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Volume 1

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SURVEY REPORT

From the joint Norwegian/Russian ecosystem survey in the Barents sea August – October 2008

Volume I

PREFACE

The sixth joint ecosystem survey was carried out during the period 1 August to 4 October 2008. The survey encompasses various surveys that previously have been carried out jointly or at national basis. Joint investigations include the 0-group survey, the acoustic survey for pelagic fish (previously known as the capelin survey), and the investigations on young Greenland halibut north and east of Spitsbergen. Oceanographic investigations have always formed a part of these surveys, and studies on plankton have been included for many years. In recent years, observations of sea mammals, seabirds, bottom fishes and benthos have been included. Consequently, from 2003, these surveys were called “ecosystem surveys”.

The present volume of the survey report covers many but not all aspects of the survey. The main focus is on the hydrographical conditions of the Barents Sea, the results from the 0-group investigations and from the acoustic investigation on pelagic fish (capelin, young herring, blue whiting and polar cod). Preliminary materials on sea mammals and seabird observations are also presented in Volume 1 of the report. Finalised analyses of results from investigations on plankton, bottom fish 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 Tromsø 01 -03 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. Besides the participants on the vessels, the following specialists took part in the preparation of the survey report:

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Synopsis

The main aim of the ecosystem survey was to map the distribution and abundance of the young and adult stages of several demersal and pelagic 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 (+0.5-+1.2 ^{o}C) than the long term mean but somewhat lower than in the same period 2007. The 2008 year-class of capelin and cod are rich. 0-group of herring, redfish, eastern component of polar cod and sandeel are near the average level. 0-group of haddock is below the average. 0-group of Greenland halibut, saithe, long rough dab, wolffish and western component of polar cod were estimated to be poor.

Recovering, the total capelin stock exceeded 4.4 million tonnes, which is 2.4 times higher than in last year. About 2.5 million tonnes were assumed to be maturing. Estimated spawning stock is two times above to the long term mean and comparable with the last peak in 2000.
The polar cod stock was estimated to be 1.2 million tonnes, the same as last year and higher than the long term mean.

The biomass of juvenile Norwegian spring spawning herring in south-western areas was estimated to 0.37 million tonnes. In south-eastern areas biomass of 0.52 million tonnes is uncertain due to greate mixing of Norwegian spring spawning herring with Pechora herring. Large parts of the numberous 2004 year-class migrated to the southeastern part of the Barents Sea, usually dominated by younger year-classes.

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, and the biomass of this stock component was estimated to be 0.097 million tonnes, which is the fourth following year of decline since 2004, where the stock reached 1.4 mill. tonnes.

Photo: Dimitry V. Prozorkevitch

1 Methods

During the survey data on cruise tracks, hydrography, trawl catches, integrator values etc. were exchanged by e-mail between the Norwegian vessels and the Russian vessel "Vilnyus". Total Russian exchange of survey data were transmitted to IMR when the Russian vessel returned to port after the survey. Final survey data from RV "Jan Mayen" were received during the meeting in Tromsø.

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, Fugløya-Bear Island, Vardø-North, North Cape-Bear Island and Bear Island-West. All vessels used CTD-probes.

1.2 0-group fish investigations

The geographical distribution of 0-group fishes was estimated by the standard procedure which was first recommended in 1980 (Anon. 1980, Anon. 1983).

All vessels used a small mesh mid-water trawl ("Harstadtrål"). The standard procedure consisted of tows at 3 depths, each of 0.5 nautical miles, with the headline of the trawl located at 0, 20 and 40 m. When the 0-group fish layer was recorded on the echo-sounder deeper than 60 m or 80 m, additional tows at 60 and 80 m, of 0.5 nm distance were also carried out. The history of the development of the 0-group investigation and assessment method is described in details in the earlier versions of the survey report (e.g. Anon. 2007, and ealier.).

1.3 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 courselines 35 nautical miles apart.

All participating vessels used ER-60 echo sounders (with ER-60 software). The Norwegian vessels used LSSS ("Large scale survey system", also called "El-trippel-S"), while the Russian vessels used FAMAS post-processing system. "G.O. Sars", "Johan 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 (Norwegian vessels) or 5 (Russian vessels) 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).

1.3.1 Area coverage

The weather conditions were favourable during the whole period of the survey. During the first half of August a partly suboptimal survey design for synoptically coverage areas lowered the quality of the survey. Start of cooling and ice making at the end of September partly limited observations of "Vilnyus" to the north of 82° N. However, a total coverage of the Barents Sea was achieved. In 2008 the survey was started from the south. "Vilnyus" worked in the eastern part of the Barents Sea inside REEZ. "G.O. Sars" and "Johan Hjort" surveyed the western, northwestern and central parts, while "Jan Mayen" observed areas around Spitsbergen, see Figure 2.1-2.4 for details of the realized survey track.

1.3.2 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).

1.4 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.

1.4.1 Strata system used

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

1.5 Plankton investigations

Data on phytoplankton abundance was obtained in several ways during the joint Russian-Norwegian Survey. On the Norwegian vessels "G.O. Sars" and "Johan Hjort" 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 both 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. However, the fluorimeter was probably not operational during the 2008 survey.

Samples for phytoplankton species composition and abundance have been obtained from the Norwegian vessels G.O. Sars and Johan Hjort. 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 the 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. Additional stratified sampling was carried out daily by the Mocness multinet planktonsampler. 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, 100-0 m and 50-0 m layers.

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 >2000 µm 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.

1.6 Stomach investigations

According to agreement at the Russian-Norwegian meeting in March 2006 capelin stomachs were continuously collected at the Norwegian ("G.O. Sars" and "J. Hjort") and Russian ("Vilnyus") vessels in August-September 2008.

Also stomach samples of cod were taken according to standard protocol on all participating vessels.

1.7 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.

The 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.

1.8 Benthos observations

1.8.1 Purpose

The purpose of the benthos investigation was to

- Monitor of 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. It is of high priority that data gained with Campelen trawl should be calibrated against samples taken with 2 m beamtrawl/1 m Sigsby trawl together with video transects at dedicated stations.
- To continue established time series of benthic community monitoring by grab (RU and NO) together with Sigsby-trawl (RU) and 2 m beamtrawl (NO) sampling on PINROes historical stations.
- Make a environmaental survey of "Nucula" (Hydro petroleum investigation)

1.8.2 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 G.O. Sars at stations located as a line from coastal areas of North Cape and north of Hopen dypet. Also the Russian RV Vilnyus had increased benthic mapping. The sampling of the established time series was made at locations already decided by PINRO from previously established monitoring stations.

Selected stations of the "Nucula" field was based on detailed topographic map, whereas VMS satellite tracking data from the Norwegian Fisheries Directorate was used to identify areas with high fishing activity.

1.8.3 Gears and methods

The following gears were used during the ecosystem cruise:

- Campod (to document epibenthic habitats and megafauna).
- Beam trawl and Sigsby trawl (to collect animals that live on the seafloor).

- van Veen grab (provides samples to quantify animals that live upon and in the sediments).

The combination of different sampling gear shall provide a picture of the surface living animals (video and trawl) and animals from inside the sediment (grab).

1.8.4 Bottom trawl

At "G.O. Sars", 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. All other animals were made available for MAR BANK for bio-prospecting.

The other Norwegian research vessels sorted and measured the bycatch into large invertebrate groups which consequently was recorded in REGFISK. On the Russian research vessel, all or some of the bycatch was identified to species or sorted into larger taxa and consequently recorded in BIOFOX.

1.8.5 van Veen grab

Quantitative collecting of macro-zoobenthos was carried out with 5 x 0,1 m^2 van Veen grabs at each of the established stations of benthic community monitoring selected by PINRO. The samples were sieved in running seawater using a 1 mm sieve. Sieved bottom organisms with remains of sediments were fixed in 4 % neutralized solution of formaldehyde. Borax was used as a buffer. Onboard "Vilnyus", dominating species and forms of macro-zoobenthos were recorded in the observation log during sieving and fixing of the samples.

1.8.6 Epibenthos trawls

Qualitative sampling of zoobenthos was carried out with a modified Sigsby trawl (Vilnus) and a small beamtrawl ("G.O. Sars"). The Sigsby trawl had a steel frame of 1 x 0.35 m. The mesh size of the inner cover in the net was 10 mm, with a cod-end part with 5 mm mesh size knotless netting.

The beamtrawl had an opening of 2 m and a net similar to the Sigsby trawl (inner cover in the net =10 mm mesh, cod-end = 4 mm mesh size).

Trawling duration was set to 5 (beamtrawl) or 10 min (Sigsbytrawl) at a vessel speed of approximately 1.5 knots. The samples were sieved trough 10 and 5 mm (Vilnus) or 4 mm ("G.O. Sars") sieves. Organisms collected in the Sigsby trawl were sorted out and processed onboard. Dominating invertebrates were counted and length measured. Organisms that required further taxonomic identification were fixed in 75 % ethylalcohol and 4 % formalin for later examination. The samples from the beamtrawl were fixed in 4 % formaldehyde for sorting and identification in the laboratory ashore. The 5-minutes 2 m-beamtrawl haul covered a bottom area of approximately 500 m^2.

1.9 Pollution

Radioactive pollution has been transported into the Barents Sea during several decades. The most important sources are fallout from testing of nuclear weapons, the Chernobyl accident, and discharges from European nuclear reprocessing facilities. Radioactive waste dumped in the Barents and Kara Seas represents a potential contamination source.

Through the Norwegian monitoring program "Radioactivity in the Marine Environment (RAME)", coordinated by the Norwegian Radiation Protection Authority (NRPA), the levels of radioactive contamination in the Barents Sea are investigated thoroughly every third year. The Institute of Marine Research (IMR) is an important contributor to the RAME programme. Sample collection is performed onboard IMR's vessels and many of the analyses are performed at IMR's chemistry laboratory in Bergen. The collected samples consist of biota, seawater and sediments, and they will be analyzed for the anthropogenic radionuclides caesium-137 (Cs-137), technetium-99 (Tc-99), strontium-90, americium-241 (Am-241) and plutonium-isotopes, as well as the naturally occurring radionuclides radium-226 (Ra-226) and polonium-210 (Po-210). Most of the analyses are performed at IMR and NRPA.

1.9.1 Sample collection

The samples collected are listed in Tables 1.9.1 (sediments and seawater) and 1.9.2 (fish and benthos).

Seawater

Ten litres of seawater was collected per sample for Po-210 and Ra-226 analysis, while 50 l seawater was collected per sample for Sr-90 analysis. All samples were stored in plastic cans and acidified with hydrochloric acid. Per sample, 200 l of seawater was collected for Am-241 and Pu-isotope analysis. 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 for further treatment.

Approximately 400 l of seawater were passed through filters onboard for Cs-137-analysis. The filters will be brought back to IMR and NRPA for further treatment.

Samples of 50 or 100 l of seawater were collected for Tc-99-analysis. Onboard "Johan Hjort", the samples were passed through Amberlite IRA 400 anion exchange columns. The columns were brought back to IMR for further treatment. Onboard "G. O. Sars" and "Jan Mayen", these samples were stored in 25 l cans and sent to IMR.

Sediments

Both surface samples and sediment cores were collected from a selection of stations. Some of the sediment cores were cut onboard the vessels. The samples were frozen and brought back to IMR and NRPA for further treatment and will be analyzed mainly for Cs-137. Samples for analysis of organic contaminants and trace metals were collected from the same stations.

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, shrimp and benthos will be analyzed whole. The samples were frozen and brought back to IMR and NRPA for further treatment.

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

Many of the analysis are time consuming, and we plan to have the results ready within about a year.

Equipment used

- A shipboard pump was used to collect surface (5 m) seawater
- A CTD/rosette multi-bottle sampler with twelve 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

2 Results and discussion

Altogether, the joint survey included 141 vessel-days, compared to 210 in 2007, 205 in 2006, 208 in 2005 and 215 in 2004. Altogether, the vessels sailed about 20 000 nautical miles and observed 430 000 square nautical miles. In total, the Norwegian vessels carried out 470 trawl hauls and the Russian vessels 306 trawl hauls, in total 776 hauls were made during the survey (while 1007 hauls were made in 2007 and 999 hauls in 2006).

Survey routes with trawl stations, environmental stations (hydrographical and plankton) and benthos sampling stations are shown in Figures 2.1, 2.2 and 2.3, respectively.

As noted in the last year's report, both parties expressed their interest in the cooperation concerning the collection of oceanographic data on the standard sections in order to diminish the costs for research during the sea cruises. This cooperation was implemented in the cruiseplans. The results from both Norwegian and Russian standard sections are included in the report.

2.1 Hydrographical conditions

Figures 2.1.1-2.1.6 show the temperature and salinity conditions along the oceanographic sections: Kola, Kanin, Bear Island-West, North Cape-Bear Island, Fugløya-Bear Island and Vardø-North. The mean temperatures in the main part 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 surface and near bottom are presented in Figures 2.1.17-2.1.20.

In general the temperature was above the long-term mean throughout the Barents Sea. The surface water temperature anomalies in the southern central part of the Barents Sea and in the north eastern area were negative (down to about 0.5-1.0 °C). Positive temperature anomalies (1.3-2.2 °C) were observed in the north-eastern, south-eastern and south-western parts of the Barents Sea (Figure 2.1.17). In the bottom layer, positive anomalies of water temperature were found practically in all the observed areas (Figure 2.1.19). Large areas had bottom temperatures of 0.5-1.5 °C above average.

Compared to 2007, the surface temperature was lower (on average 0.5-1.0 °C). The water temperature in the southern Barents Sea was the same as in 2007. The highest negative deviations (more than by 3 °C lower in 2008) were found north of 78° N. Waters in the south-eastern Barents Sea were warmer than in the previous year. The highest positive deviations were more than 3 °C. The temperatures at 50 m depth were 0.5-1.0 °C lower than in the previous year (Figure 2.1.9). The bottom temperatures were the same as in 2007. The highest

negative deviations (1.0-1.5 °C lower in 2008) were found to the east of Spitsbergen Archipelago and at the area between 72°30′ N and 73°30′ N, 28° E and 32° E.

The surface salinity was in general slightly higher (by 0.1-0.3 on average) than the long-term mean. The highest salinity anomalies (more than 0.8) were observed at the Great Perseus Bank and in the eastern part of the Barents Sea. The bottom salinity was 0.1 higher than the long-term mean and was the same as in 2007.

The Kola section is divided into three parts. The inner part represents the Murmansk Coastal Current and contains mostly coastal water masses, the central part represents the Murmansk 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. In the 0-50 m layer in parts of the Murmansk Coastal Current and the Murmansk Current, the positive temperature anomalies were 0.1 °C, while in the Central Branch of the North Cape Current it was 0.4 °C. In the 0-200 m layer in the part of Murmansk Coastal Current the temperature anomaly was insignificant, and in the parts of the Murmansk Current and of the North Cape Current, the corresponding anomalies were 0.3 and 0.4 °C , respectively.

The Kanin section is divided into two parts. The inner part represents the Kanin Current and had a positive temperature anomaly of 0.1 °C in the 0-50 m layer. The temperature in the 0-200 m layer was near the long-term mean. The outer part represents the Novaya Zemlya Current and had positive temperature anomalies of 0.8 °C in the 0-200 m layer.

The Bear Island-West Section is divided into three parts representing the middle, the east-marine and the east-coastal branches of the Norwegian Current. Temperatures in the 0-50, 0-200 m and 0-500 m layers were all higher than average. The positive anomalies in all parts of the sections were 0.6-0.8 °C in the 0-50 m layer, 0.5-0.8 °C in the 0-200 m layer and 0.3-0.4 °C in the 0-500 m layer.

The main part of the North Cape-Bear Island Section represents the North Cape Current, which mostly contains Atlantic water masses. The temperature anomalies in 0-50 m and 0-200 m layers were 0.4 °C.

The southernmost part of the Fugløya-Bear Island section is in the Norwegian Coastal Current and the middle part in the North Cape Current. In the northern part the section cuts through the eastward flowing Bear Island Current and eastward flowing water masses in the deeper part of the Bear Island Trench. Similar to 2007, the stratification in the upper waters in the section is stronger due to northward spreading of coastal water, producing a strong pycnocline at about 50 m depth (Figure 2.1.5). The mean temperature in the North Cape Current is about 0.5 ^{o}C above the long-term mean for the period 1977-2004. The Bear Island Current and the outflow in the deepest part of the Bear Island Trench are warmer and fresher than in 2007.

The Vardø-North section covers in south the Norwegian Coastal Current and the Murmansk Current, containing both coastal and Atlantic water masses. North of this (about 72°15´-74° 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. In contrast to the Fugløya-Bear Island section, the Vardø-North section shows weaker stratification in the upper water masses, similar to the situation in 2007 (Figure 2.1.6). Both the Coastal Current and the Central Branch of the North Cape Current are colder and fresher than last year. The mean temperature in the Central Branch is about 0.5 °C above the long-term mean for the period 1977-2004.

The high sub-surface temperature in the Barents Sea is mostly due to the inflow of water masses with high temperatures from the Norwegian Sea. During the last 5-6 years the inflow to the Barents Sea has had high temperatures and been strong, and in particular the year of 2007 and the winter of 2007/2008 were warm. In the inflow area, the decrease in temperature from last year might indicate that the inflow now is being reduced.

2.2 Distribution and abundance of 0-group fish

The distribution of twelve species of 0-group fish (capelin, cod, haddock, herring, polar cod, saithe, redfish, Greenland halibut, long rough dab, wolfish, sand eel and blue whiting) and Gonatus is shown in Figures 2.2.1-2.2.13. Abundance indices calculated for nine fish species (capelin, cod, haddock, herring, polar cod, saithe, redfish, Greenland halibut and long rough dab) from 1980-2008 are shown in Tables 2.2.1 and 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 denser concentrations. The distribution of all species was well covered, except for Greenland halibut and polar cod, which were distributed further north and east of the observed area. The length frequency distributions of the main species are given in Table 2.2.3.

The 2008 year class of capelin is a record high, while the year classes of cod and long rough dab are high and can be characterized as abundant. The 2008 year class of haddock is close to average, while the year classes or herring, polar cod, saithe, redfish and Greenland halibut are poor.

The length distributions of the studied fish were all dominated by smaller fish, the mean fish lengths were therefore lower than in 2007, except for saithe, polar cod and Greenland halibut. In some cases fish otoliths were taken to split the 0-group from older fish.

2.2.1 Capelin

Since 2006, 0-group capelin have been distributed over a wide area - from the Norwegian and Russian coast up to 81˚ N and between 10˚ and 57˚ E (Figure 2.2.1). The larger catches of

capelin were taken in the central part of the Barents Sea, between 20° and 50˚ E and 68° and 76˚ N. Scattered concentrations were found in the western and eastern parts of the distribution area and also to the west and north of Spitsbergen.

Otoliths were taken regularly to split the 0-group from older fish. The samples showed that the maximum length of 0-group capelin was 6.5 cm, with the exception of two samples of 7.5 cm. The mean length of capelin was 4.4 cm, which is lower than in 2007. This is likely due to an increasing number of smaller fish; the catches contained 28 % capelin smaller than 4 cm.

The calculated density varied from 0 to 30 470 724 fish per square nautical mile. The mean catch per trawl haul was 4391 fish, which was above the levels of the last four years. In the last three years, the abundance of capelin has been really high, and the abundance in 2008 was four times higher than the long term average level, so the 2008 year class of capelin is a record high.

2.2.2 Cod

0-group cod were distributed over a wide area, as in previous years, and even more widely than in 2007 (Figure 2.2.2). Dense concentrations were registered in the western and central parts of the Barents sea from 70˚ N to 76˚ N between 17˚and 40˚ E, whereas scattered registrations were observed as far as 78˚ N and to the west and north of Spitsbergen up to 81˚ N. 0-group cod from bottom trawl catches were not taken into account of year-class abundance.

Otoliths were taken at some stations to split 0-group from older fish. The otolith readings showed that the maximum length of 0-group cod was 13.5 cm. For the last three years, the individual size of the 0-group cod has been nearly the same. The mean length was 7.2 cm in 2008.

The calculated density varied from 0 to 5 370 800 fish per square nautical mile. The mean catch was 875 fish per trawl haul, which is lower than in 2007.

The abundance index of the 2008 year class was the highest since 1998 and three times higher than the long term mean level. Therefore, the 2008 year class of cod is abundant.

2.2.3 Haddock

0-group haddock were distributed in the western part of the Barents Sea; from the coast up to 75˚ N, between 13˚ and 36˚ E and west and south of Spitsbergen. A few scattered catches were observed in the eastern areas as far as 46˚ E (Figure 2.2.3).

Otoliths were taken at a few stations to split 0-group from older fish. The otolith readings showed that the maximum length of 0-group haddock was 13 cm, but this must be interpreted carefully due to lack of larger 0-group fish in the age samples. The mean length of haddock

was 8.7 cm. The number of fish smaller than 7 cm was twice as high as in 2007, and caused a reduction of the mean length.
During the last three years, the mean catch per trawl haul has continuously decreased, and in 2008 it was 41 fish. The calculated density varied from 0 to 708 828 fish per square nautical mile.

The abundance index of 0-group haddock is somewhat lower than in 2007 and the average level. Therefore, the 2008 year class of haddock can be characterized as close to medium.

2.2.4 Herring

The distribution of 0-group herring has continuously decreased for the last two years. Scattered concentrations were registered from the coast of northern Norway and up to 75˚30′ N between 18˚ and 38˚ E (Figure 2.2.4). Some spots were found to the north and east of the described area, while dense concentrations were observed between 28˚-34˚ E and 71-73˚ N.

