
				Sabinea sarsi Smith, 1879		2		
				Sabinea septemcarinata (Sabine, 1821)		58	41	155
				Sabinea sp.				1
				Sclerocrangon boreas (Phipps, 1774)		6	7	15
				Sclerocrangon ferox (G.O. Sars, 1821)		22	21	73
			Galatheidae	Munida bamffica (Pennant, 1777)		5		
			Hippolitydae	Bythocaris biruli (Kobjakova, 1964)			8	2
				Bythocaris payeri (Heller, 1875)			1	
				Bythocaris simplicirostris G.O. Sars, 1869				1
				Bythocaris sp.				11
				Eualus gaimardi (Milne-Edwards, 1837)		4		3
				Eualus pusiolus (Kroeyer, 1841)			2	
				Eualus sp.				33
				Lebbeus polaris (Sabine, 1821)		21	20	58
				Spirontocaris lilljeborgii (Danielssen, 1859)		1	2	
				Spirontocaris phippsii (Kroeyer, 1841)			2	
				Spirontocaris spinus (Sowerby, 1802)		11	13	14
			Lithodidae	Lithodes maja (L., 1758)		2		
				Paralithodes camtschaticus (Tilesius, 1815)				7
			Majidae	Chionoecetes opilio (Fabricius, 1788)		16		45
				Hyas araneus (L., 1758)		12	17	35
				Hyas coarctatus Leash, 1815		21	3	2
			Paguridae	Pagurus bernhardus (L., 1758)		12		
				Pagurus pubescens (Kroeyer, 1838)		15	21	7
				Pagurus sp.				12
			Pandalidae	Pandalus borealis Kroeyer, 1837	26	76	51	146
				Pandalus montagui Leach, 1814		4	3	
			Pasiphaeidae	Pasiphaea multidentata Esmark, 1886		4	4	12
				Pasiphaea sivado (Risso, 1816)			1	16
				Pasiphaea sp.			14	1
			Sergestidae	Sargestes arcticus Kroeyer, 1855			4	5
				Anomura g. sp.	19			
				Brachyura g. sp.	13			

				Decapoda g. sp.				1
				Natantia g. sp.	21			
		Isopoda	Aegidae	Aega sp.			1	
			Idotheidae	Saduria sabini (Kroeyer, 1849)		22	2	58
				Saduria sibirica (Birula, 1896)				4
				Isopoda g. sp.	6	1		4
	Pycnogonida	Pantopoda	Ammotheidae	Eurycyde hispida (Kroeyer, 1844-45)			1	
			Colossendeidae	Colossendeis angusta G.O. Sars, 1877			1	
				Colossendeis proboscidea (Sabine, 1824)			1	
				Colossendeis sp.		49	3	48
			Nymphonidae	Boreonymphon robustum (Bell, 1855)			7	
				Nymphon brevirostre Hodge, 1863			60	
				Nymphon grossipes (Fabricius, 1780)			1	
				Nymphon sluiteri Hoek, 1881			1	
				Nymphon sp.		1		
				Nymphon spinosum (Goodsir, 1842)			3	
				Pycnogonida g. sp.	17	64		97
				Crustacea g. sp.				1
Bryozoa	Gymnolaemata	Cheilostomida	Bicellariidae	Dendrobeania sp.			4	
			Celleporidae	Cellepora sp.			9	
			Flustridae	Flustra sp.		8	1	5
				Securiflustra securifrons (Pallas, 1766)			1	
				Terminoflustra membranaceo-truncata (Smitt, 1868)		1		
			Myriaporidae	Myriapora coarctata (M. Sars, 1863)			2	
			Reteporidae	Retepora beaniana King, 1846		2		
				Sertella septentrionalis Jullen, 1933			21	
			Schizoporellidae	Myriozoella crustacea Smitt, 1868			13	
				Myriozoella sp.				