The mean length of herring was 5.7 cm. The number of fish smaller than 6 cm was three times higher than in 2007, and caused a reduction in the mean fish length.

Mean catch per trawl haul was 271 fish, less than in 2007. The calculated density varied from 0 to 2 857 146 fish per square nautical mile.

The 2008 year-class of 0-group herring is two times lower than the average level, and, therefore, the 2008 year class of herring can be characterized as poor.

2.2.5 Polar cod

The eastern component of polar cod was distributed mostly along western coast of Novaja Zemlja (Figure 2.2.5). Dense concentrations were observed close to the coast. The calculated density reached 1 456 598 fish per square nautical mile. The abundance index of the eastern component of 0-group polar cod is six times lower than the long term average, and therefore the 2008 year class of polar cod seems to be poor. 0-group polar cod distributes further north and east of the surveyed area, and only a small part of the total distribution was covered during this survey.

Scattered concentrations of the western component of polar cod were registered around Spitsbergen. The abundance index of the western component of polar cod is 94 times lower than the long term average, and hence the 2008 year-class may be characterized as very poor. Since 1980, a similar situation, with a strong dominance of the eastern component and at the same time extremely low abundance of the western component, has only been observed once, in 1987.

The length distribution of 0-group polar cod was similar to 2007; about 90 % of the fish was between 3 and 6 cm long. To identify 0-group fish, otoliths were taken at two stations. The otoliths showed that 1-year old polar cod were longer than 7 cm. Otoliths were taken from

fish between 3 and 4 cm only, and the results must therefore be interpreted carefully, due to lack of larger 0-group fish in age samples.

2.2.6 Saithe

The distribution of 0-group saithe was wider in 2007. In 2008, scattered concentrations were observed in several small areas in the southern part of the Barents Sea, from the coast of northern Norway to 75˚ N between 18-42˚ E (Figure 2.2.6).

Otoliths were taken at two stations to split 0-group from older fish. Otolith readings show a maximum length of 0-group saithe of 11.5 cm , but it must be interpreted carefully due to lack of larger 0-group fish (larger than 11.5 cm) in the age samples. The mean length of saithe was 8.9 cm which is higher than in 2008. The mean catch per trawl haul did not exceed one fish. The calculated density reached 5 328 fish per square nautical mile.

Since 2006, abundance indices have continuously decreased, and in 2008 they were four times lower than the long term average. The 2008 year-class may be assessed as very poor.

2.2.7 Redfish

0-group redfish was observed in two components: one was registered in the western part of the Barents Sea, and the other to the south and west of Spitsbergen (Figure 2.2.7). Distribution of redfish was smaller in 2008. Dense concentrations of redfish were registered north of the Norwegian coast up to 72˚ N and 16˚-24˚ E, while in the last two years it was between 14˚-37˚ E.

Otoliths were taken regularly to split 0-group from older fish. Otolith readings will be carried out later at the IMR; therefore a 6 cm limit for 0-group fish was used for calculation. The mean length for redfish was lower than in 2007, because the number of fish smaller 4 cm was three times higher in 2008. In 2008 the mean fish length was 3.4 cm.

The mean catch per trawl haul was 142 fish, about 16 times lower than in 2007. The calculated density reached 4 050 088 fish per square nautical mile, and only 4 % of the stations had fish densities higher than 1 000 000 fish per square nautical mile.

The abundance of 0-group redfish is seven times lower than the long term average. The 2008 year-class may be characterized as poor.

2.2.8 Greenland halibut

As in the previous two years, 0-group Greenland halibut were found only in small areas and in very low densities to the north, west and south of Spitsbergen (Figure 2.2.8). The distribution of Greenland halibut was not completely covered. Lack of samples from depths layers between 60 and 100 m may also influence the results. In addition, Greenland halibut starts to settle at the bottom before the ecosystem cruise is carried out. There might be a strong

variation in the time of larvae settling. Therefore the 0-group index, which is calculated from pelagic sampling, may not be a good index of Greenland halibut 0-group strength.

At some stations fish otoliths were taken to split 0-group from older fish. Otolith readings will take place at the IMR later. For abundance calculations, 10 cm was used as maximum length of 0-group fish, but Greenland halibut longer than 8.5 cm were not found during this survey. The mean length was 7.2 cm, which is higher than in 2007.

The mean catch did not exceed 1 fish per trawl haul. The calculated density reached 1852 fish per square nautical mile.

The 0-group index is five times lower than the long term average, and the 2008 year-class of Greenland halibut is very week.

2.2.9 Long rough dab

Long rough dab was mainly found in the south-eastern part of the Barents Sea, but some spots were also found in the western part (Figure 2.2.9). Denser concentrations of 0-group long rough dab were observed in a limited area between 38˚-52˚30′ E and 69˚-75˚ N.

The mean length was 3.2 cm, somewhat lower than in 2007. In most catches a fish length between 2.5 and 4 cm dominated.

Mean catch per trawl haul was 14.4 fish. The calculated density reached 210 554 fish per square nautical mile.

In total, the 2008 year-class of long rough dab is higher than average. The 2008 year class is the most abundant since 1995, and may be characterized as strong.

2.2.10 Wolffish

0-group Wolfish was found at four stations. Three catches were taken around Spitsbergen and one catch in the central part (Figure 2.2.10).

Mean catch not exceeded 1 fish per trawl haul. The calculated density reached 1747 fish per square nautical mile. No index calculated for this species.

2.2.11 Sandeel

Scattered distribution of 0-group sand eel was found in the central and eastern parts of the Barents Sea (Figure 2.2.11).

To identify 0-group fish, otoliths were taken at three stations. Otoliths reading shows length of 0-group sandeel up to 11.5 cm.

Mean catch was 2.8 fish per trawl haul, and it was lower than in 2006 and 2007. The calculated density reached 23 237 fish per square nautical mile. No index calculated for this species.

2.2.12 Blue whiting

0-group of blue whiting were caught near the Norwegian coast at two stations only (Figure 2.2.12). Otoliths were taken from fish between 4 and 10.9 cm for age determination; and all fish belong to the 0-group.

Mean catch was 4.4 fish per trawl haul. The calculated density reached 699 fish per square nautical mile. No index is calculated for this species.

2.2.13 Gonatus (Gonatus fabricii)

In the western part of the Barents Sea, distribution of Gonatus compared to the last four years was significantly increased and was similar to that observed in 2003. Both scattered and dense concentrations were registered to the north of the Norwegian coast up to 76˚ N and westward of 28˚ E. To the north of Spitsbergen it was found up to 81º N (Figure 2.2.13). No index is calculated for this species.

2.3 Distribution and abundance of pelagic fish

2.3.1 Capelin

Distribution

The geographical density distribution of capelin at age 1+ and for the total stock is shown in Figures 2.3.1 and 2.3.2. The total distribution area of the capelin was quite wide this year, covering most parts of the Barents Sea and to the west of Spitsbergen. The main concentrations were found east of the Hopen island and in the Central Bank area. Young capelin also had a wide distribution this year.

Sample echograms of capelin distribution in north-western and northern areas are shown in Figs 2.3.3-2.3.4. Echorecords of capelin mixed with different proportions of polar cod are in Figs 2.3.5-2.3.6.

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 2008 are summarized in the text table below. The 2007 estimate is shown on a shaded background for comparison.

The total stock is estimated at about 2.4 million tonnes, about 2.4 times higher than the stock estimated last year. This annual rate of increase is the same as observed from 2005 to 2006 and to 2007. About 56 % (2467.5 thousand tonnes) of this stock is above 14 cm and considered to be maturing. The 2007 year class (1-group) consists, according to this estimate,

of about 313 billion individuals. This estimate is about 1.4 times higher than that obtained for the 1-group last year. The mean weight is estimated at 3.1 g, which is 1.1 g lower than that measured last year, and 0.5 g below the long-term average. The biomass of the 2007 year class is about 0.97 million tonnes. 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.

Summary of stock size estimates for capelin

Year class		Age	Number (10^9)		Mean weight (g)		Biomass (10^3 t)	
2007	2006	1	312.9	221.7	3.1	4.2	970.1	928.1
2006	2005	2	231.4	54.8	12.1	15.5	2796.3	848.2
2005	2004	3	24.9	3.7	24.6	27.5	611.7	101.3
2004	2003	4	1.7	0.1	30.0	28.1	50.3	3.8
Total stock in:								
2008	2007	1-4	570.9	280.3	7.8	6.7	4428.5	1881.6

Based on TS value: 19.1 log L – 74.0, corresponding to $\sigma = 5.0 \cdot 10^7 \cdot L^{1.91}$

The estimated number of fish in the 2006 year class (2-group) is about 231 billion, which is about 4.2 times higher compared to the 2005 year class measured last year. Consequently the biomass of the two years old fish is about 2.80 million tonnes. The mean weight at this age is 12.1 g, that is lower than in last year (15.5 g), but 1.4 g above the long-term average (Table 2.3.2).

The 2005 year class is estimated at about 25 billion individuals with a mean weight of 24.6 g, giving a biomass of about 0.6 million tonnes. The mean weight is 5.5 g above the long-term average. The 2004 year class (now 4 years old) is estimated at 1.7 billion individuals. With a mean weight of 30 g, this age group makes up only about 50 thousand tonnes. Practically no capelin older than four years was found.

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 increased again, up to 85 % in 1992-93. This 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 again. The results of the calculation for the year classes 1992, 1994, and 2006 show, however, that either the 1-group are underestimated or the 2-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

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 Figures 2.3.7 and 2.3.8. The main concentrations were found along the west and the south coast of Novaja Zemlja and in the area between the archipelagos Spitsbergen-Frans 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.

Distribution

In northern areas polar cod was found between 22º and 55º E to the north of 77º N and up to 82º N between 42˚ and 51˚ E. South of 77º N, polar cod distributed mainly to the east of 42º E. The densest registrations of polar cod were found in two areas: to the west of Novaja Zemlja and to the south of the archipelago Frans Josef Land. During the trawl survey for Greenland halibut in the areas around Spitsbergen, polar cod were caught by bottom trawl in the studied areas, but in smaller area than in last year. Figure 2.3.9 shows typical acoustic registrations of polar cod.

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 2008 are summarized in the text table below. The 2007 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)	
2007	2006	1	41.7	29.5	10.1	10.9	421.8	321.2
2006	2005	2	18.1	25.8	28.8	28.8	522.0	743.4
2005	2004	3	5.9	3.2	42.0	45.1	247.8	145.8
2004+	2003+	4	0.4	0.3	67.4	61.6	27.8	19.6
Total stock in:								
2008	2007	1-4	66.1	58.8	18.4	20.9	1219.4	1230.1

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 2007 year class (the one-year-olds) is almost 30 % higher than the one-group measured last year. Therefore, the biomass of one-year-olds is 1.3 times higher compared to last year. The abundance of the 2006 year class (the two-year-olds) is 18.1 billions. This is almost 30 % lower than the 2-group found last year with the same mean weight. The biomass has, therefore, decreased 1.4 times compared to the 2005 year class estimated last year. The three-years-old fish (2005 year class) is about 5.9 billions, that is 1.8 times higher than the 3-group estimated last year. The mean weight is lower, but the biomass

of this age group is almost 1.7 times higher than that for the corresponding age group during the 2007 survey. The four-year-olds (2004 year class) are scarcely found and estimated at the same level as in last year. Also, there were fish with age 5 and 6, but in insignificant quantities. The total stock, estimated at 1.2 million tonnes, is equal to that found in 2007 and indicates that the polar cod stock is presently quite stable.

Total mortality calculated from surveys

Table 2.3.6 shows the "survey-mortality rates" of polar cod in the period 1985 to 2008. 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 the 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 2003-2004, and from 2006-2007, there are negative survey mortalities for age groups 1 and 2, and in 2003-2004 also for age group 2 and 3, confirming the impression expressed previously that in some years the estimate for various reasons were underestimated. Apart from these years, the survey mortalities have been quite stable in recent time.

2.3.3 Herring

In the Barents Sea, only young Norwegian spring spawning (Atlantic) herring is present. At age 3-4, the herring migrates to the Norwegian Sea, where it spends the rest of their adult life. Young herring have large fluctuations and abrupt changes in numbers in the Barents Sea.

In some cases, it is difficult to assess the herring stock size during autumn. The main problem is distribution of herring schools close to the surface, above the range of the echo sounders. In the last two years a new problem has occured. Firstly, due to warming conditions, young Atlantic herring has migrated further southeast where the water area is shallow (30-50 m depth). Consequently, most of the herring spread above the sounder. Schools of herring were well visible from shipboard and some fishes jumped out ahead of the vessel, but was not registered by the echo sounder. Secondly, a sudden increase in the numbers of local Pechora herring was observed in the open parts of the Barents Sea. Both aggregated into mixed concentrations, and it is impossible to split their Sa values. Therefore, in the eastern part of the Barents Sea an estimation of "mixed" herring has been done.

Distribution

The distribution of young herring is shown in Figure 2.3.10.

Total distribution area of herring in 2008 was similar to that observed in the previous year and was divided into eastern and western components. Western juvenile of Atlantic herring with a predominance of 3+ year olds were distributed over a large area between 16° and 26° E up to 75° N.

The eastern component was distributed between 34° and 52° E along the Russian coast. In this area, Atlantic herring and Pechora herring were mixed in different ratio. For both species, herring at age 3+ and 4+ prevailed.

Abundance estimation

The estimated number and biomass of eastern and western components of herring per age- and length group are given separately in Tables 2.3.7 and 2.3.8. The main results of the abundance estimation in 2008 are summarized in the text table below. The 2007 estimate is shown on a shaded background for comparison. Due to the mixed distribution noted above, the total stock assessment of Atlantic herring in this report is 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)	
2007	2006	1	0.0296	3.9	20.27027	37.4	0.6	147.5
2006	2005	2	1.6264	2.6	47.28234	83.8	76.9	217.5
2005	2004	3	3.987	6.3	72.05919	127.0	287.3	810.1
2004	2003	4+	4.1164	0.3	127.2714	181.2	523.9	45.7
Total stock in:								
2008	2007	1-4+	9.7594	13.2		92.7	888.7	1220.9

Based on TS value: 20.0 log L – 71.9, corresponding to $\sigma = 8.1 \cdot 10^{-7} \cdot L^{2.00}$

Total abundance of both herring species was estimated at $9.7 \cdot 10^9$ sp. and biomass at $0.89 \cdot 10^6$ t, that is somewhat lesser than last year. The number of Atlantic herring at age 1-3 years old was considerably decreased compared to the previous year. Numbers of herring at age 4 has increased, but elements of Pechora herring can have mad this estimation uncertain. The mean weight of all age classes was lower than last year because the Pechora herring's mean weight was considerably lower for the same length and age compared to Atlantic herring.

2.3.4 Blue whiting

In the southwestern 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.

Distribution

The distribution of blue whiting (all age groups) is shown in Figure 2.3.11. As in 2007 the distribution area stretches eastward from the western border of the covered area up to 32° E. Compared to previous years, blue whiting were found in several local areas, and the total distribution area was significantly decreased.

Abundance estimation

The estimated number and biomass of blue whiting per age- and length group are given in Table 2.3.9. Total abundance was estimated to be 0.6×10^9 individual fish and the biomass to 0.1×10^6 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 numbers, and the age distribution has been shifted towards older fish. The main bulk of this stock component in 2008 consisted of 2004-

2001 year-classes at age 4-7. Older fish were found in smaller quantities, and only insignificant numbers of fish younger than four years old were found.

2.4 Demersal fish

Figures 2.4.1-2.4.10 show the distribution of demersal fish. Appendix 3 lists the number of fish sampled during the survey, and stomach samples are presented in Appendix 4. Age-based biomass assessments of main commercial fishes, as well as detailed analyses from the samples taken, will be made available as electronic attachment to the report on the internet.

2.4.1 Cod

The distribution area of cod in the Barents Sea (Figure 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 reached the limits of its natural habitat and could spread far north and east. Compared to the last year, the observations of cod distribution were basically similar. A reduced concentration of cod in the central parts of the Barents Sea is the main difference in distribution compared to 2007.

Two main concentrations were observed: one south of the Novaya Zemlya archipelago, and the other on the Great Bank, to the north-east of Hopen Island.

2.4.2 Haddock

The haddock distribution (Figure 2.4.2) was absolutely covered by the survey. Haddock were distributed in the large area from coast to 79°N and to east until 57°E. Main dense concentrations were found between 38-44°E along Murman Coast and to the north from Bear Island.

2.4.3 Saithe

No considerable concentration of saithe was found during the survey. Compared to the survey in 2007, the distribution area (Figure 2.4.3) was predominantly the same. Essentially, saithe were distributed in the warm water masses along the coast of Norway and Russia between 19-37° E. Also in 2008 saithe has been caught on Great Bank to the northeast from Hope Island.

2.4.4 Greenland halibut

Mainly young Greenland halibut were observed (Figure 2.4.4), because the adult part of the stock were distributed outside the survey area. The main concentrations were located in traditional places on the slope around Bear and Hope Islands and in the deeper part around Spitsbergen until to Franz Josef Land archipelago. In the central part of the Barents Sea, catches of Greenland halibut were taken to the east until 50° E (compared to 48° E in 2007). Increasing concentrations of Greenland halibut to the north and west of Franz Josef Land archipelago, is the main difference in distribution compared to 2007.

2.4.5 Golden redfish (*Sebastes marinus*)

Sebastes marinus (Figure 2.4.5) were distributed in the same part of the Barents Sea basin as in previous years. Most larger catches were taken in the central part of the Barents Sea. The main densities were detected between 71°-73° N and 22°-32° E and along the shelf slope to the west and north of the Spitsbergen archipelago.

2.4.6 Deep-water redfish (*Sebastes mentella*)

The main dense concentrations of *Sebastes mentella* were distributed in the same area as in 2007 (Figure 2.4.6), and were found in western and north-western parts of the Barents Sea. Most concentrations were located along the shelf slope off the Bear and Hopen islands and to the west of the Spitsbergen archipelago.

2.4.7 Long rough dab

As in previous years, distribution of long rough dab (Figure 2.4.7) was wider than the other species. It was found in practically all areas, and its catches were quite significant in most cases. Catches of LRD were taken as far east as 58° E and north as 82° N.

2.4.8 Wolffishes

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 2007 Atlantic wolffish spread more limited (Figure 2.4.8) and catches were lower. As last year, Atlantic wolffish were not found to the east of the Spitsbergen archipelago and to the south of Novaya Zemlya.

Compared to 2007, spotted wolffish were spread more widely (Figure 2.4.9), especially to the north and east.

In the current year, the distribution of northern wolffish was similar to that observed in 2007, with a small increase in the west Spitsbergen area (Figure 2.4.10). Most concentrations were located in the central areas and along the continental slope to the west of Spitsbergen.

2.4.9 Sand eel

Sand eel were only caught at one station during the survey.

2.5 Non-target fish species

A list of all fish species caught during the survey is given in Appendix 5. Some species were chosen as indicator species to demonstrate the distribution patterns of fishes from the different zoogeographic groups: thorny skate, Norway pout, snake pipefish, Atlantic poacher and Arctic alligator fish (Figures 2.5.1-2.5.5).

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

As in 2007 this species was quite widely distributed in the Barents Sea, excluding south eastern and north-eastern regions (Figure 2.5.1). In all observed areas, catches of this species were higher than in 2007. The main larger catches were taken in the central area, around Bear Island and to the west of Spitsbergen. As last year, a strong correlation between negative anomalies of bottom temperature and catch level of skate was observed.

2.5.2 Norway pout (*Trisopterus esmarkii),* boreal zoogeographic group

The species was distributed mainly in the south western part of the Barents Sea (Figure 2.5.2). The main concentration of Norway pout was found on the Norwegian coast between 18° and 28° E. As last year, they were not found near the west coast of Spitsbergen. In total, the distribution area and frequency of Norway pout were nearly the same as in 2007, but the mean catch was 10 times increased.

2.5.3 Snake pipefish (*Entelurus aequoreus),* southboreal atlantic zoogeographic group

Snake pipefish were first registered in the Barents Sea ecosystem survey in 2005, following an expansion of the species range from the North Sea and northward through the Norwegian Sea (Beare et al., 2006). In 2006 and 2007, the intrusion into the Barents sea expanded north to 81° N and east to 35° E, with some scattered observations further east. In 2008, the distribution area and catch rates of snake pipefish decreased significantly. The northernmost observation was almost the same as in the two previous years - up to 81˚ N, but to the east the main area of this species was limited to 25˚ E, and only two small catches were taken near the coast of the Varanger peninsula (Figure 2.5.3). Most of the catches did not exceed 3 species per trawl haul.

2.5.4 Atlantic poacher *(Leptagonus decagonus),* arcto-boreal zoogeographic group

Distribution of Atlantic poacher in 2008 was near the same wide as in 2007, and it was found between 10˚ and 57˚ E from 69˚ N in the south eastern area up to 81˚ N (Figure 2.5.4). Only to the north east of Spitsbergen (as in last year) this species was not found. Compared to the previous year, the frequency occurrence was 1.4 times lesser, and mean catch per nautical mile did not exceed 21 fish.

2.5.5 Arctic alligator fish (*Ulcina olriki),* arctic zoogeographic group

This typical Arctic kind of fish was found in 22 bottom trawl catches in the south-eastern part of the Barents Sea (Figure 2.5.5). The maximum catch did not exceed 100 species per nautical mile. A strong correlation between negative anomalies of bottom temperature and catch level of Arctic alligator fish was observed.

2.5.6 New and rare species in the Barents Sea

During the survey, two species were caught which have never been seen during joint investigations. One was the **Deal fish** (*Trachipterus arcticus*), which is more typical for the southern part of the Norwegian Sea. It was caught at 73˚27′8'' N and 38˚34′4'' E, at 0-40 m depth, by pelagic trawl on "G.O. Sars". The length of the fish was 1.5 m and the weight 6.5 kg.

The other species was **Polar place (*Pleuronectes glacialis*).** It is common in Arctic areas, but has not been caught during previous joint surveys. Three species of this fish were caught at 69˚10′ N and 55˚19′ E, at depth 20 m depth by pelagic trawl on "Vilnyus". The length of were 17-18 cm and in total their weight was 188 g.

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 attachments 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 Figure 2.4 and Figure 2.7.1. The main results of the zooplankton observations will be presented in an electronic attachment after the data have been analyzed in the laboratories.

From Figure 2.2 and Figure 2.7.1 it is apparent that the investigated area is very well covered as seen from the number of CTD stations taken. However, due to time limitations the coverage was less satisfactory compared to the years 2007 and 2006, seen from a zooplankton point of view. The table below gives an overview of the zooplankton hauls for the 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 2008.

	Norwegian ships		Russian ships	
Net	«G.O.Sars»	«J.Hjort»	«Vilnyus»	«Smolensk»
WP-2	159	42	-	-
Juday	-	-	181	-
MOCNESS	13	11	-	-

A map of the zooplankton biomass distribution based on joint Russian and Norwegian data is shown in Figure 2.7.1. From the Norwegian data, sampled in the western part, it is evident that a greater region of the Barents Sea has a very low biomass in 2008. Compared to 2007 the influence of the normally higher biomass region of the western Barents Sea, is still comparatively low. The average zooplankton biomass in 2008, based only on Norwegian data (i.e. the western half of the Barents Sea), is 6.48 g/m^2, a reduction compared to the 7.13 g/m^2 observed in 2007. 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 (Figure 2.7.1.). However, because of limited availability of sampling in the north, we had no data on the 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 159 WP-2 hauls (100-0 m and bottom-0 m) were conducted at 85 stations. From the Norwegian vessels no Juday net was deployed during the ecosystem survey in 2008. Hauls taken by "Johan Hjort" west of the 500 m depth contour is not included, nor are data from the 200-0 m net hauls where bottom depth significantly exceeds 200 m. On "Johan Hjort", a total of 42 WP-2 hauls (100-0 m and bottom-0 m) were conducted at 22 stations east of the 500 m bottom contour in the Barents Sea. A total of 98 stations from both Norwegian ships satisfied the extraction criteria for the bottom-0 m 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. A 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 paries with regard to working up samples, exchange of raw data, analysis and publication in relevant reports, symposia and 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

The marine mammal data were taken from the research vessels during the Ecosystem survey in August-September. The abundance of marine mammals is presented in the Table 2.8.1. The distributions are shown in Figures 2.8.1-2.8.2.

More than 2000 individuals of marine mammals comprising 12 identified species were recorded in the Barents Sea during the Ecosystem survey in 2008. The most abundant species were the white-beaked dolphins (approximately 30 % of the total number of observations and more than half of all recorded individuals). Large groups of dolphins were registered in the area of the Great Bank, the Central Bank and the Eastern basin, where they were feeding on capelin. It is marked that white-beaked dolphins were hunting together with humpback whales on the large schools of capelin.

Among the odontocetes, there were also the harbour porpoises, killer whales and sperm whales were. Harbour porpoises were observed in the southern part of the Barents Sea in the coastal zone. Single registrations of killer whales were made in the south-eastern and eastern part of the Sea. Sperm whales were observed along the continental slope towards the Norwegian Sea.

Of the baleen whales, minke, humpback, and fin whales were the most often observed species. Compared to 2007, there has been a 50 – 70 % decline in number of baleen whales observed. The reason for this is unknown, but could be related to distribution shifts or that the baleen whales were leaving the system earlier than previous years. The main aggregations of minke whales were in the central and northern parts of the Barents Sea. . The majority of fin whales were concentrated around Spitsbergen and near the Bear Island, while some individuals were observed at the ice edge. The main groups of humpback whales were registered in their traditional area – east of Spitsbergen. Three blue whales were observed north of Spitsbergen.

Among the pennipeds harp seals, hooded seals and walruses were observed (Figure 2.8.3). Among the seals, the most abundant were harp seals, which were observed mainly north of 79°N. A single harp seal was recorded in the central part of the Barents Sea. A single hooded seal and a single walrus were observed to the North from Spitsbergen.

Two polar bears were observed to the west of Franz Josef Land.

2.8.2 Seabirds

During the ecosystem cruise, 4 376 observations of 59 115 individual birds from 25 species were recorded at the vessels "Vilnyus", "Johan Hjort", "Jan Mayen" and "G.O. Sars" (Table 2.8.2). Northern fulmar, kittiwake and Brünnichs guillemot were the single most observed species, comprising 34 %, 19 % and 14 % of all observations, respectively. However, northern fulmars and gulls are ship-followers, and hence, the numbers and distribution may greatly depend on the presence of the ship, Russian observers on board "Vilnyus" did not record the occurrence of these species in 2008.

Northern fulmars, only recorded by the Norwegian observers, were observed throughout most of the surveyed area (Figure 2.8.4), and dominate in the areas in which they were observed. The total number of individuals observed has increased dramatically since 2007 (43 543 vs 5 600 individuals), suggesting an increased abundance of fulmars in the Barents Sea. Among the tubenosed birds (*Procellariformes*), also sooty shearwaters (9 individuals) were observed.

The distribution of the gull species, as observed from Norwegian vessels, are given in Figure 2.8.4. Kittiwakes were the dominating gull, occurring mostly in the central Barents Sea. Glaucous gulls inhabited the western areas between Bear Island and Spitsbergen. Herring and black-backed gulls were common in the southern Barents Sea. Five observations of 8 ivory gulls were recorded in the northern end of the surveyed area, west of Franz Josef Land.

The alcids were observed throughout the study area, but they were more numerous in the central Barents Sea than in the western and eastern Barents sea (Figure 2.8.5). However, species abundances and distributions varied geographically. Puffins dominated in the south-western areas, common guillemots in the south-east, and Brünnichs guillemots in the central and northern areas. Little auks were numerous in the northern Barents Sea, while black guillemots, also a northern species, where not observed this year. Razorbills were observed 17 times (31 individuals) in the same areas as common guillemots.

Skuas were abundant in the central and northern Barents Sea, and pomarine skua dominated numerically (Figure 2.8.6). Arctic skua dominated in the south, great skua around Bear Island and long-tailed skuas were generally observed in the south-eastern Barents Sea.

More anecdotal observations of other aquatic birds were also registered; common eiders and Arctic terns were observed in the central and southern Barents Sea, gannets and European shags were observed in the southern Barents Sea, and purple sandpipers were observed in the

eastern Barents Sea. Among the terrestrial bird species were both pied wagtail and northern wheateater observed during the cruises.

The observed distributions of birds shown in Figures 2.8.4-2.8.6 are not effort corrected. Due to unfavourable weather and light conditions, observers were active in only parts of the survey time, which may yield biased distribution maps. Furthermore, a greater observation effort on the vessels "G.O. Sars", "Jan Mayen" and "Johan Hjort" (one dedicated seabird observer) than on "Vilnyus" (one combined marine mammal and seabird observer) likely yield observed seabird densities biased towards the western Barents Sea.

2.9 Benthos investigations

The five vessels involved in the ecosystem survey in 2008 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 1 g to 2000 kg among trawl hauls.

The eight animal groups – Annelida, Bryozoa, Coelenterata, Crustacea, Echinodermata, Mollusca, Porifera and Varia were used for the bentic bycatch distribution analysis. The total biomass of all registered invertebrate bycatch (exept *Pandalus borealis* "deep sea prawn", *Paralithodes camtschatica* "king krab" and *Chionoecetes opilio* "snow crab") was summarised per station and is presented in Figure 2.9.1. The biomass hotspots were located on the shallow banks and the continental slope. The low biomasses were in the central part of the Barents Sea.

Figure 2.9.1 shows that the sponges make up larger part of the biomass in the south-west of the research area and in the areas of the continental slope (for example in the West Spitzbergen slope area). The echinoderms (sea stars, sea urchins, brittle stars, sea cucumbers and sea lilies) make up large proportions of the biomass in the 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.

2.9.1 King Crab (Paralithodes camtschaticus)

The distribution area for king crab located close to the coast between 31-42° E (Figure 2.9.2). Compared to the previous year, the total area and number of catches with king krab significantly decreased. The westernmost catch was in the Varanger fjord. The maximal quantity of king crab exceeded 100 specimens per nautical mile and was registered on RV "Vilnyus" near the coast at 40˚ E. Several trawl stations close to the shore and inside the fjords need to be made in order to make a realistic distribution map of red king crab. This is not possible with the large ships participating in the ecosystem cruise network.

2.9.2 Snow crab (*Chionoecetes opilio*)

In the eastern part of the Barents Sea, the distribution area of snow crab was nearly the same as last year. But frequency occurrence of snow crab increased in 2008 compared to earlier years (Figure 2.9.3). This species was registered on 74 stations (compared with 55 stations in 2007 and 3 stations in 2006). Abundance of snow crab in most cases exceeded 50 and even 100 specimens per nautical mile.

2.9.3 Northern shrimp (*Pandalus borealis*)

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

3 References

Anon. 1980. Preliminary report of the International 0-group fish survey in the Barents Sea and adjacent waters in August/September 1978. Annals biol., Copenh. 35:237-280.

Anon. 1983. Preliminary report of the International 0-group fish survey in the Barents Sea and adjacent waters in August/September 1980. Annals biol., Copenh. 37:259-266.

Anon. 2006. Survey report from the joint Norwegian/Russian ecosystem survey in the Barents Sea in August-Jctober 2006 (vol.1). IMR/PINRO Joint Report Series, No.2/2006.ISSN 1502-8828.90 pp.

Anon. 2007. Survey report from the joint Norwegian/Russian ecosystem survey in the Barents Sea in August-September 2007 (vol.1). IMR/PINRO Joint Report Series, No.4/2007.ISSN 1502-8828.97 pp.

Beare, D, Harris, M.P., Toresen, R., Nøttestad, L., Kloppmann, M., Dorner, H., Peach, K., Rushton, D.R.A., Foster-Smith, J., Wanless, S. 2006. A major increase in snake pipefish (Entelurus aequoreus) in northern European seas since 2003: potential implications for seabird breeding success. Marine Biology 151(3): 973-983.

4 Tables

Table 1.9.1. Overview of pollution sampling on sediments and seawater

					Surface sediments Analysis			Sed. cores Analysis	Seawater Analysis					
	Station	Date	Lat	Long	Cs-137	Org. cont.	Metals	Cs-137	Cs-137	Tc-99	Pu/Am	Sr-90	Po-210	Ra-226
G. O. SARS	372	21.08.08	73.72	13.27					x	x	x	x	x	x
	372 (1693 m)	21.08.08	73.72	13.27	x	x	x	x	x	x	x		x	x
	374	22.08.08	74.50	6.99					x	x	x	x	x	x
	404	27.08.08	71.25	28.73					x	x	x	x	x	x
	404 (395 m)	27.08.08	71.25	28.73	x	x	x	x		x	x		x	x
	417	30.08.08	71.80	36.07					x	x	x	x	x	x
	417 (264 m)	30.08.08	71.80	36.07	x	x	x	x		x	x		x	x
	441/442/443	04.09.08	75.00	31.22					x	x	x	x	x	x
	441/442/443 (351 m)	04.09.08	75.00	31.22	x	x	x	x		x	x		x	x
	453	06.09.08	76.82	43.01	x	x	x	x	x	x	x	x	x	x
	473	12.09.08	74.53	41.30	x	x	x	x	x	x	x	x	x	x
JOHAN HJORT	647	02.09.08	70.50	19.99					x	x	x	x	x	x
	654	02.09.08	71.75	19.73						x				
	658	03.09.08	72.75	19.52						x				
	666	03.09.08	74.25	19.16					x		x	x	x	x
	667	04.09.08	74.54	21.65						x				
	675	06.09.08	78.21	27.17		x	x	x	x	x				
	677	07.09.08	78.78	35.96					x	x	x	x	x	x
	677 (235 m)	07.09.08	78.78	35.95		x	x	x		x	x		x	x
	684	08.09.08	76.45	27.76	x	x	x		x	x				
	688	09.09.08	75.92	30.26					x	x				
	692	11.09.08	74.17	30.40					x	x				
	694	11.09.08	75.26	25.78	x	x	x		x	x				
	699	13.09.08	73.97	21.93		x	x	x	x	x				
	702	13.09.08	72.94	26.46		x	x	x	x	x				

Table 1.9.2. Overview of Pollution sampling on fish and benthos

	Station	Date	Altitude	Longitude	Species
JOHAN HJORT	322	02.09.2008	71.18	19.91	cod, haddock
	325	03.09.2008	72.79	19.52	shrimp, blue whiting, long rough dab
	328	04.09.2008	74.54	21.58	cod
	331	04.09.2008	74.65	23.75	Atlantic wolffish, Greenland halibut
	332	04.09.2008	75.00	23.64	capelin
	344	06.09.2008	78.23	27.27	polar cod, Greenland halibut
	363	08.09.2008	77.02	27.61	nordlig knurrulke (hele)
	377	10.09.2008	75.28	27.91	redfish
	379	10.09.2008	74.73	30.39	Brittel star, sea cucumbers
	380	10.09.2008	74.70	30.47	0-group cod
	384	11.09.2008	74.51	29.06	0-group cod
	394	12.09.2008	74.15	28.14	0-group capelin
	397	12.09.2008	74.09	25.09	Brittel star, sea anemones, sponges
G. O. SARShad	?	20.08.2008			blue whiting
	?	20.08.2008			mackerel
	?	20.08.2008			herring
	?	21.08.2008	74.28	19.27	haddock, capelin, cod
	2685	27.08.2008	71.51	30.25	shrimp, cod, redfish
	2679	26.08.2008	71.11	26.58	haddock, krill
	2692	28.08.2008	72.28	34.2	long rough dab, capelin, shrimp, cod
	2706	01.09.2008	70.104	30.579	herring
	2707	01.09.2008	70.104	30.579	cod
	2712	02.09.2008	70.75	31.217	long rough dab, shrimp
	2716	02.09.2008	71.25	31.217	long rough dab, cod, haddock
	2717	02.09.2008	71.25	31.217	capelin
	2719	03.09.2008	73.25	31.217	haddock, cod
	2728	05.09.2008	77.654	32.848	capelin
	2729	05.09.2008	77.654	32.848	long rough dab, cod, haddock
	2733	06.09.2008	77.49	40.91	capelin
	2741	07.09.2008	76.984	38.607	cod
	2743	07.09.2008	76.994	37.946	long rough dab, haddock
	2744	07.09.2008	76.994	37.946	long rough dab, cod
	2753	08.09.2008	76.467	35.202	long rough dab, shrimp, haddock, cod
	2754	08.09.2008	76.417	37.669	haddock
	2760	09.09.2008	75.675	42.085	capelin
	2761	09.09.2008	75.675	42.085	shrimp
	2762	09.09.2008	75.768	39.763	long rough dab, Greenland halibut, redfish
	2766	10.09.2008	75.887	35.046	long rough dab, cod, haddock
	2767	10.09.2008	75.887	35.046	polar cod
	2770	10.09.2008	75.912	32.664	haddock, cod
	2775	11.09.2008	75.262	37.18	long rough dab, cod
	2778	11.09.2008	75.193	39.441	cod
	2785	12.09.2008	74.684	36.964	capelin
	2786	12.09.2008	74.684	36.964	long rough dab, shrimp, haddock, cod
	2787	12.09.2008	74.728	34.769	haddock
	2794	13.09.2008	74.148	34.647	haddock
	2795	13.09.2008	74.105	36.764	cod
	2805	14.09.2008	73.466	38.61	cod
	2811	15.09.2008	73.589	32.48	haddock, blue whiting, cod, redfisk, Norway pout
	2818	16.09.2008	72.411	28.561	polar cod
	2819	16.09.2008	72.411	28.561	long rough dab, haddock, cod, redfish, Norway pout, shrimp
	2820	16.09.2008	72.375	26.645	long rough dab, cod

Table 2.1.1. Mean water temperatures in the main parts of standard oceanographic sections in the Barents Sea and adjacent waters in August-October 1965-2008

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 (NCB, 71º33´N, 25º02´E – 73º35´N, 20º46´E), Bear Island – West (BW, 74º30´N, 06º34´E – 15º55´E), Vardø – North (VN, 72º15´N-74º15´N,31º13´E) and Fugløya – Bear Island (FB, 71º30´N, 19º48´E – 73º30´N, 19º20´E).

Year	Section and layer (depth in metres)								
	Kola	Kola	Kola	Kanin S	Kanin N	NCB	BW	VN	FB
	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	4.7	6.3
Average (1965-2008)	7.5	3.9	4.8	4.4	3.4	5.8	4.8	4.3	5.9

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	284259	175817	392700	50265	30637	69893	2562	860	4265	15727	4306	27147	9364	0	19623
Mean	73685			18590			3724			28906			64660		

Table 2.2.1. Continued

Year	Saithe			Greenland 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	43	21	65	6	0	13	941	399	1484	6649	845	12453	91	0	182
Mean	186			30			603			36323			8568		

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

Year	Capelin			Cod			Haddock			Herring		
	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	979 481	616554	1342408	218851	127536	310166	9069	1339	16799	197166	65795	328537
Mean	252373			72380			10454			171269		

Table 2.2.2. Continued.

Year	Saithe			Polar cod (east)			Polar cod (west)		
	Abundance index	Confidence limit		Abundance index	Confidence lmit		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	136	68	204	42657	5936	79377	616	23	1209
Mean	536			296033			70608		

Table 2.2.3. Length distributions (%) of 0-group fish in the Barents Sea and adjacent waters, August-September 2008

Length, cm	Cod	Haddock	Capelin	Herring	Saithe	Redfish	Polarcod	Greenland halibut	LRD	Sandeel
1.0-1.4						3.3			0.4	
1.4-1.9						6.6			2.5	
2.0-2.4	0.2		0.4			7.9			6.0	0.1
2.5-2.9	0.2		2.0			8.2	0.0		13.6	5.7
3.0-3.4	0.2	0.7	8.6	0.7		24.7	0.2		28.5	3.4
3.5-3.9	1.1	1.2	17.6	6.4		18.6	0.8		28.0	9.0
4.0-4.4	3.9	1.0	22.3	4.5		20.0	6.0	3.8	14.3	3.9
4.5-.4.9	4.8	1.7	22.1	6.4		9.3	18.5		5.9	3.9
5.0-5.4	5.0	3.6	15.9	17.0		1.2	32.0	4.7	0.3	8.2
5.5-5.9	5.1	4.7	8.1	20.5		0.1	33.0			5.2
6.0-6.4	7.7	7.7	2.3	22.2	3.5	0.2	7.6	8.6	0.6	8.6
6.5-6.9	9.4	4.8	0.5	13.2	5.3		1.5	20.4		8.1
7.0-7.4	13.1	5.5	0.2	7.4	1.1		0.3	9.2		12.6
7.5-7.9	12.1	7.5	0.1	1.7	13.8			38.6		4.5
8.0-8.4	13.5	7.3			6.5			14.7		5.7
8.5-8.9	10.4	7.7			25.5					8.5
9.0-9.4	6.8	5.4			11.6					4.2
9.5-9.9	3.8	8.4			14.2					7.4
10.0-10.4	1.6	6.4			7.7					
10.5-10.9	0.6	6.5			4.6					
11.0-11.4	0.4	7.9			2.7					
11.5-11.9	0.1	4.8			0.5					1.1
12.0-12.4		3.1			3.0					
12.5-12.9		2.0								
13.0-13.4		1.2								
13.5-13.9		0.5								
14.0-14.4		0.4								
14.5-14.9		0.0								
15.0-15.4		0.1								
Mean length. cm	7.2	8.7	4.4	5.7	8.9	3.4	5.1	7.2	3.2	6.3

Table 2.3.1. Acoustic estimate of Barents Sea capelin. August-October 2008.