			Scrupocellariidae	Scrupocellaria scabra (Van Beneden, 1848)			1	
			Smittinidae	Parasmittina jeffreysii (Norman, 1903)			2	
				Porella sp.			4	
		Ctenostomata	Alcyonidiidae	Alcyonidium sp.		2		
				Alcyonidium disciforme (Smitt, 1878)				2
				Alcyonidium gelatinosum (L., 1767)			11	6
				Alcyonidium sp.		8		
		Cyclostomata	Corymboporidae	Defrancia lucernaria (M. Sars, 1851)		1	3	
			Diastoporidae	Diplosolen intricarius (Smitt, 1872)			3	
			Horneridae	Stegohornera lichenoides (L., 1758)		11	15	6
				Bryozoa g. sp.		29		14
Mollusca	Aplacophora	Solenogastres	Neomeniidae	Proneomenia sluiteri Huebrecht, 1880		1		
	Bivalvia	Cardiiformes	Arcticidae	Arctica islandica (L., 1767)			1	
			Cardiidae	Clinocardium ciliatum (Fabricius, 1780)		36	16	25
				Serripes groenlandicus (Bruguiere, 1789)			1	
			Myidae	Mya truncata L., 1767		4		1
			Tellinidae	Macoma calcarea (Gmelin, 1791)			3	
		Cuspidariiformes	Cuspidariidae	Cuspidaria arctica (M. Sars, 1859)		18	2	10
		Luciniformes	Astartidae	Astarte borealis Schumacher, 1817		4	6	4

				Astarte crenata (Gray, 1842)		55	14	33
				Astarte elliptica (Brown, 1827)		2		
			Hiatellidae	Hiatella arctica (L., 1767)		13	2	8
				Hiatella sp.		14	2	2
		Mytiliformes	Arcidae	Bathyarca glacialis (Gray, 1842)		24	21	24
			Mytilidae	Modiolus modiolus (L., 1758)		1		4
		Nuculiformes	Nuculanidae	Nuculana pernula (Mueller, 1779)			3	3
			Yoldiidae	Yoldia hyperborea (Torell, 1859)		2	9	6
				Yoldiella lenticula (Moeller, 1842)				1
		Pectiniformes	Pectinidae	Chlamys islandica (O.F. Mueller, 1776)		26	18	27
				Chlamys sp.				7
				Pseudamussium septemradiatum (Mueller, 1776)		14		
			Propeamussiidae	Arctinula greenlandica (Sowerby, 1842)		9	4	31
				Cyclopecten imbrifer (Loven, 1846)		1		
				Bivalvia g. sp.	25	3		4
	Cephalopoda	Octopoda	Bathypolypodinae	Bathypolypus arcticus (Prosch, 1849)		14	17	5
				Benthoctopus sp.			1	5
		Sepiida	Sepiolidae	Rossia moelleri Steenstrup, 1856		11		9
				Rossia palpebrosa Owen, 1834		17	6	8
				Rossia sp.		3		20
		Teuthida	Gonatidae	Gonatus fabricii (Lichtenstein, 1818)	2	7	13	4
				Teuthida g. sp.				2
				Cephalopoda g. sp.	12			
				Eggs Cephalopoda g. sp. ?				3
	Gastropoda	Bucciniformes	Beringiidae	Beringius ossiani (Friele, 1879)			2	1
				Beringius turtoni (Bean, 1834)		1		
			Buccinidae	Buccinidae g. sp.			5	
				Buccinum angulosum Gray, 1839		1	2	
				Buccinum belcheri Reeve, 1855		1		
				Buccinum ciliatum ciliatum (Fabricius, 1780)		1	2	
				Buccinum ciliatum sericatum Hancock, 1846				4
				Buccinum cyaneum Bruguiere, 1789-1792		1	2	
				Buccinum elatior (Middendorff, 1849)		3	6	4
				Buccinum finmarchianum Verkruezen, 1875		1	1	1
				Buccinum fragile Verkruezen in G.O. Sars, 1878		16	3	9
				Buccinum glaciale L., 1761			1	5
				Buccinum hydrophanum Hancock, 1846		37	20	33
				Buccinum micropoma Jensen in Thorson, 1944		3		
				Buccinum sp.		2		9
				Buccinum undatum L., 1758		3	4	1
				Colus altus (S. Wood, 1848)				2
				Colus holboelli (Moeller,1842)		5	3	
				Colus islandicus (Mohr, 1786)		8	1	7
				Colus kroyeri (Moeller,1842)		3		
				Colus latericeus (Moeller,1842)			3	
				Colus pubescens (Verrill, 1882)		7	4	2
				Colus sabini (Gray, 1824)		21	15	24
				Colus sp.		6		29

				Colus turgidulus (Jeffreys, 1877)		17	2	13