Length (cm)	Age/Year class				Sum (10^9)	Biomass (10^3 t)	Mean weight (g)
	1	2	3	4+			
	2007	2006	2005	2004-			
6.5 - 7.0	0.993				0.993	1.1	1.1
7.0 - 7.5	6.878				6.878	7.8	1.1
7.5 - 8.0	17.019				17.019	29.6	1.7
8.0 - 8.5	32.836				32.836	62.7	1.9
8.5 - 9.0	43.480				43.480	100.6	2.3
9.0 - 9.5	55.359				55.359	156.3	2.8
9.5 - 10.0	52.963				52.963	165.2	3.1
10.0 - 10.5	50.649				50.649	187.6	3.7
10.5 - 11.0	27.691				27.691	118.0	4.3
11.0 - 11.5	15.005	2.067			17.072	83.6	4.9
11.5 - 12.0	8.007	10.357			18.364	114.1	6.2
12.0 - 12.5	1.410	10.930			12.340	89.2	7.2
12.5 - 13.0	0.237	26.960			27.197	215.8	7.9
13.0 - 13.5	0.324	28.927			29.252	276.5	9.5
13.5 - 14.0	0.000	32.200			32.200	355.2	11.0
14.0 - 14.5	0.106	43.301	0.013		43.420	525.1	12.1
14.5 - 15.0	0.000	25.115	0.338		25.452	350.8	13.8
15.0 - 15.5	0.001	23.045	0.827		23.873	376.1	15.8
15.5 - 16.0		12.540	2.331		14.871	257.4	17.3
16.0 - 16.5		9.329	2.968		12.297	252.9	20.6
16.5 - 17.0		3.967	4.791	0.548	9.307	204.3	22.0
17.0 - 17.5		1.679	5.618	0.015	7.312	182.3	24.9
17.5 - 18.0		0.527	3.626	0.000	4.154	119.7	28.8
18.0 - 18.5		0.222	3.168	0.051	3.441	107.4	31.2
18.5 - 19.0		0.044	0.708	0.976	1.729	60.1	34.8
19.0 - 19.5		0.197	0.453	0.054	0.704	27.3	38.8
19.5 - 20.0			0.014	0.035	0.049	1.9	38.5
TSN (10^9)	312.96	231.41	24.86	1.68	570.9		
TSB (10^3 t)	965.2	2799.1	610.7	51.4		4426.5	
Mean length (cm)	9.5	14.0	17.1	18.1	11.7		
Mean weight (g)	3.1	12.1	24.6	30.0			7.8
SSN (10^6)	0.11	119.97	24.86	1.68	146.6		
SSB (10^3 t)	1.3	1804.1	610.7	51.4		2467.6	

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
Averagee	0.68	3.63	1.34	10.78	0.81	19.15	0.24	24.70	0.07	28.05	2.96

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

Table 2.3.4. Acoustic estimate of polar cod in August-October 2008

Length (cm)	Age/Yearclass					Sum (10^6)	Biomass (10^3 t)	Mean weigt(g)
	1 2007	2 2006	3 2005	4 2004	5 2003			
6.5 - 7.0	24					24	0.1	2.1
7.0 - 7.5	369					369	36.5	98.9
7.5 - 8.0	306					306	0.7	2.2
8.0 - 8.5	1686					1686	14.0	8.3
8.5 - 9.0	1771	1				1771	11.8	6.6
9.0 - 9.5	3655	2				3657	16.6	4.5
9.5 - 10.0	4745	4				4749	34.0	7.2
10.0 - 10.5	5092	10				5102	35.1	6.9
10.5 - 11.0	5321	13				5334	39.5	7.4
11.0 - 11.5	4957	92				5049	48.1	9.5
11.5 - 12.0	4153	68	1			4221	45.2	10.7
12.0 - 12.5	4587	169	2			4759	62.8	13.2
12.5 - 13.0	2348	1074	6			3428	49.2	14.4
13.0 - 13.5	1987	969	2			2958	49.1	16.6
13.5 - 14.0	422	1651	20			2093	38.9	18.6
14.0 - 14.5	77	1822	47			1947	41.3	21.2
14.5 - 15.0	123	1309	15			1447	34.6	23.9
15.0 - 15.5	0	2051	200			2251	58.4	26.0
15.5 - 16.0	70	1454	296			1820	48.2	26.5
16.0 - 16.5		1733	306			2039	59.0	28.9
16.5 - 17.0		695	1037			1732	53.9	31.1
17.0 - 17.5		1029	921			1950	66.8	34.3
17.5 - 18.0		1067	319			1387	51.6	37.2
18.0 - 18.5		718	644	13	8	1383	56.9	41.1
18.5 - 19.0		517	355	10		882	45.4	51.4
19.0 - 19.5		574	278	56		908	41.6	45.8
19.5 - 20.0		244	445	96		785	39.5	50.3
20.0 - 20.5		363	270	48		681	37.5	55.1
20.5 - 21.0		283	111	23		417	25.3	60.6
21.0 - 21.5		2	304	16	3	325	22.8	69.9
21.5 - 22.0		119	102	22		243	17.4	71.5
22.0 - 22.5		46	93	24	1	164	12.8	78.1
22.5 - 23.0			26	20		47	3.3	70.0
23.0 - 23.5		35	28			63	5.3	84.7
23.5 - 24.0			10			10	1.0	99.9
24.0 - 24.5			17			17	1.8	107.0
24.5 - 25.0			18	6		24	2.3	98.2
25.0 - 25.5			29	12		41	4.0	97.3
25.5 - 26.0				10		10	1.2	117.0
26.0 - 26.5				21		21	2.5	116.9
26.5 - 27.0				20		20	2.6	134.0
27.0 - 27.5								
27.5 - 28.0								
28.0 - 28.5								
28.5 - 29.0								
29.0 - 29.5				6		7	1.0	144.2
TSN(10^6)	41693	18114	5905	403	12	66127		
TSB(10^3 t)	421.8	522	247.8	27.2	0.6		1219.4	
Mean length	10.8	15.8	18.1	21.4	19.4	12.9		
Mean weight (g)	10.1	28.8	42	67.4	45.3			18.4

Based on TS value: 21.8 log L - 72.7. corresponding to $\sigma = 6.7 \cdot 10^{-7} \cdot L^{2.18}$

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
Average	33031	261.7	15839	358.8	4364	161.5	575	30.7	53854	815.1

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

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

Table 2.3.7. Acoustic estimate of young Norwegian spring spawning herring in the western part of the Barents Sea August-October 2008

Length (cm)	Age / Year class						Sum (10^6)	Biomass (10^3 t)	Mean weight (g)
	1 2007	2 2006	3 2005	4 2004	5 2003	6 2002			
13.0 - 13.4	15	0	0	0	0	0	15	0.3	18.7
13.5 - 13.9	0	0	0	0	0	0	0	0.0	.
14.0 - 14.4	0	0	35	0	0	0	35	0.8	22.5
14.5 - 14.9	0	1	1	0	0	0	1	0.0	25.9
15.0 - 15.4	0	98	65	0	0	0	163	3.9	24.0
15.5 - 15.9	0	3	3	0	0	0	6	0.2	31.6
16.0 - 16.4	0	84	84	0	0	0	168	5.4	32.0
16.5 - 16.9	0	9	21	0	0	0	29	1.1	38.0
17.0 - 17.4	0	63	146	0	0	0	209	8.4	40.0
17.5 - 17.9	0	44	103	0	0	0	147	6.6	44.7
18.0 - 18.4	0	0	84	0	0	0	84	3.6	43.0
18.5 - 18.9	0	0	13	0	0	0	13	0.8	63.0
19.0 - 19.4	0	0	37	0	0	0	37	2.4	66.9
19.5 - 19.9	0	0	17	0	0	0	17	1.1	66.7
20.0 - 20.4	0	0	40	0	0	0	40	2.9	72.3
20.5 - 20.9	0	0	61	0	0	0	61	4.5	74.3
21.0 - 21.4	0	0	58	0	0	0	58	4.7	81.4
21.5 - 21.9	0	0	23	0	0	0	23	2.0	86.9
22.0 - 22.4	0	0	54	0	0	0	54	4.6	85.0
22.5 - 22.9	0	0	47	0	0	0	47	4.7	99.0
23.0 - 23.4	0	0	47	0	0	0	47	5.3	111.0
23.5 - 23.9	0	0	87	22	0	0	109	12.4	113.0
24.0 - 24.4	0	0	54	13	0	0	67	7.9	117.0
24.5 - 24.9	0	0	13	9	0	0	22	2.6	117.0
25.0 - 25.4	0	0	87	87	0	0	175	21.4	122.6
25.5 - 25.9	0	0	29	43	0	0	72	11.1	154.6
26.0 - 26.4	0	0	28	111	0	0	138	20.0	144.8
26.5 - 26.9	0	0	0	143	0	0	143	22.9	160.0
27.0 - 27.4	0	0	0	67	0	0	67	11.7	175.4
27.5 - 27.9	0	0	0	143	0	0	143	24.4	170.5
28.0 - 28.4	0	0	0	188	81	0	269	49.5	184.2
28.5 - 28.9	0	0	0	98	98	0	197	37.9	192.8
29.0 - 29.4	0	0	0	28	28	0	56	11.1	199.0
29.5 - 29.9	0	0	0	0	71	0	71	15.0	209.7
30.0 - 30.4	0	0	0	0	85	0	85	19.6	229.8
30.5 - 30.9	0	0	0	0	149	0	149	34.5	231.0
31.0 - 31.4	0	0	0	0	0	0	0	0.0	.
31.5 - 31.9	0	0	0	0	0	0	0	0.0	.
32.0 - 32.4	0	0	0	0	6	6	12	3.3	278.2
TSN (106)	15	301	1237	952	519	6	3031		
TSB(103 t)	0.3	10.0	89.9	156.6	110.1	1.7		368.5	
Mean length (cm)	13.3	16.4	20.2	27.1	29.7	32.3		23.6	
Mean weight (g)	18.7	33.1	72.7	164.4	212.2	278.2			121.6

TS=20.0* log(L) - 71.9

Table 2.3.8. Acoustic estimate of herring (mix) in the eastern part of Barents Sea August-September 2008

Length (cm)	Age / Year class								Sum (10^6)	Biomass (10^3 t)	Mean weight (g)
	1 2007	2 2006	3 2005	4 2004	5 2003	6 2002	7 2001	8 2000			
15.0 - 15.4	14.6								14.57	0.30	20.50
15.5 - 15.9											
16.0 - 16.4											
16.5 - 16.9											
17.0 - 17.4		72.8							72.83	2.45	33.74
17.5 - 17.9		29.1							29.13	1.08	37.03
18.0 - 18.4		127.4	127.4						254.90	11.59	45.48
18.5 - 18.9		415.1	207.5						622.68	30.36	48.75
19.0 - 19.4		189.4	473.4	94.7					757.42	35.83	47.30
19.5 - 19.9		208.5	416.9	208.5					833.89	41.94	50.3
20.0 - 20.4		89.2	267.6	178.4					535.29	30.08	56.2
20.5 - 20.9		68.3	136.6	341.4					546.21	32.65	59.8
21.0 - 21.4		57.1	57.1	228.2					342.29	22.18	64.8
21.5 - 21.9		68.5		102.7					171.15	12.72	74.3
22.0 - 22.4			48.5	97.1					145.66	11.03	75.7
22.5 - 22.9				24.3	48.6				72.83	6.12	84.1
23.0 - 23.4			196.6						196.64	18.92	96.2
23.5 - 23.9			134.7		134.7				269.47	25.75	95.6
24.0 - 24.4			385.5	55.1					440.61	46.08	104.6
24.5 - 24.9			169.3	84.7			84.7		338.65	35.46	104.7
25.0 - 25.4				134.7					134.73	15.01	111.4
25.5 - 25.9			31.0	61.9				31.0	123.81	15.36	124.1
26.0 - 26.4				97.1				48.5	145.66	18.59	127.6
26.5 - 26.9			72.8	109.2					182.07	24.84	136.4
27.0 - 27.4				128.0	21.3				149.30	22.31	149.5
27.5 - 27.9			24.9	124.4					149.30	23.53	157.6
28.0 - 28.4				87.4					87.39	15.95	182.5
28.5 - 28.9				105.6					105.60	18.65	176.6
29.0 - 29.4				7.3					7.28	1.31	180.0
TSN (10^6)	14.6	1325.4	2750.0	2270.6	204.6		84.7	79.5	6729.4		
TSB(10^3 t)	0.3	66.9	197.4	216.5	20.1		8.9	10.0		520.1	
Mean length (cm)	15.0	19.0	21.2	23.1	23.6		24.5	25.8	21.548		
Mean weight (g)	20.5	50.47	71.78	95.33	98.5	-	104.7	126.24			77.28639

TS=20.0* log(L) - 71.9

Table 2.3.9. Acoustic estimate of blue whiting in the Barents Sea August-October 2008

Length (cm)	Age/Yearclass									Sum	Biomass	Mean
	1 2007	2 2006	3 2005	4 2004	5 2003	6 2002	7 2001	8 2000	9 1999	(10^6)	(103 t)	weigt(g)
16.0 - 16.5		2								2	0	23.1
16.5 - 17.0												
17.0 - 17.5												
17.5 - 18.0												
18.0 - 18.5												
18.5 - 19.0												
19.0 - 19.5												
19.5 - 20.0												
20.0 - 20.5												
20.5 - 21.0												
21.0 - 21.5		1								1	0.1	49.0
21.5 - 22.0												
22.0 - 22.5												
22.5 - 23.0												
23.0 - 23.5			2							2	0.1	72.3
23.5 - 24.0												
24.0 - 24.5												
24.5 - 25.0				1						1	0.1	88.2
25.0 - 25.5				7	1					8	0.7	88.0
25.5 - 26.0				3	1					4	0.4	102.1
26.0 - 26.5					19					19	1.9	102.4
26.5 - 27.0					23					23	2.3	101.9
27.0 - 27.5					2	32				34	4.0	116.1
27.5 - 28.0						47				47	5.9	123.3
28.0 - 28.5							53			53	7.2	136.9
28.5 - 29.0					19	12	36	1		68	9.4	138.6
29.0 - 29.5							66			66	9.7	146.3
29.5 - 30.0					26			25		52	8.0	154.4
30.0 - 30.5					6	5	6		21	39	6.3	163.4
30.5 - 31.0					19	7	1		21	47	8.1	171.0
31.0 - 31.5								38		38	6.9	184.0
31.5 - 32.0							16			16	3.1	190.4
32.0 - 32.5								21		22	4.4	203.5
32.5 - 33.0								23		23	5.1	215.6
33.0 - 33.5								21		21	4.5	217.0
33.5 - 34.0								7		7	1.5	200.8
34.0 - 34.5								4		4	1.0	233.5
34.5 - 35.0									7	7	1.9	254.7
35.0 - 35.5									5	5	1.2	241.0
35.5 - 36.0										0	0	284.3
36.0 - 36.5												
36.5 - 37.0									7	7	2	296.9
37.0 - 37.5												
37.5 - 38.0									1	3	0.6	245.0
38.0 - 38.5								1	1	2	0.5	286.7
TSN(10^6)		3	2	11	116	103	179	142	57	7	620		
TSB(10^3 t)		0.1	0.1	1.1	15.6	13.2	26.2	27.6	11.1	1.9		96.9	
Mean length		18.3	23.3	25.4	28.5	28	29.1	31.9	31.9	36.2	29.7		
Mean weight		33.5	73.1	92.3	134.7	128.2	146.7	194.3	195.1	249.5			156.2

TS=21.8* lg(L) - 72.7

Table 2.8.1. Number of marine mammal observed during the ecosystem survey. August-September 2008

Class/suborder	Species name	GO Sars	Johan Hjort	Jan Mayen	Vilnus	Total	%
Cetacea/baleen whales	Blue whale			3		3	0.14
	Fin whale	6	23	38	5	72	3.44
	Humpback whale	17	47	4	24	92	4.4
	Minke whale	88	21	23	16	148	7.07
	Unidentified whale	1	27	14	1	43	2.05
Cetacea/toothed whales	Sperm whale	10	-	-		10	0.48
	Killer whale	-	-	-	8	8	0.38
	Harbour porpoise	-	14	-	17	31	1.48
	White-beaked dolphin	972	61	143	218	1394	66.6
	Dolphin spp.	-	16	90	-	106	5.06
Pinnipedia	Harp seal	-	-	162	19	181	8.65
	Hooded seal	-	-	1	-	1	0.05
	Whalrus	-	-	1	-	1	0.05
	Seal spp.	-	-	1	-	1	0.05
Other	Polar bear	-	-	-	2	2	0.14
Total		1094	209	480	310	2093	100

Table 2.8.2. Number of birds observed by observers on board the research vessels.
"Vilnyus". "Johan Hjort" . "Jan Mayen" and "G.O. Sars" during the ecosystem cruise in the Barents Sea 2008
Note that occurrence of northern fulmars and gulls were not recorded at "Vilnyus".

Species	No. of observations	No. of individuals
Northern fulmar	1 511	43 543
Sooty shearwater	9	9
Ivory gull	5	8
Great black-backed gull	66	209
Glaucous gull	219	780
Herring gull	152	935
Kittiwake	846	7 922
Razorbill	17	31
Puffin	302	1 309
Little auk	60	221
Common guillemot	99	282
Brunnichs guillemot	620	2 623
Guillemot spp.	186	601
Great scua	7	7
Long-tailed scua	6	8
Arctic scua	61	78
Pomarine scua	173	454
Scua spp.	3	7
Arctic tern	19	44
Eider duck	2	14
Northern gannet	2	2
European shag	2	2
Purple sandpiper	7	24
Pied wagtail	1	1
Northern wheateater	1	1
Grand Total	4 376	59 115

5 Figures

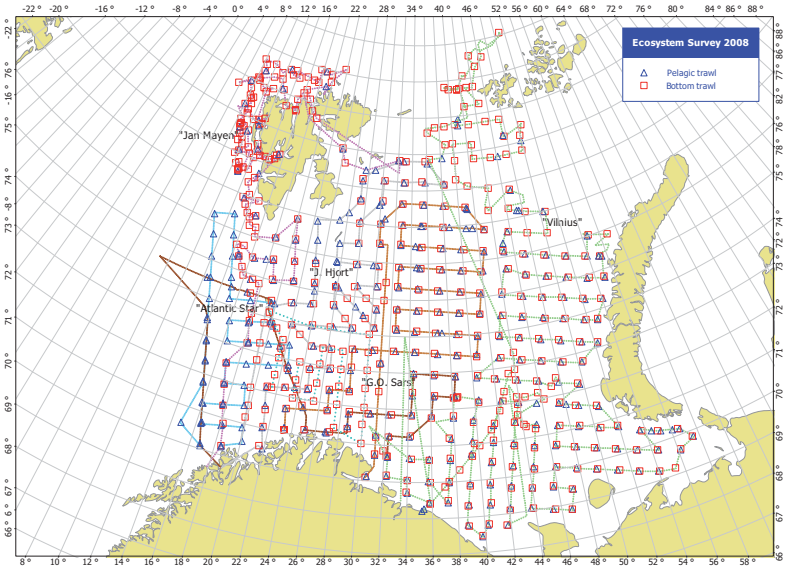

Figure 2.1. Trawl stations for "G.O. Sars" "Johan Hjort", "Jan Mayen", “Atlantic Star” and "Vilnyus", August – October 2008

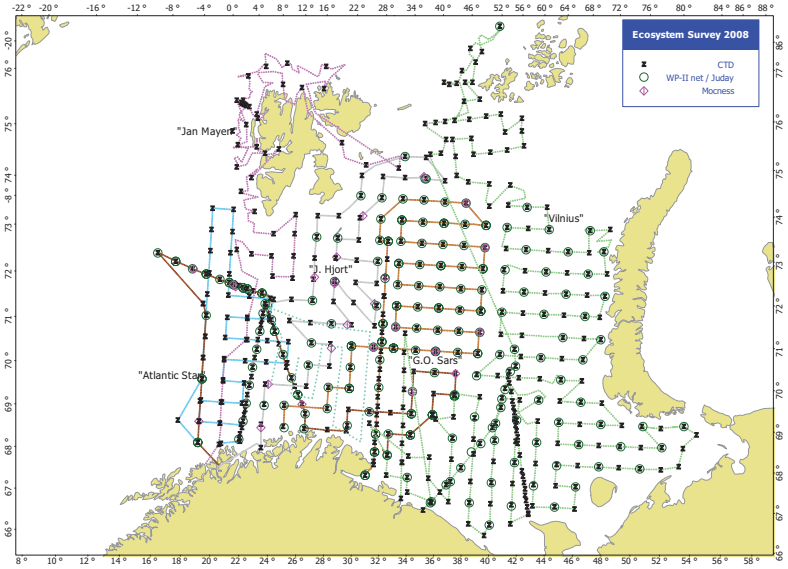

Figure 2.2. Environmental stations (hydrograhy and plankton) for "G.O. Sars" "Johan Hjort", "Jan Mayen", “Atlantic Star” and "Vilnyus", August - October 2008

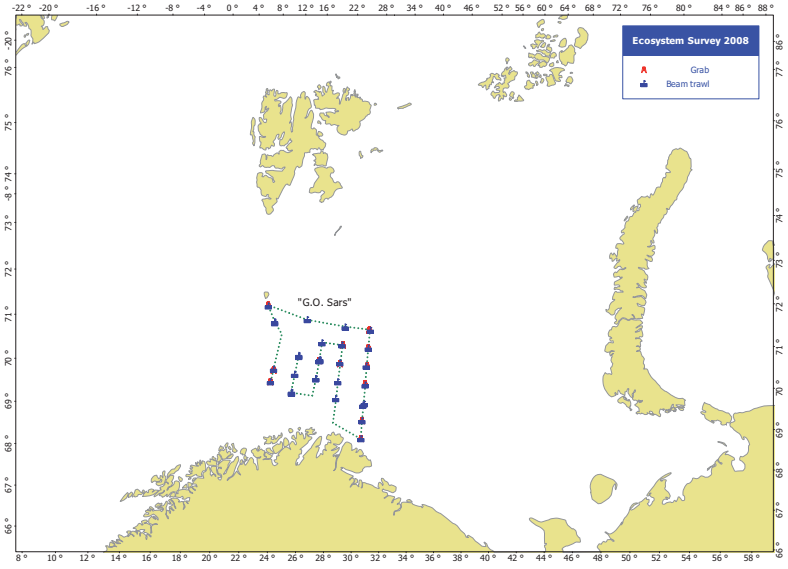

Figure 2.3. Benthos stations for "G.O. Sars", August - October 2008

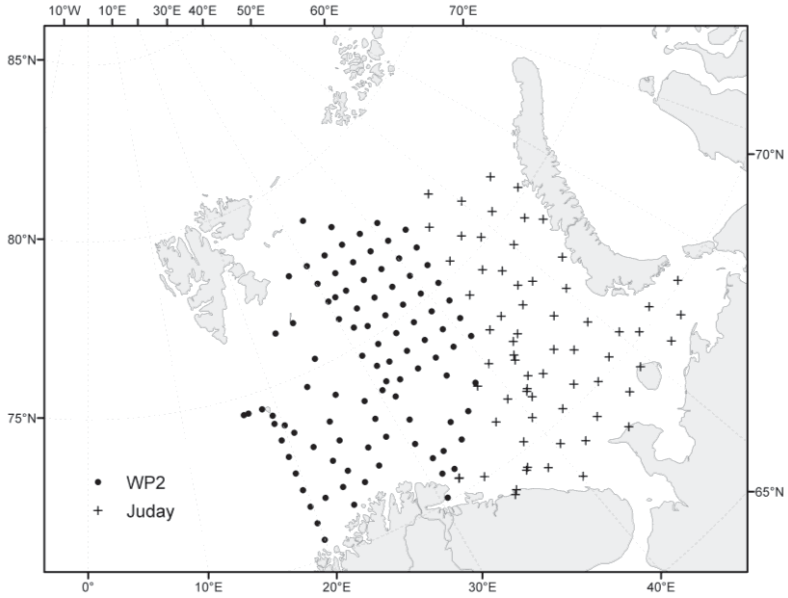

Figure 2.4. Specifics for the zooplankton stations. + is Russian Juday net stations (67 stations) and dotted is Norwegian WP2 stations (98 stations)