				Eggs Buccinidae g. sp.				10
				Neptunea denselirata Brogger, 1901		8	7	5
				Neptunea despecta (L., 1758)		4	2	1
				Neptunea sp.				1
				Neptunea ventricosa (Gmelin, 1789)				1
				Pyrulofusus deformis (Reeve, 1847)			1	
				Turrisipho dalli (Friele in Tryon, 1881)		3		
				Turrisipho fenestratus (Turton, 1834)		1		
				Turrisipho lachesis (Moerch, 1869)		11	3	18
				Turrisipho sp.		1		
				Turrisipho voeringi Bouchet et Waren, 1985		1		
				Volutopsis norvegicus (Gmelin, 1790)		12	6	2
			Muricidae	Boreotrophon truncatus (Stroem, 1767)			2	
		Cephalaspidea	Philinidae	Philine finmarchica G.O. Sars, 1878		15	12	13
			Scaphandridae	Cylichna alba (Brown, 1827)			2	
				Scaphander punctostriatus (Mighels & Adams, 1842)		7	3	8
		Cerithiiformes	Naticidae	Bulbus smithi Brown, 1839		2		2
				Cryptonatica affinis (Gmelin, 1791)		16	7	3
				Eggs Naticidae g. sp.				1
				Lunatia pallida (Broderip & Sowerby, 1829)		2	10	5
			Velutinidae	Limneria undata (Brown, 1838)			1	1
				Onchidiopsis glacialis (M. Sars, 1851)		5	2	1
				Velutina velutina (Mueller, 1776)			2	
				Velutinidae g. sp.		1		
		Coniformes	Admetidae	Admete sp.				2
				Admete viridula (Fabricius, 1780)			3	
			Turridae	Oenopota sp.		1		
				Propebela nobilis (Moeller, 1842)			1	
		Epitoniiformes	Epitoniidae	Boreoscala groenlandica (Moeller, 1842)		2		
		Nudibranchia	Cadlinidae	Cadlina laevis (L., 1767)			6	
			Dendronotidae	Dendronotus frondosus (Ascanius, 1774)			1	
				Dendronotus robustus Verrill, 1870		1		1
				Dendronotus sp.			1	
				Nudibranchia g. sp.		21	1	39
		Patelliformes	Lepetidae	Lepeta coeca (O.F. Mueller, 1776)		3	1	1
			Tecturidae	Capulacmaea radiata (M. Sars, 1851)		2	1	6
		Pleurotomariiformes	Fissurellidae	Puncturella noachina (L., 1771)		1		
		Trochiformes	Trochidae	Margarites costalis (Gould, 1841)		1	5	5
				Margarites groenlandicus groenlandicus (Gmelin, 1790)		3	1	7
				Margarites groenlandicus umbilicalis (Broderip & Sowerby, 1829)				1
				Margarites sp.		1		
				Gastropoda g. sp.	22	6		2
	Polyplacophora	Chitonida	Ischnochitonidae	Stenosemus albus (L., 1767)			1	
		Lepidopleurida	Leptochitonidae	Hanleya hanleyi J.E. Gray, 1857			1	
				Polyplacophora g. sp.	2			
	Scaphopoda			Scaphopoda g. sp.		1		

Brachiopoda	Rhynchonellata	Rhynchonellida	Hemithyrididae	Hemithyris psittacea (Gmelin, 1790)		4	9	6
		Terebratulida	Cancellothyrididae	Terebratulina retusa (L., 1758)		1	19	
			Macandreviidae	Macandrevia cranium (Mueller, 1776)		8		
				Brachiopoda g. sp.	10			
Echinodermata	Asteroidea	Forcipulatidae	Asteriidae	Asterias rubens L., 1758		3		
				Asteriidae g. sp.		2		1
				Icasterias panopla (Stuxberg, 1879)		39	11	63
				Leptasterias muelleri (M. Sars, 1846)		1		
				Leptasterias sp.		2	11	19
				Urasterias linckii (Mueller & Troschel, 1842)		39	20	80
			Pedicellasteridae	Pedicellaster typicus M. Sars, 1861		1		
		Notomyotida	Benthopectinidae	Pontaster tenuispinus (Dueben & Koren, 1846)		65	15	90
		Paxillosida	Astropectinidae	Bathybiaster vexillifer (W. Thomson, 1873)		1	2	7
				Leptychaster arcticus (M. Sars, 1851)		13	3	
			Ctenodiscidae	Ctenodiscus crispatus (Retzius, 1805)		69	39	125
		Spinulosida	Echinasteridae	Henricia sp.		45	32	47
		Valvatida	Goniasteridae	Ceramaster granularis granularis (Retzius, 1783)		8	1	
				Hippasteria phrygiana phrygiana (Parelius, 1768)			1	3
			Poraniidae	Poraniomorpha hispida (Sars, 1872)			6	
				Poraniomorpha tumida (Stuxberg, 1878)		14	3	32
				Tylaster willei				1
		Velatida	Korethrasteridae	Korethraster hispidus W. Thomson, 1873		2		
			Pterasteridae	Hymenaster pellucidus W. Thomson, 1873		9	11	29
				Pteraster militaris (O.F. Mueller, 1776)		14		34
				Pteraster obscurus (Perrier, 1891)		6	11	2
				Pteraster pulvillus M. Sars, 1861		17	24	2
				Pteraster sp.				1
			Solasteridae	Crossaster papposus (L., 1768)		25	22	44
				Lophaster furcifer (Dueben & Koren, 1846)		21	9	25
				Solaster endeca (L., 1771)			4	11
				Solaster sp.		2		28
				Solaster syrtensis Verrill, 1894		14	1	1
	Crinoidea	Comatulida	Antedonidae	Heliometra glacialis (Owen, 1833)		1	22	66
				Poliometra prolixa (Sladen, 1881)		22	6	1
	Echinoidea	Echinoida	Echinidae	Echinus esculentus L., 1758		10		
			Strongylocentrotidae	Strongylocentrotus droebachiensis O.F. Mueller, 1776		14	7	2
				Strongylocentrotus pallidus (G.O. Sars, 1871)		28	35	16
				Strongylocentrotus sp.				61
		Spatangoida	Spatangidae	Brisaster fragilis (Dueben & Koren, 1846)		9		
				Spatangus purpureus (O.F. Mueller, 1776)		3		
				Echinoidea g. sp.	16			
	Holothuroidea	Apodida	Myriotrochidae	Myriotrochus rinkii Steenstrup, 1851		20	5	15
		Aspidochirotida	Stichopodidae	Stichopus tremulus (Gunnerus, 1767)		4		
		Dendrochirotida	Cucumariidae	Cucumaria frondosa (Gunnerus, 1867)			1	5

				Ocnus glacialis (Ljungman, 1880)			1	
			Phyllophoridae	Phyllophoridae g. sp.		8		3
				Thyonidium drummondi (Thompson, 1840)				3
			Psolidae	Psolus phantapus Strussenfelt, 1765		6	2	11
				Psolus squamatus (O.F. Muller, 1776)		1		
		Molpadiida	Molpadiidae	Molpadia arctica von Marenzeller, 1878			9	15
				Molpadia borealis (M. Sars, 1859)		49	1	43
				Holothuroidea g. sp.				2
	Ophiuroidea	Euryalida	Gorgonocephalidae	Gorgonocephalus arcticus (Leach, 1819)		18	24	86
				Gorgonocephalus eucnemis (Mueller & Troschel, 1842)		17	6	46
				Gorgonocephalus sp.				11
		Ophiurida	Amphiuridae	Amphiura borealis (G.O. Sars, 1871)		1		
			Ophiacanthidae	Ophiacantha bidentata (Retzius, 1805)		53	48	139
			Ophiactidae	Ophiopholis aculeata (L., 1767)		57	7	67
			Ophiomyxidae	Ophioscolex glacialis Mueller & Troschel, 1842		37	17	63
			Ophiuridae	Ophiocten sericeum (Forbes, 1852)			4	16
				Ophiopleura borealis Danielssen & Koren, 1877		14		71
				Ophiura robusta (Ayers, 1851)			6	
				Ophiura sarsi Luetken, 1855		46	45	58
				Stegophiura nodosa (Luetken, 1854)				2
				Ophiuroidea g. sp.	21			
				Echinodermata g. sp.				9
Chordata	Ascidiacea	Phlebobranchia	Ascidiidae	Ascidia prunum (Mueller, 1776)		22	1	
			Cionidae	Ciona intestinalis (L., 1767)		6		28
		Stolidobranchia	Pyuridae	Halocynthia pyriformis (Rathke, 1806)			1	
				Halocynthia sp.			1	
				Microcosmus glacialis (M. Sars, 1859)			3	
			Styelidae	Styela rustica (L., 1767)			4	3
				Ascidiacea g. sp.	30	25		8
				Tunicata g. sp.				24
	Ascidiasea	Stolidobranchia	Styelida	Dendrodoa aggregata (Rathke, 1806)			1	

Appendix 6

Catch per unit effort (kg per nautical mile towed) from bottom trawls, together with number of stations with the species recorded and mean length with lenth range in parenthesis from the ecosystem survey in 2009.