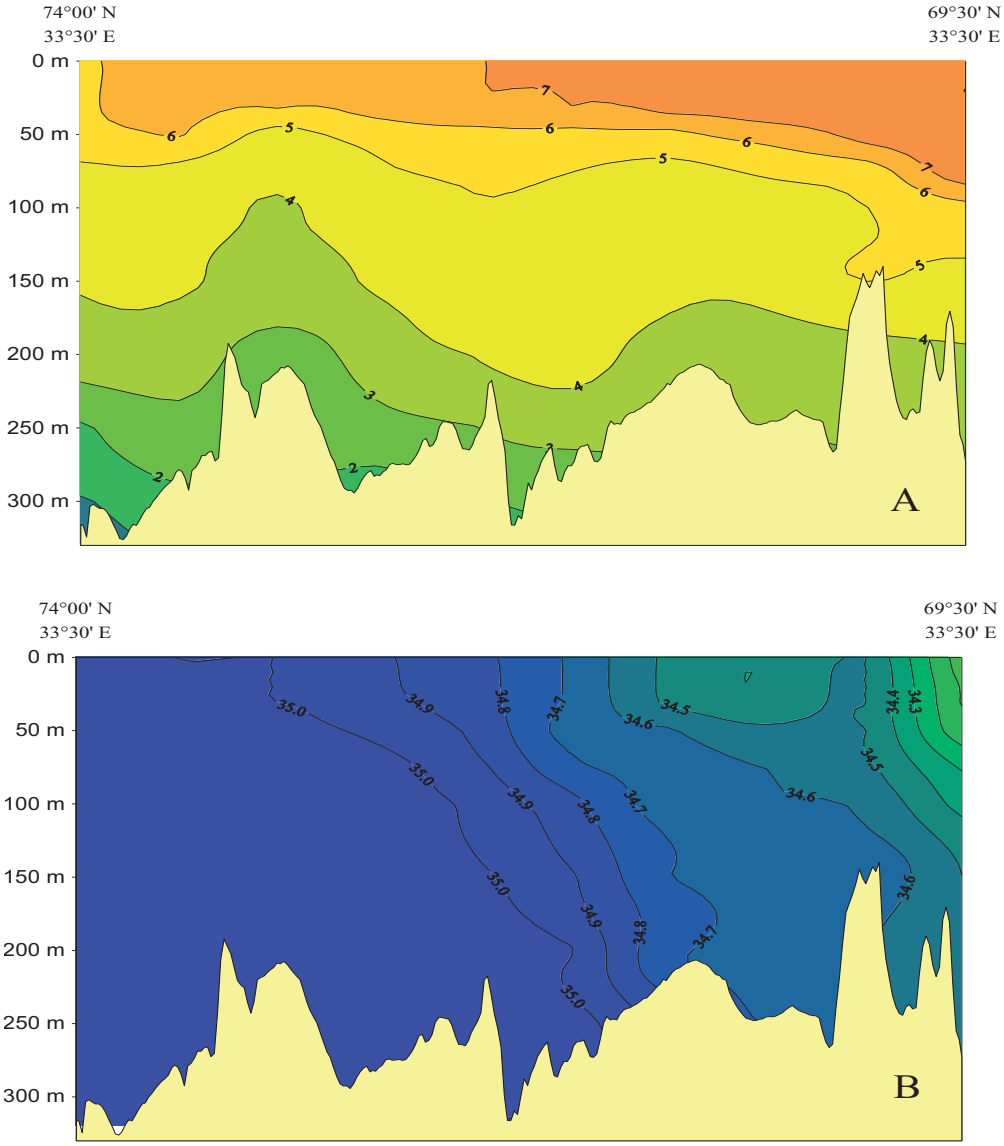

Figure 2.1.1. Temperature (A) and salinity (B) in the Kola Section, August-October 2008

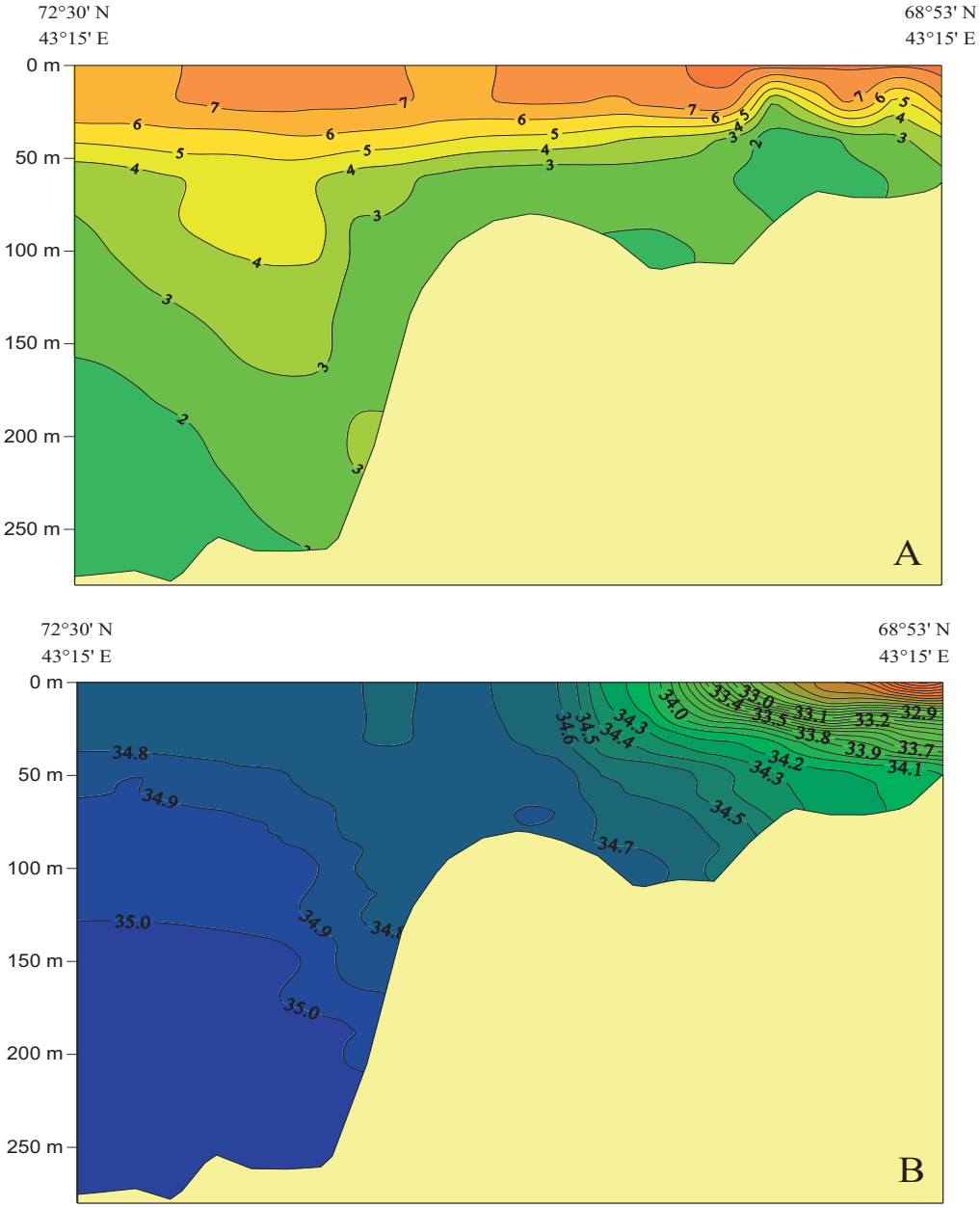

Figure 2.1.2. Temperature (A) and salinity (B) in the Kanin Section, August-October 2008

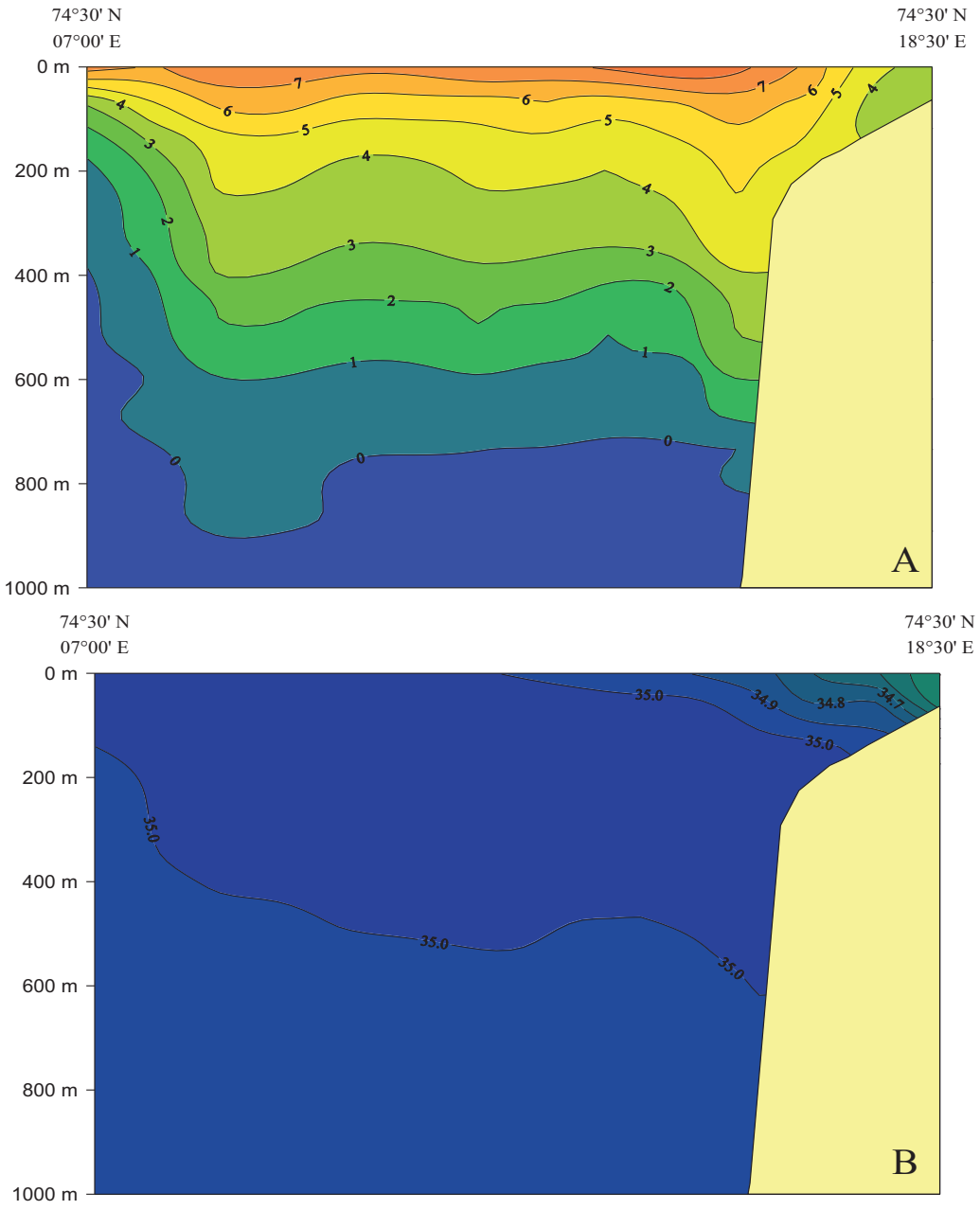

Figure 2.1.3. Temperature (A) and salinity (B) in the Bear Island - West Section, August-October 2008

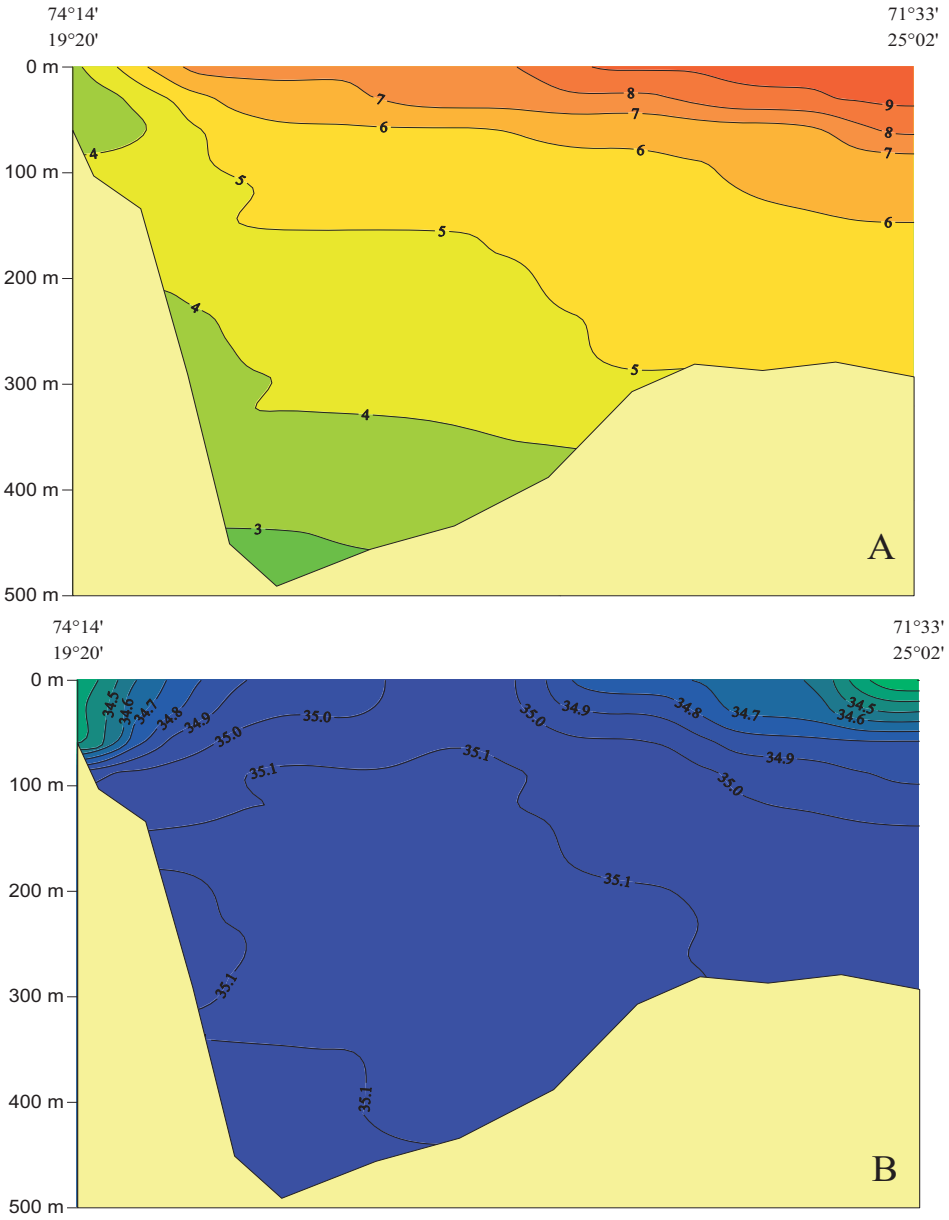

Figure 2.1.4. Temperature (A) and salinity (B) in the North Cape – Bear Island section, August-October 2008

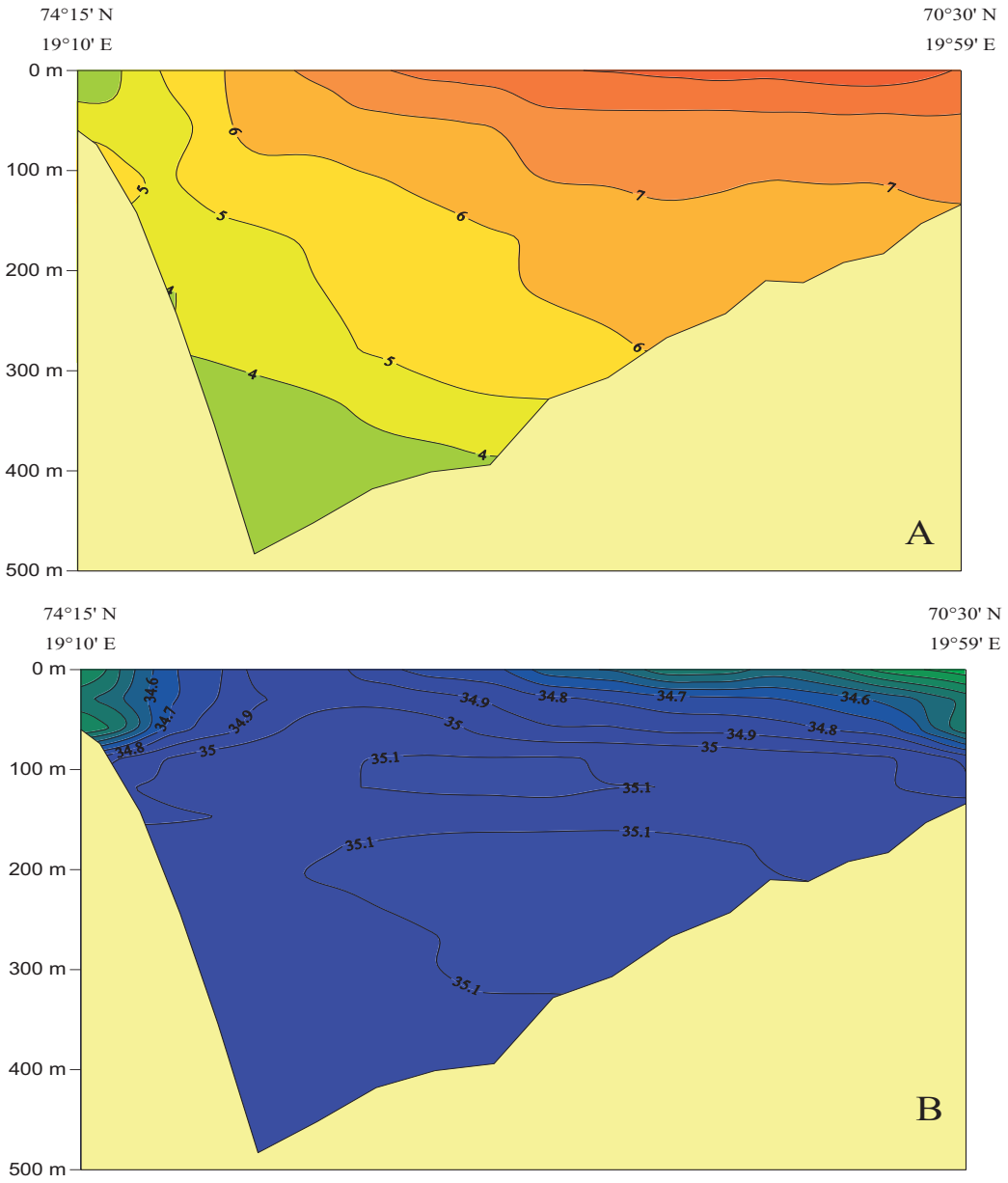

Figure 2.1.5. Temperature (A) and salinity (B) in the Fugløya – Bear Island section, August-October 2008