Family	Scientific name	English name	Cpue	n	Length
Rajidae	*Bathyraja spinicauda*	Spinetail ray	0.009	6	60.7 (34;115)
Rajidae	*Amblyraja hyperborea*	Arctic skate	0.030	11	38.5 (15;85)
Rajidae	*Amblyraja radiata*	Thorny skate	0.115	84	37.7 (11;60)
Rajidae	*Rajella fyllae*	Round ray	0.002	9	24.5 (10;52)
Chimaeridae	*Chimaera monstrosa*	Rabbit fish	0.009	3	48.9 (30;62)
Clupeidae	*Clupea harengus*	Herring	0.001	106	23.8 (4.4;46)
Argentinidae	*Argentina silus*	Greater argentine	0.096	23	24.4 (9;44)
Osmeridae	*Mallotus villosus*	Capelin	0.282	268	15.6 (3.2;42.9)
Salmonidae	*Salmo salar*	Atlantic salmon	0.006	2	58.5 (31;86)
Sternoptychidae	*Maurolicus muelleri*	Pearlsides	0.000	9	8.3 (4;22.5)
Paralepididae	*Arctozenus risso*	White barracudina	0.001	19	25.4 (15;29)
Myctophidae	*Benthosema glaciale*	Glacier lanternfish	0.000	7	12.5 (3.5;33.5)
Macrouridae	*Macrourus berglax*	Rough-head grenadier	0.003	5	15.8 (10;23)
Gadidae	*Boreogadus saida*	Polar cod	0.245	135	17.2 (3.1;40.2)
Gadidae	*Gadiculus argenteus thori*	Silvery pout	0.010	18	12.9 (8;18)
Gadidae	*Gadus morhua*	Atlantic cod	5.598	365	28.5 (3.4;118)
Gadidae	*Melanogrammus aeglefinus*	Haddock	3.652	270	28.3 (3;70)
Gadidae	*Merlangius merlangus*	Whiting	0.001	3	30.7 (10.9;47)
Gadidae	*Micromesistius poutassou*	Blue whiting	0.500	55	35 (22;51)
Gadidae	*Pollachius virens*	Saithe	0.206	25	42.6 (7.5;86)
Gadidae	*Trisopterus esmarkii*	Norway pout	0.672	113	18.7 (1.8;43.1)
Lotidae	*Brosme brosme*	Tusk	0.028	14	43.4 (16;61)
Lotidae	*Enchelyopus cimbrius*	Fourbeard rockling	0.000	4	20.3 (11;29)
Lotidae	*Gaidropsarus argentatus*	Arctic rockling	0.001	4	28.3 (19;36)
Lotidae	*Molva molva*	Ling	0.002	1	75 (75;75)
Lophiidae	*Lophius piscatorius*	Anglerfish	0.004	2	80 (78;81)
Gasterosteidae	*Gasterosteus aculeatus*	Three-spined stickleback	0.000	7	7.6 (5;11)
Sebastidae	*Sebastes marinus*	Golden redfish	0.101	28	36.1 (8;64)
Sebastidae	*Sebastes mentella*	Deepwater redfish	1.418	121	20.7 (4;45)
Sebastidae	*Sebastes viviparus*	Norway redfish	0.022	20	22.2 (9;33)
Cottidae	*Artediellus atlanticus*	Atlantic hookear sculpin	0.011	142	8.1 (3;24)
Cottidae	*Gymnocanthus tricuspis*	Arctic staghorn sculpin	0.001	7	11.6 (7;20)
Cottidae	*Icelus bicornis*	Twohorn sculpin	0.000	22	7.1 (3.9;14.1)
Cottidae	*Triglops murrayi*	Moustache sculpin	0.005	44	10.2 (3.8;15)
Cottidae	*Triglops nybelini*	Bigeye sculpin	0.010	37	10.3 (4.2;16.2)
Cottidae	*Triglops pingelii*	Ribbed sculpin	0.001	17	13.4 (3.4;26.4)