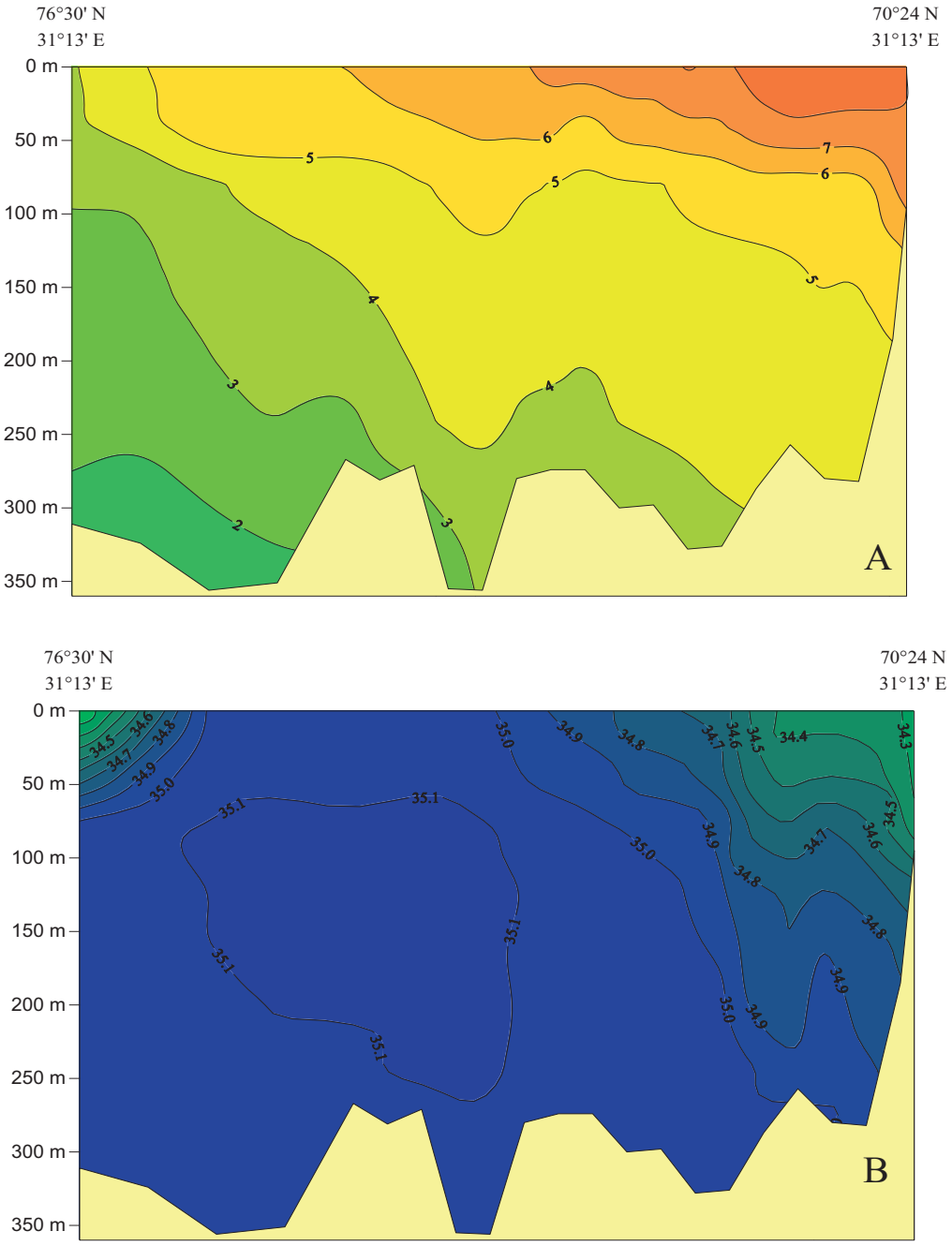

Figure 2.1.6. Temperature (A) and salinity (B) in the Vardø – North section, August-October 2008

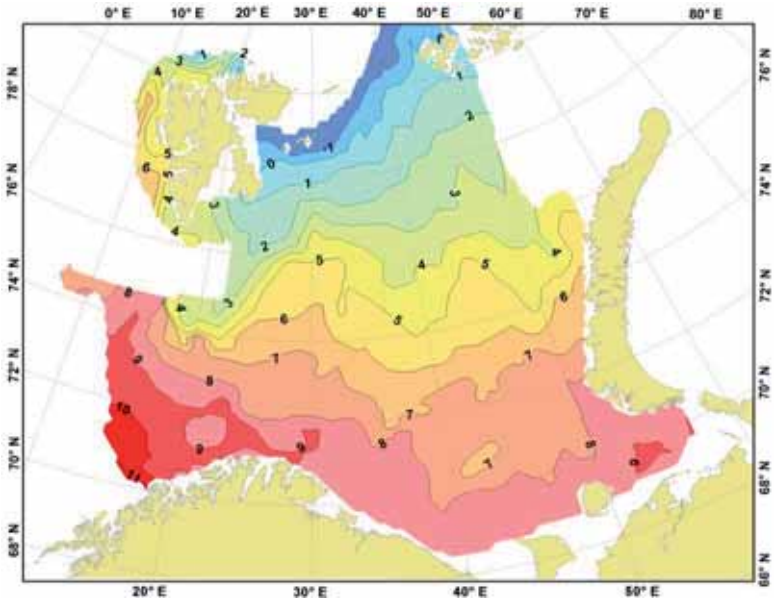

Figure 2.1.7. Distribution of surface temperature (˚C), August-October 2008

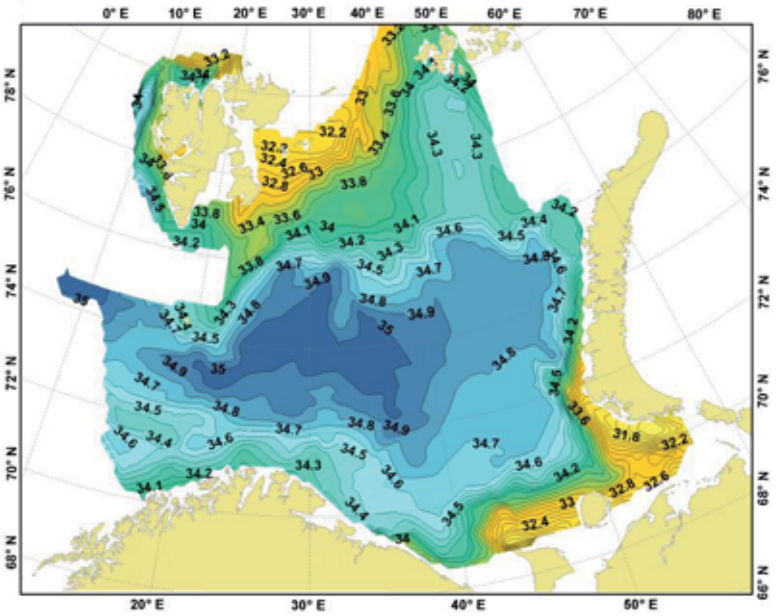

Figure 2.1.8. Distribution of surface salinity, August-October 2008

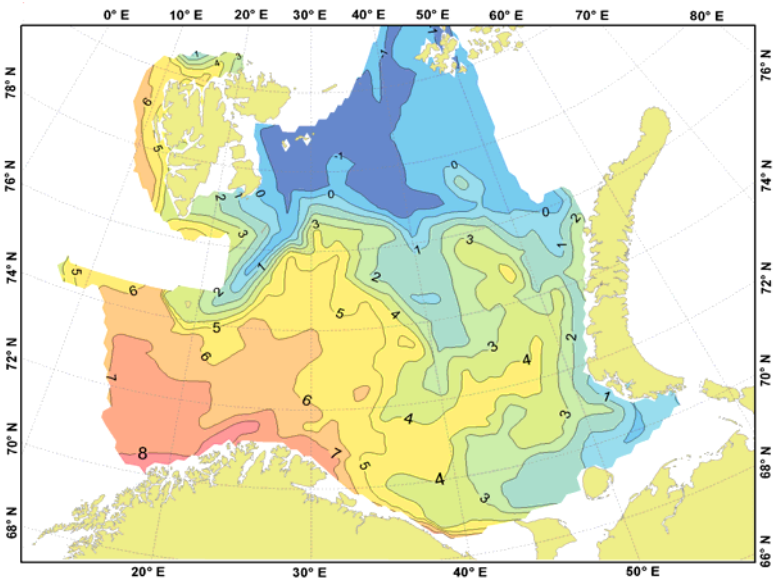

Figure 2.1.9. Distribution of temperature (˚C) at the 50 m depth, August-October 2008

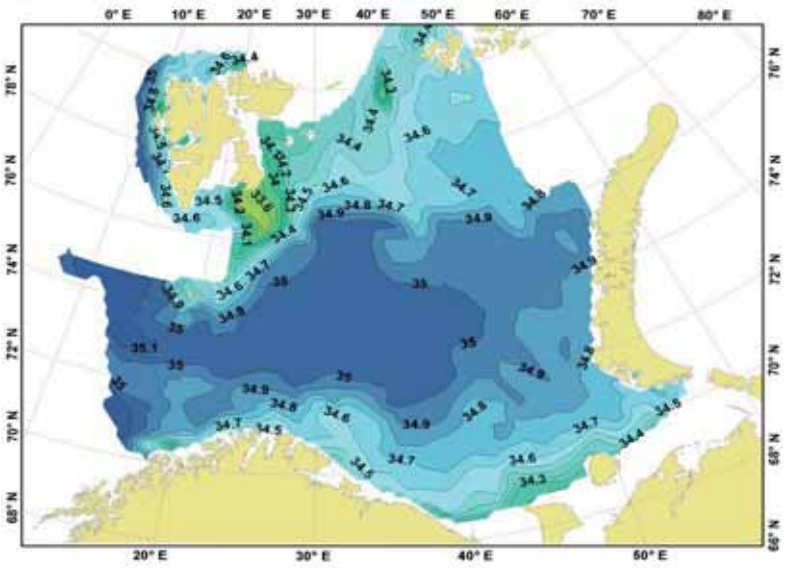

Figure 2.1.10. Distribution of salinity at the 50 m depth, August-October 2008

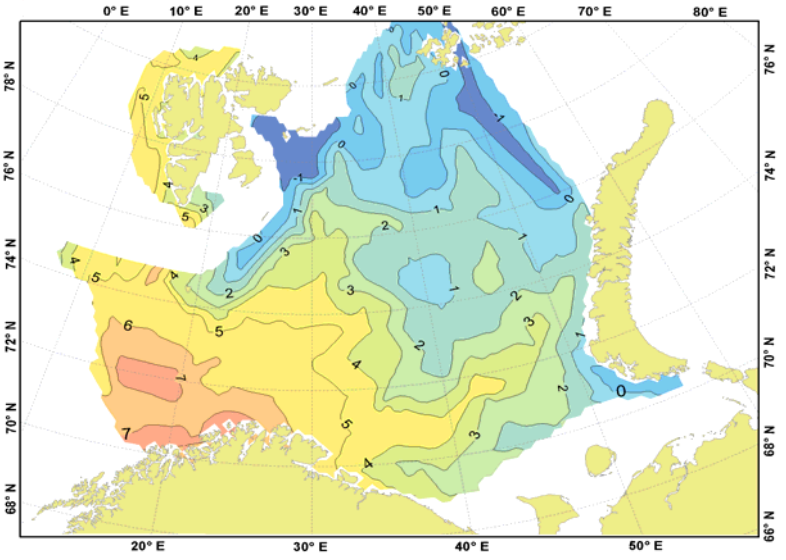

Figure 2.1.11. Distribution of temperature (˚C) at the 100 m depth, August-October 2008

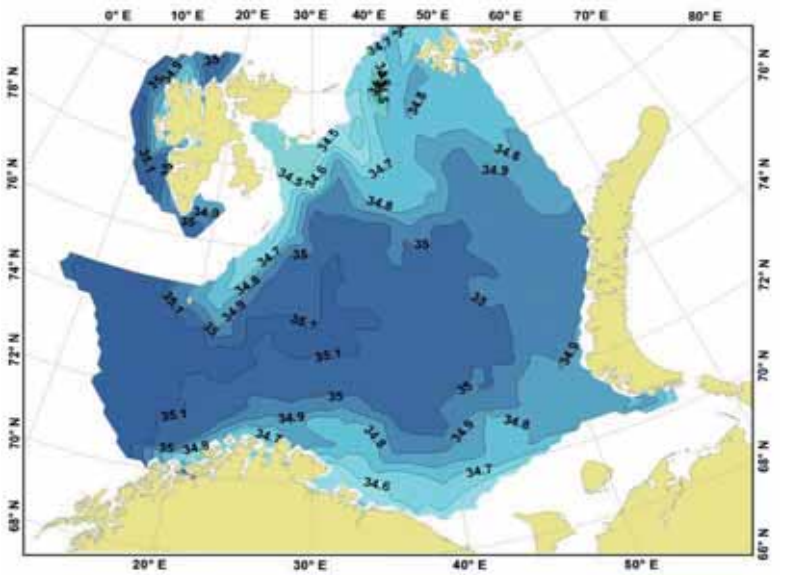

Figure 2.1.12. Distribution of salinity at the 100 m depth, August-October 2008

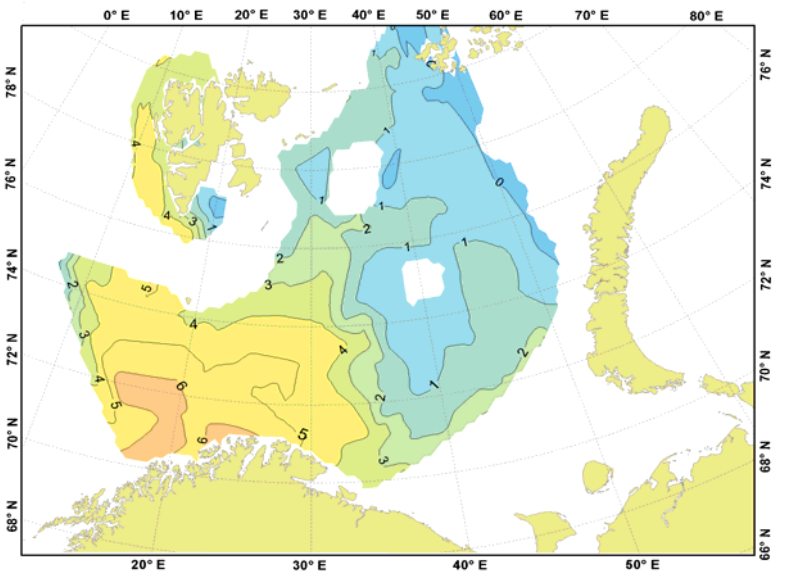

Figure 2.1.13. Distribution of temperature (˚C) at the 200 m depth, August-October 2008

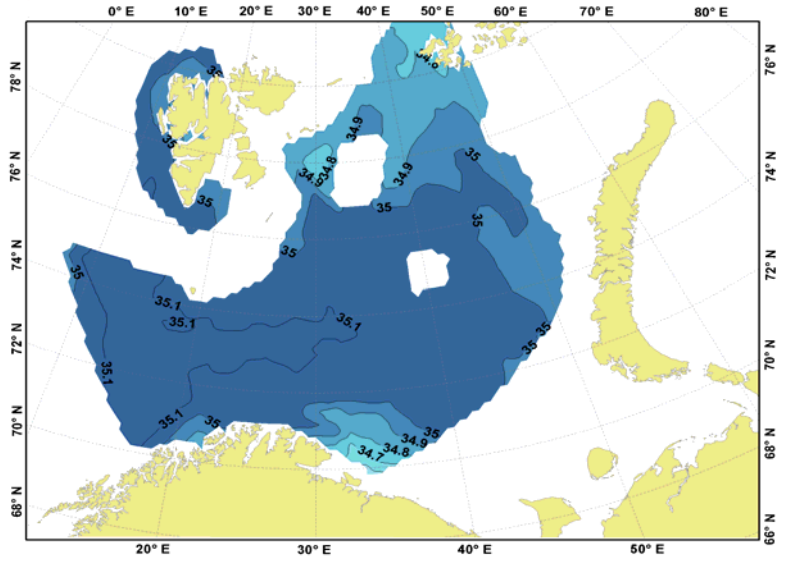

Figure 2.1.14. Distribution of salinity at the 200 m depth, August-October 2008

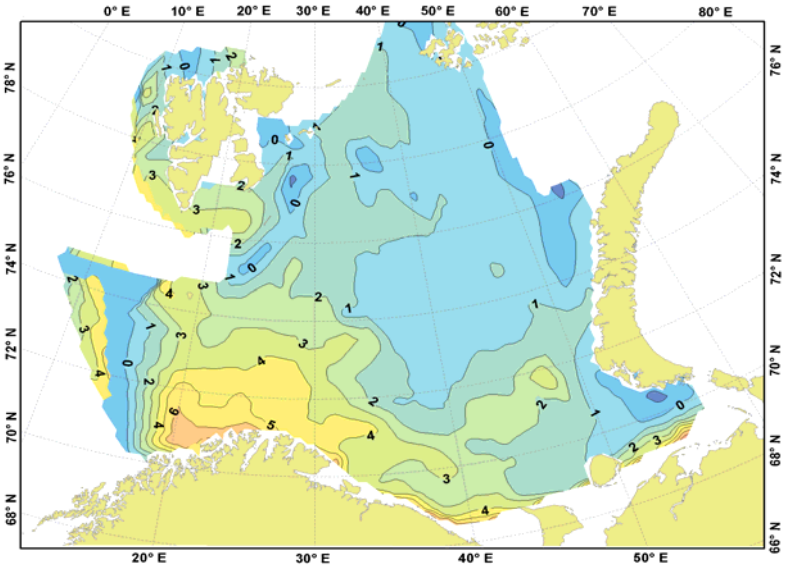

Figure 2.1.15. Distribution of temperature (˚C) at the bottom, August-October 2008

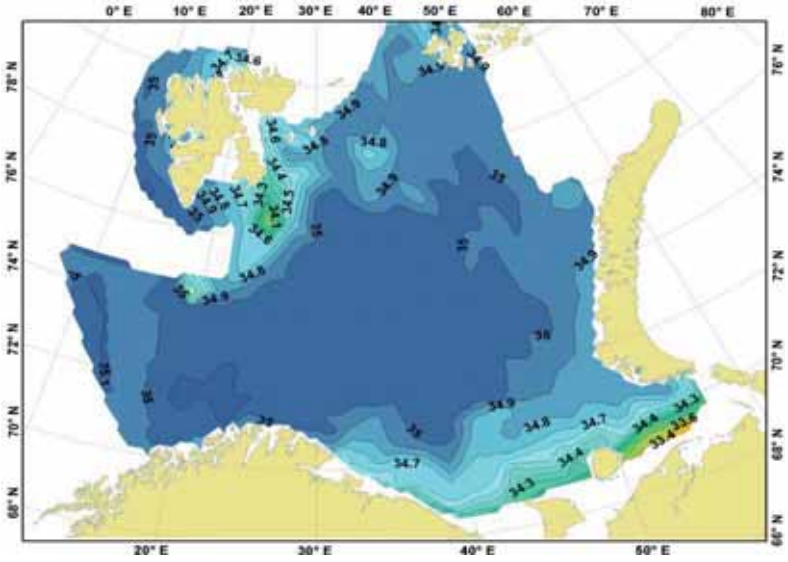

Figure 2.1.16. Distribution of salinity at the bottom, August - October 2008

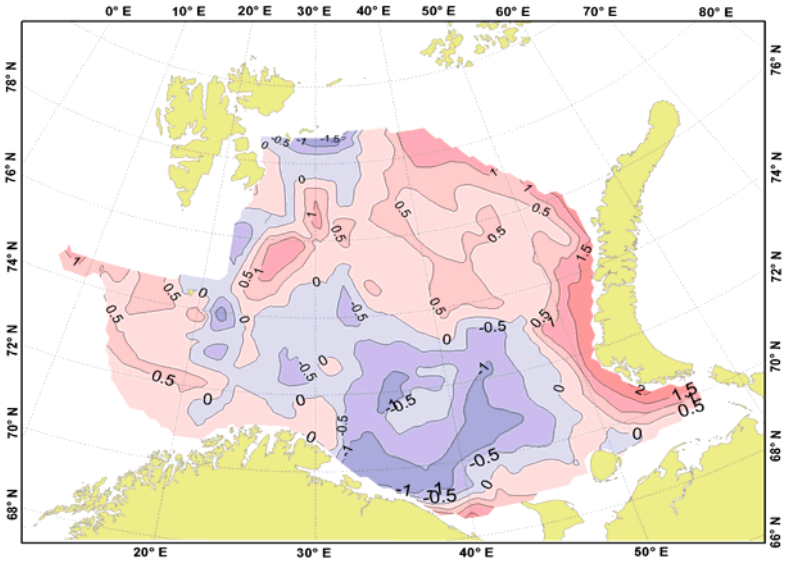

Figure 2.1.17. Surface temperature anomalies (˚C), August - October 2008

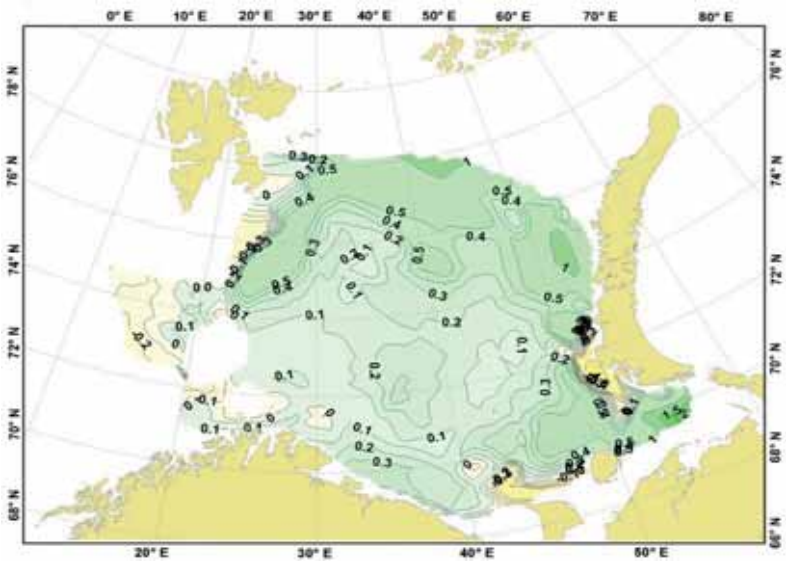

Figure 2.1.18. Surface salinity anomalies, August - October 2008

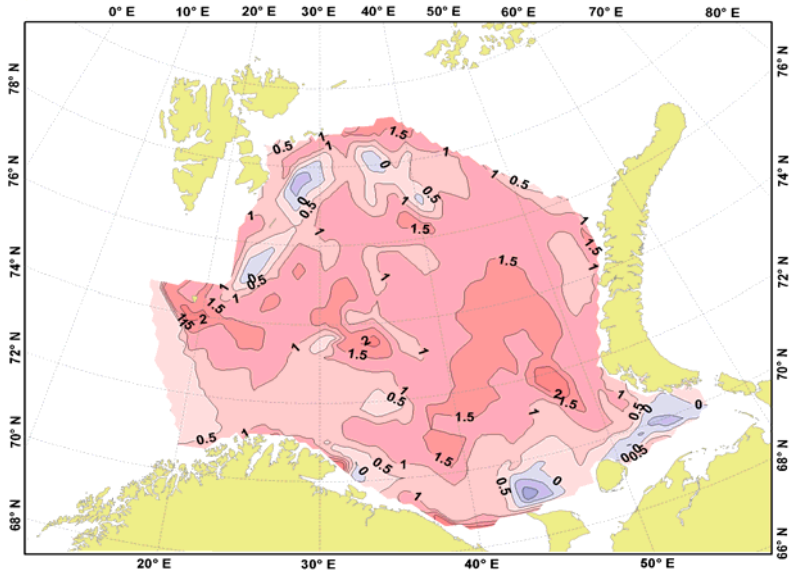

Figure 2.1.19. Temperature anomalies (˚C) at the bottom, August-October 2008

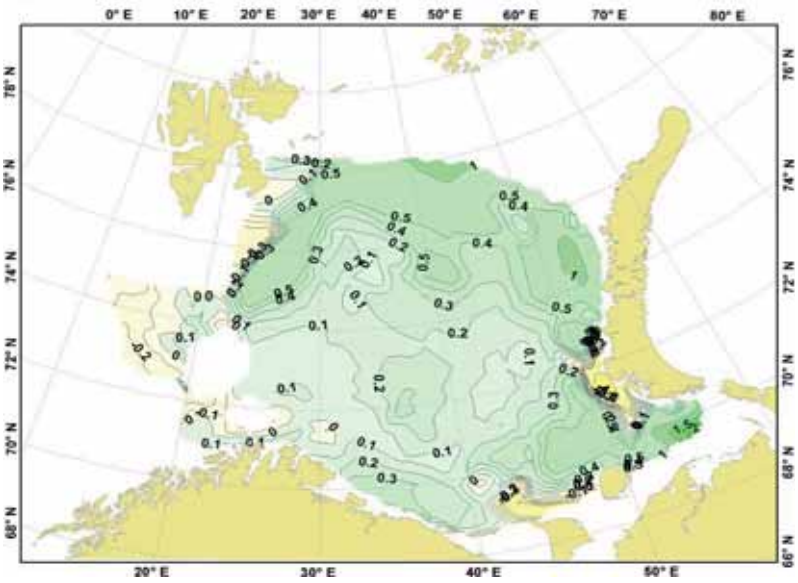

Figure 2.1.20. Bottom salinity anomalies, August - October 2008

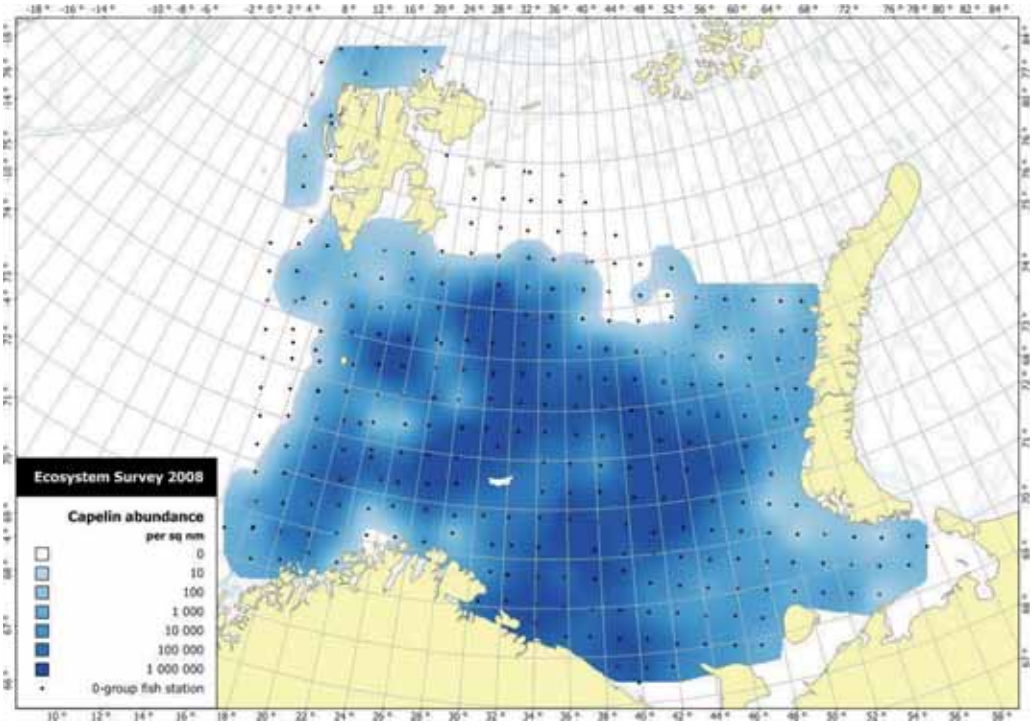

Figure 2.2.1. Distribution of 0-group capelin, August-October 2008

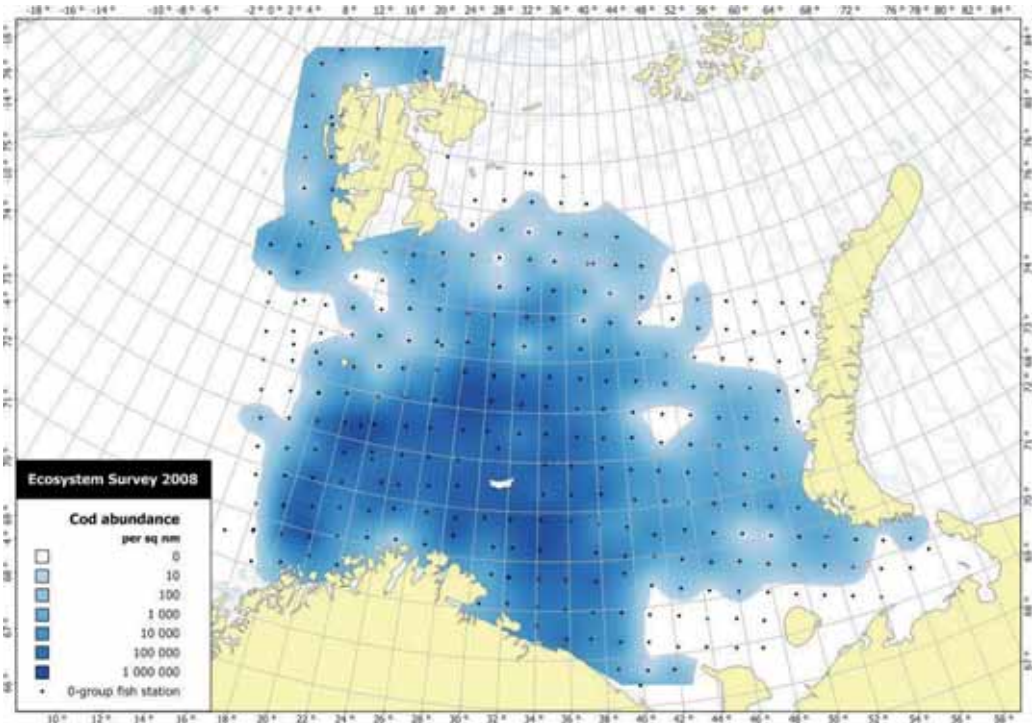

Figure 2.2.2. Distribution of 0-group cod, August-October 2008

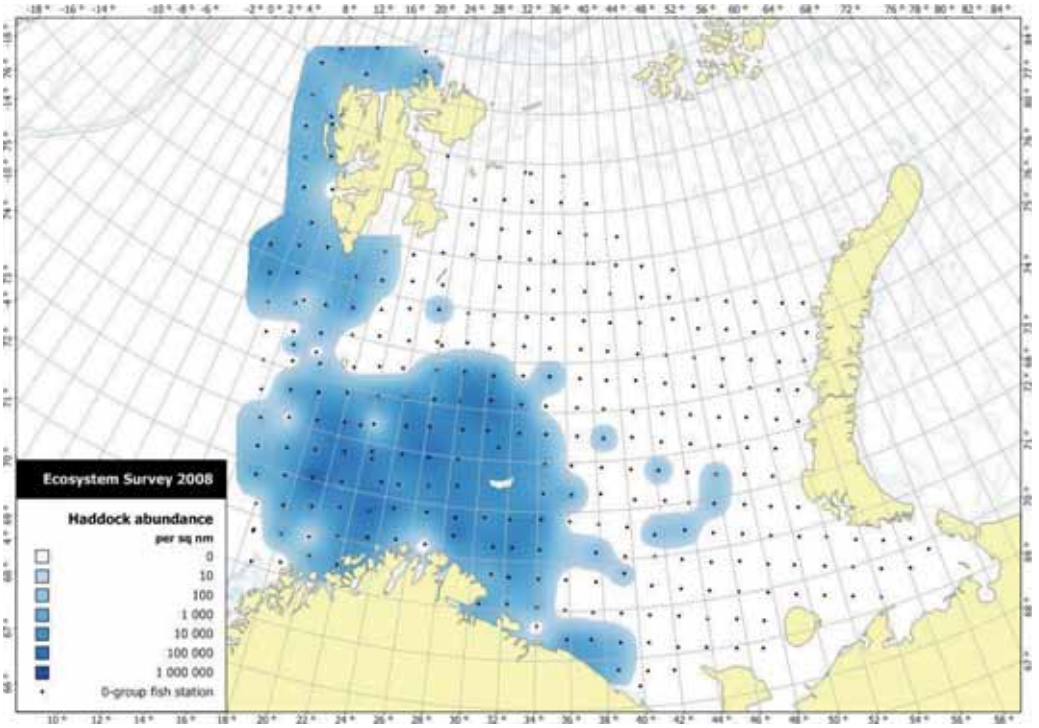

Figure 2.2.3. Distribution of 0-group haddock, August - October 2008

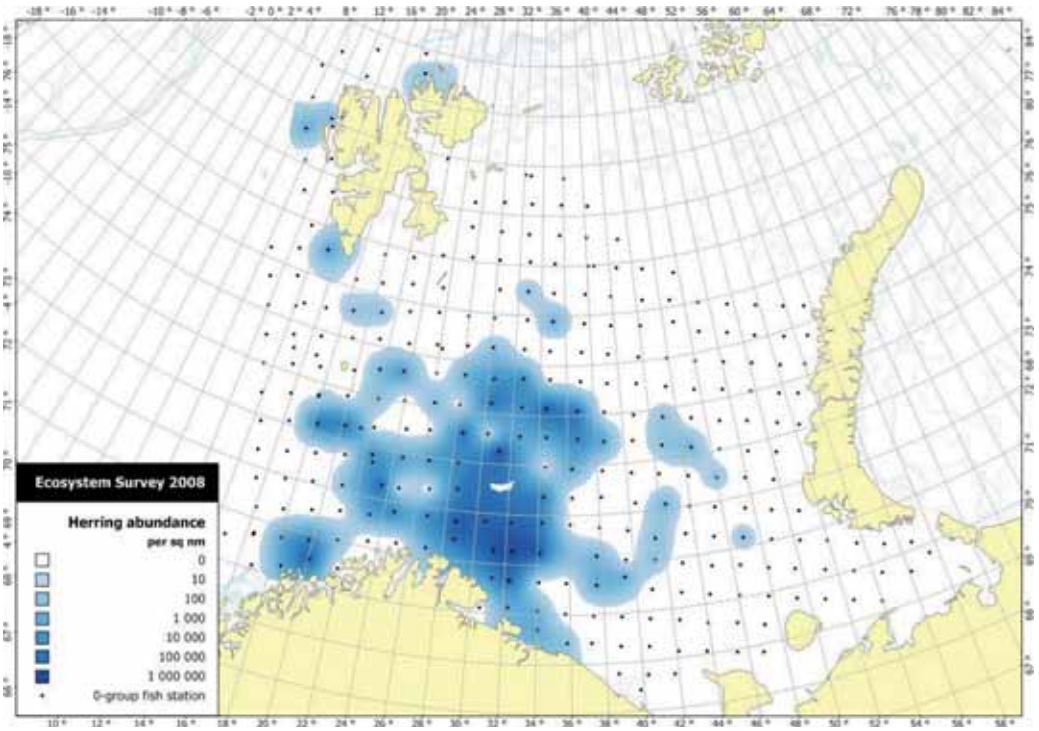

Figure 2.2.4. Distribution of 0-group herring, August - October 2008

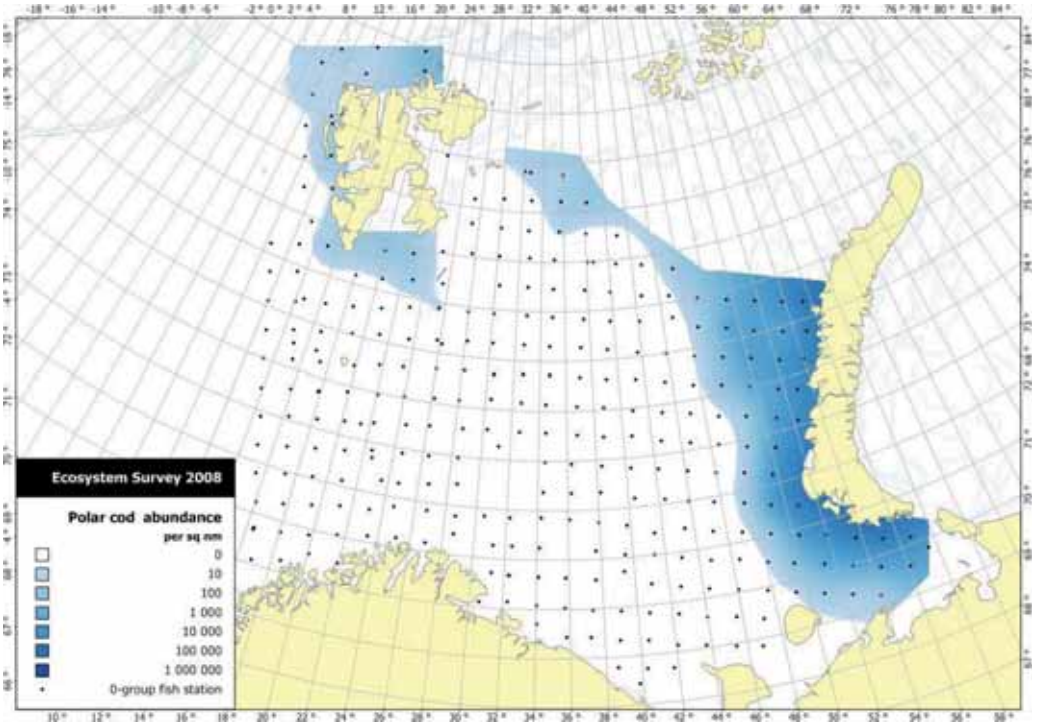

Figure 2.2.5. Distribution of 0-group polar cod, August - October 2008

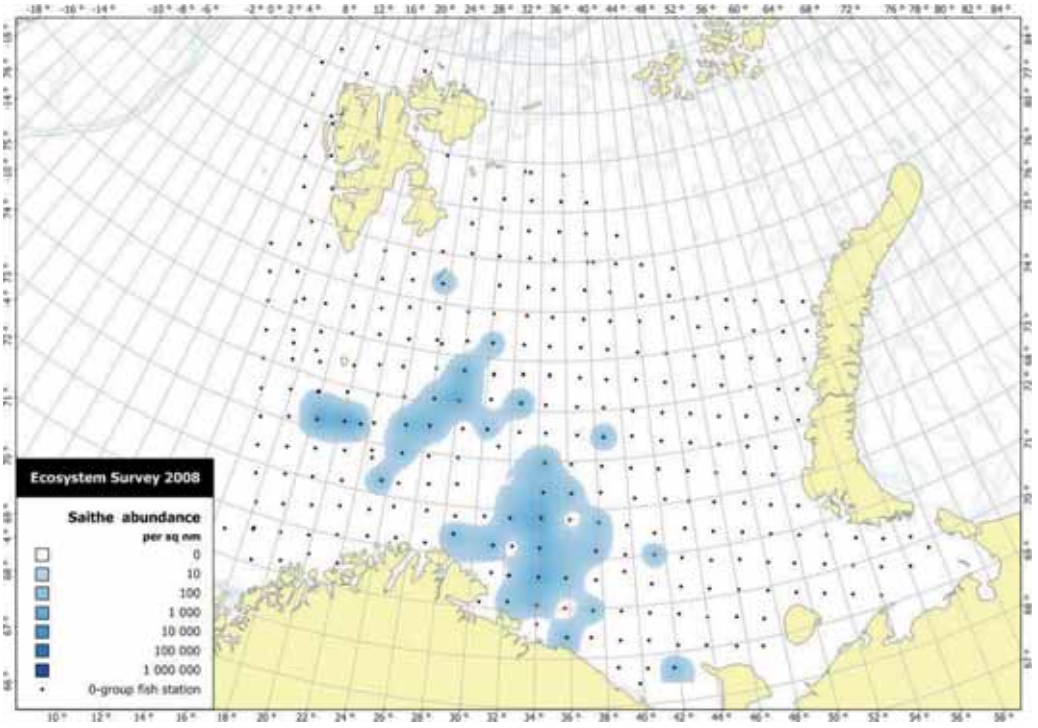

Figure 2.2.6. Distribution of 0-group saithe, August - October 2008

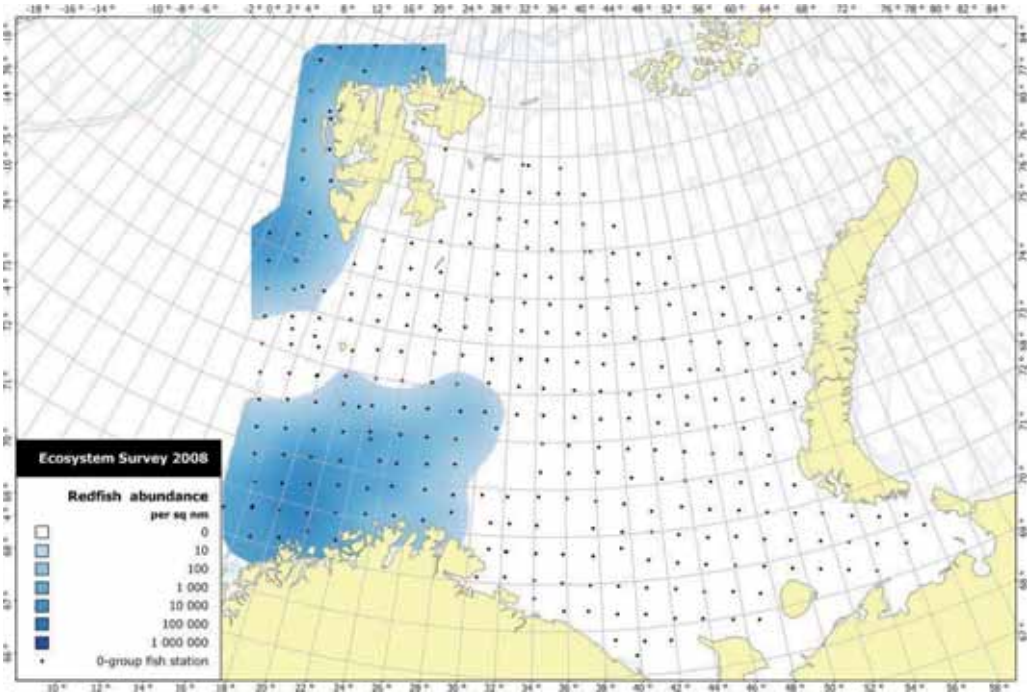