Psychrolutidae	*Cottunculus microps*	Polar sculpin	0.002	26	11.3 (6;29)
Agonidae	*Leptagonus decagonus*	Atlantic poacher	0.003	84	12.7 (3.5;21)
Agonidae	*Ulcina olrikii*	Northern alligatorfish	0.000	1	7 (7;7)
Cyclopteridae	*Cyclopterus lumpus*	Lumpsucker	0.002	89	27.4 (7;50)

Cyclopteridae	*Eumicrotremus spinosus*	Atlantic spiny lumpsucker	0.003	13	6.9 (5;13)
Liparidae	*Liparis fabricii*	Gelantinous snailfish	0.000	11	8.8 (5.1;13)
Liparidae	*Liparis gibbus*	Variegated snailfish	0.000	10	9 (3.8;16.8)
Liparidae	*Liparis liparis*	Striped seasnail	0.000	7	8.2 (2.3;16.3)
Liparidae	*Careproctus sp*	Snailfish	0.001	56	10.6 (3.7;23)
Liparidae	*Paraliparis bathybius*	Black seasnail	0.000	4	15.6 (7;24)
Liparidae	*Rhodichthys regina*	Threadfin seasnail	0.000	1	9 (9;9)
Zoarcidae	*Lycenchelys kolthoffi*	Checkered wolf eel	0.000	5	17.5 (12.4;19)
Zoarcidae	*Lycenchelys muraena*	Moray wolf eel	0.000	1	18 (18;18)
Zoarcidae	*Lycodes adolfi*	Adolf's eelpout	0.000	1	11 (10;14)
Zoarcidae	*Lycodes esmarkii*	Greater eelpout	0.004	8	22 (10;57)
Zoarcidae	*Lycodes eudipleurostictus*	Doubleline eelpout	0.004	19	23.5 (9;38)
Zoarcidae	*Lycodes luetkenii*	Lütken's eelpout	0.002	2	48.3 (44;51)
Zoarcidae	*Lycodes paamiuti*	Paamiut eelpout	0.000	2	13.6 (2.9;23)
Zoarcidae	*Lycodes gracilis*	Vahl's eelpout	0.009	67	19.3 (10;43)
Zoarcidae	*Gymnelus retrodorsalis*	Aurora pout	0.000	9	12.2 (10;14)
Zoarcidae	*Lycodes pallidus*	Pale eelpout	0.002	29	15.2 (6;28)
Zoarcidae	*Lycodes reticulatus*	Arctic eelpout	0.004	19	23.9 (8;79)
Zoarcidae	*Lycodes rossi*	Threespot eelpout	0.002	19	15.6 (8;28)
Zoarcidae	*Lycodes seminudus*	Longear eelpout	0.001	11	19.2 (10;38)
Zoarcidae	*Lycodonus flagellicauda*		0.000	1	22.3 (20;24)
Stichaeidae	*Anisarchus medius*	Stout eelblenny	0.000	9	11.4 (7;17)
Stichaeidae	*Leptoclinus maculatus*	Daubed shanny	0.013	136	15.3 (4.2;40.6)
Stichaeidae	*Lumpenus lampretaeformis*	Snake blenny	0.012	75	20.3 (5.5;43)
Anarhichadidae	*Anarhichas denticulatus*	Northern wolffish	0.186	21	85.5 (5.7;131)
Anarhichadidae	*Anarhichas lupus*	Atlantic wolffish	0.058	47	22.7 (3.5;73)
Anarhichadidae	*Anarhichas minor*	Spotted wolffish	0.218	40	62.2 (11;115)
Ammodytidae	*Ammodytes marinus*	Lesser sand-eel	0.000	15	16.3 (6.4;39.3)
Pleuronectidae	*Hippoglossoides platessoides*	Long rough dab	1.232	180	21.6 (3.1;49)
Pleuronectidae	*Microstomus kitt*	Lemon sole	0.006	5	28.1 (13;48)
Pleuronectidae	*Reinhardtius hippoglossoides*	Greenland halibut	0.336	111	41.9 (4.5;75)