Figure 2.2.7. Distribution of 0-group redfish, August - October 2008

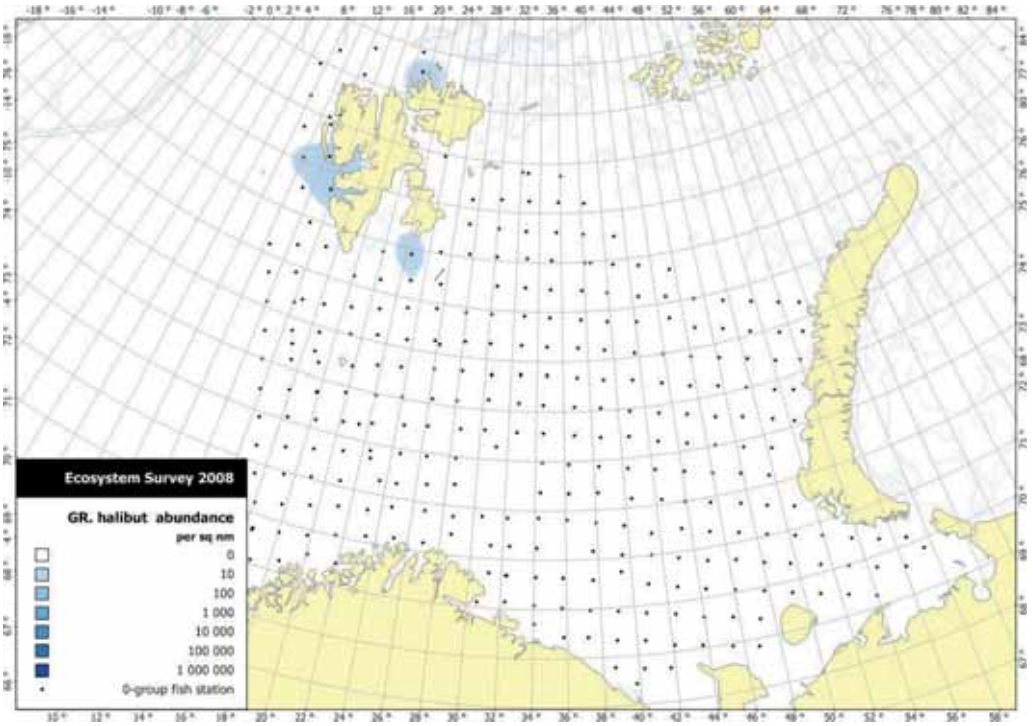

Figure 2.2.8. Distribution of 0-group Greenland halibut, August - October 2008

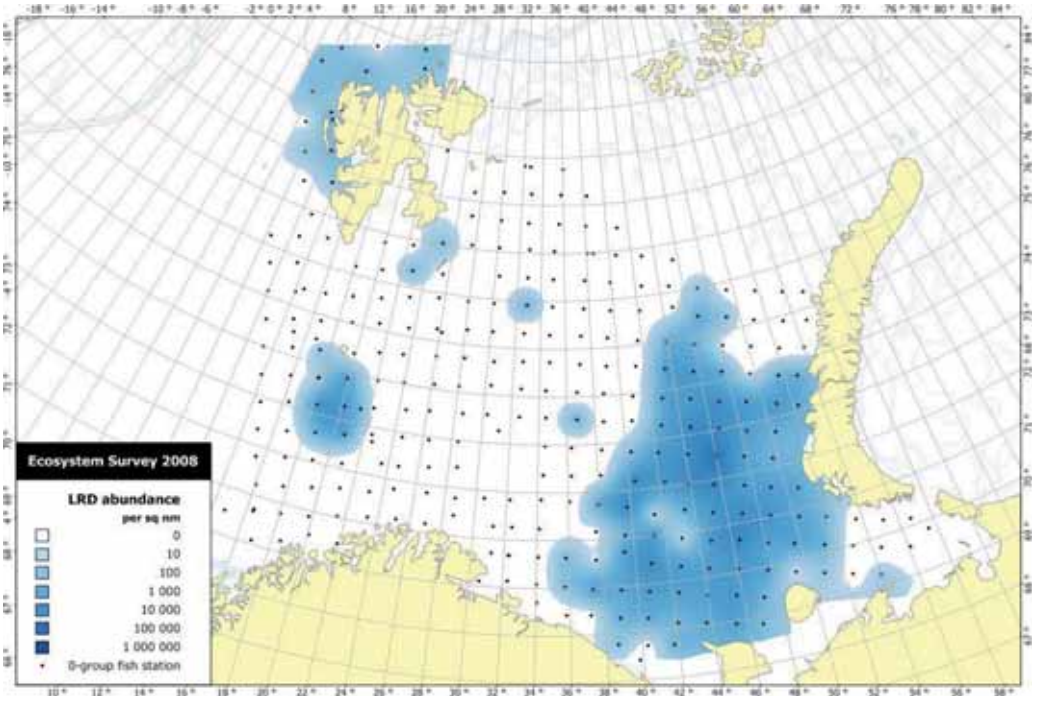

Figure 2.2.9. Distribution of 0-group long rough dab, August-October 2008

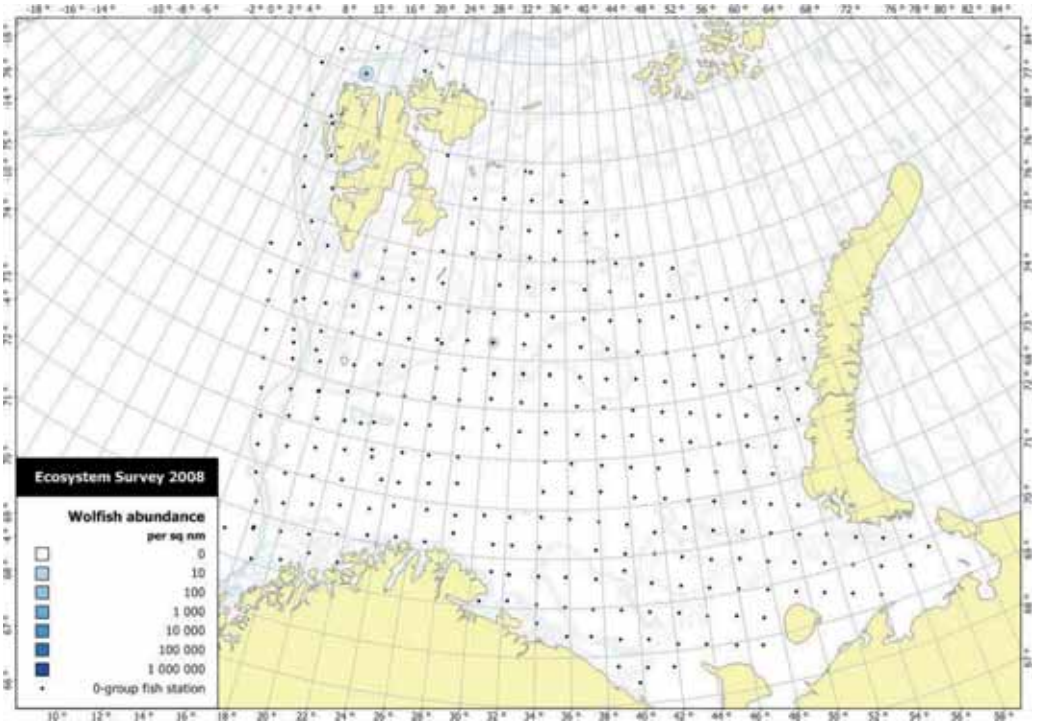

Figure 2.2.10. Distribution of 0-group wolffish, August-October 2008

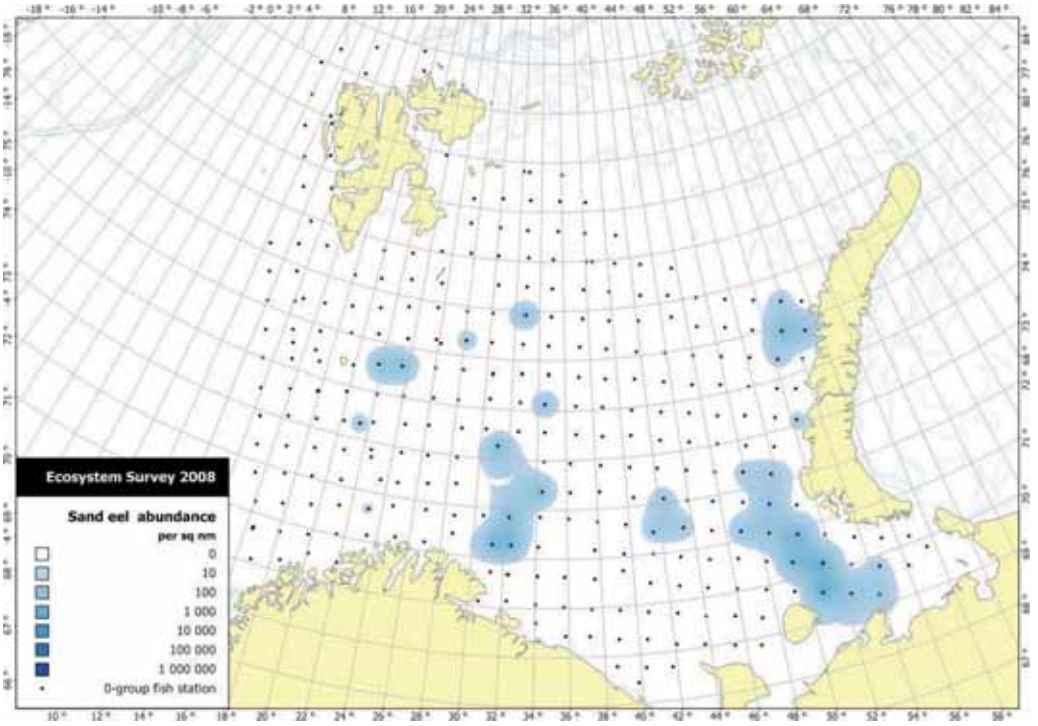

Figure 2.2.11. Disistribution of 0-group sandeel, August-October 2008

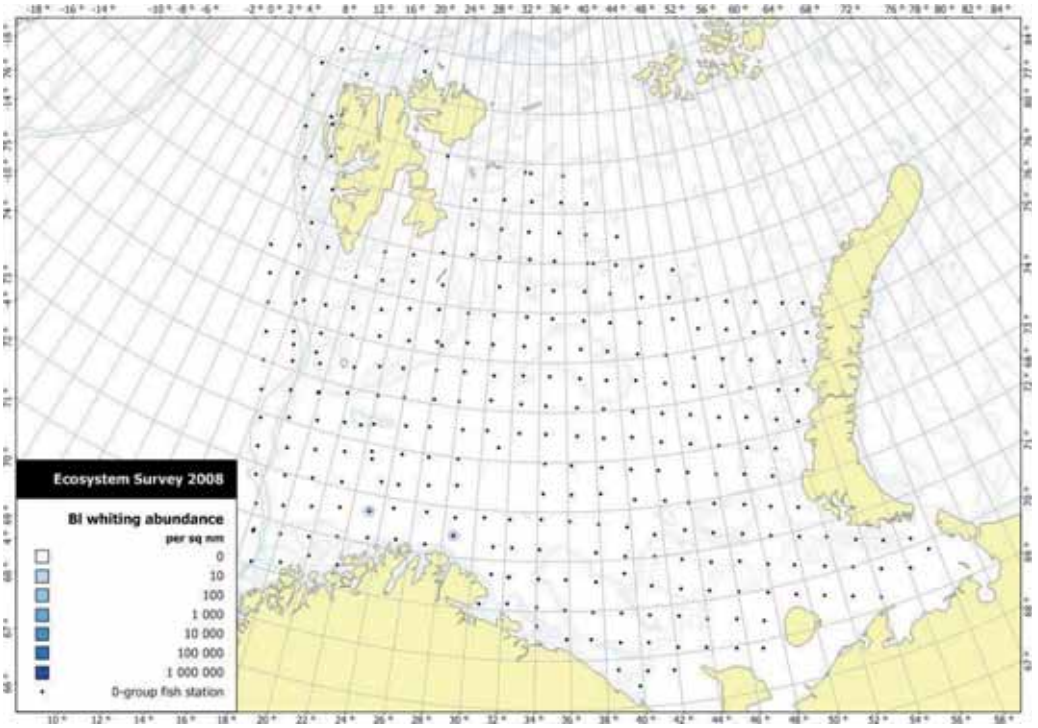

Figure 2.2.12. Distribution of 0-group blue whiting August-October 2008

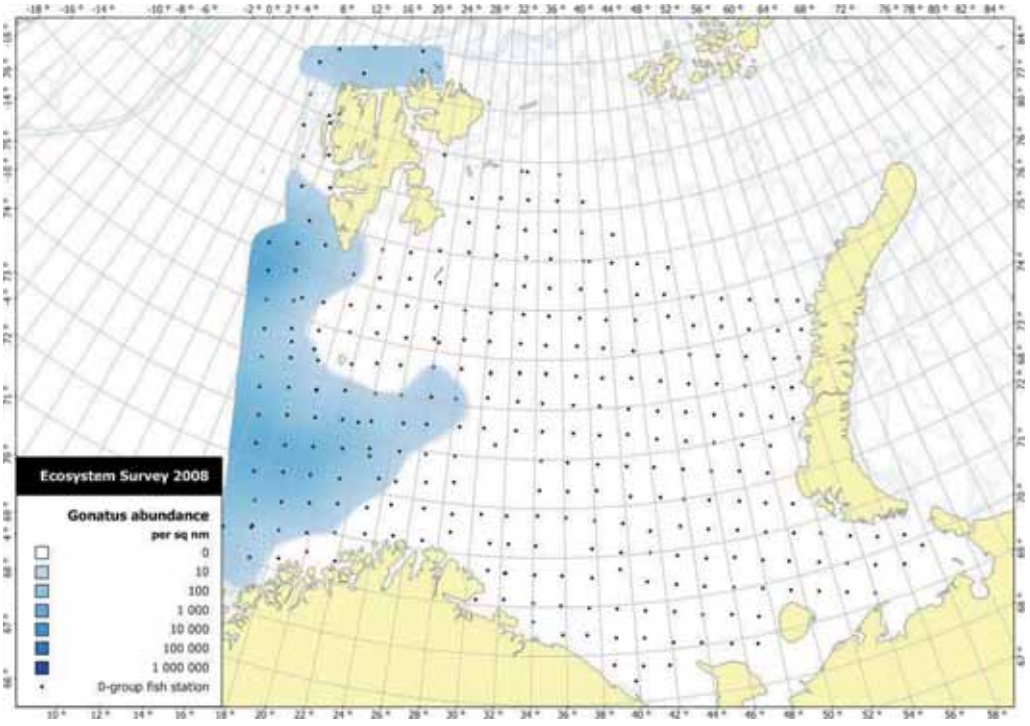

Figure 2.2.13. Distribution of 0-group gonatus (*Gonatus fabricii*), August - October 2008

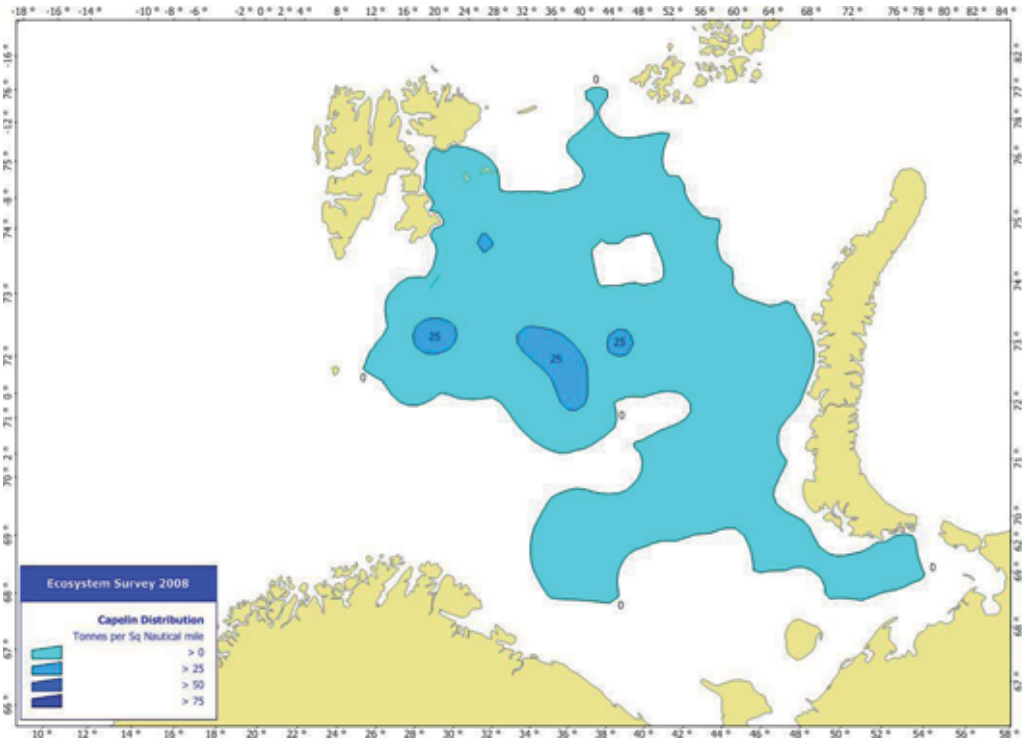

Figure 2.3.1. Estimated density distribution of one-year-old capelin (t/nautical mile^2), August - October 2008

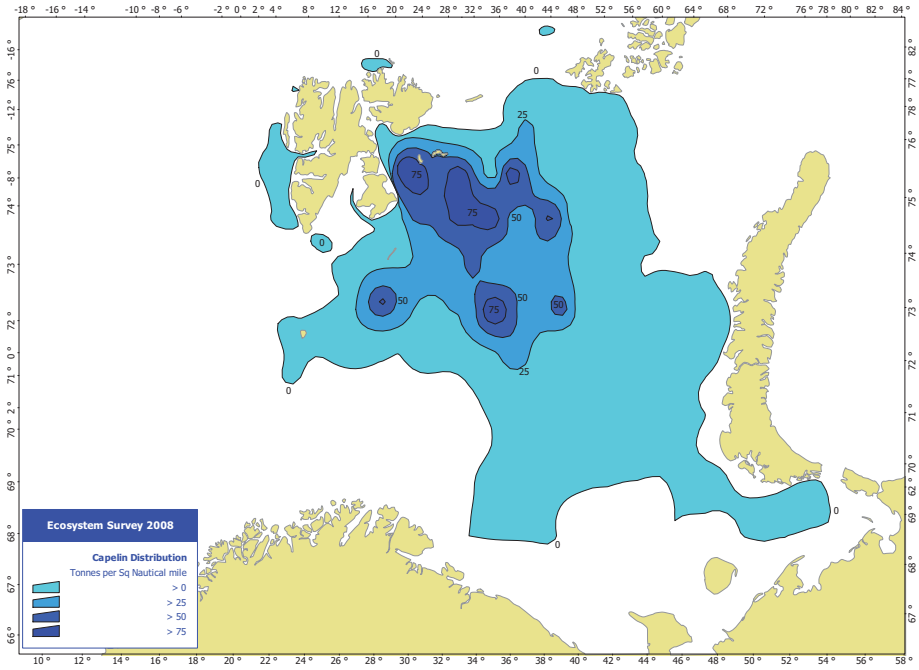

Figure 2.3.2. Estimated total density distribution of capelin (t/nautical mile^2), August - October 2008

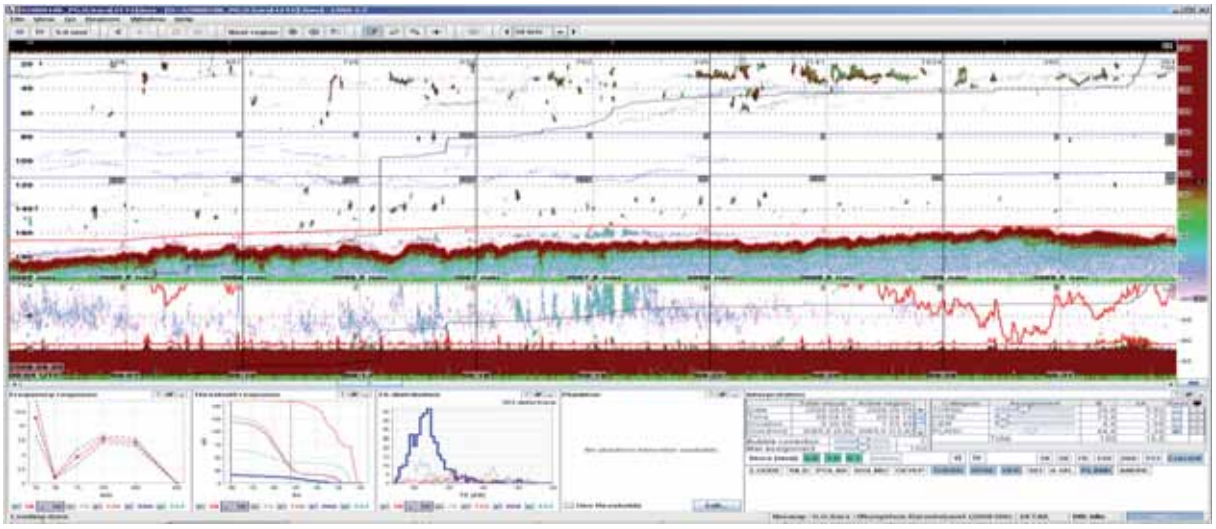

Figure 2.3.3. Echo-records of capelin 05.09.2008 (77º05′ N, 30º12′ E)

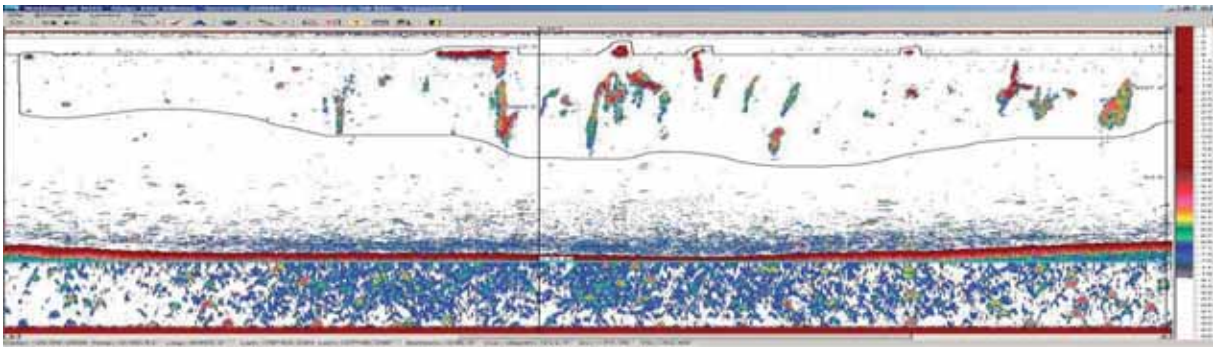

Figure 2.3.4. Echo-records of capelin 19.09.2008 (78º53′ N, 37º46′ E, depth 245 m)

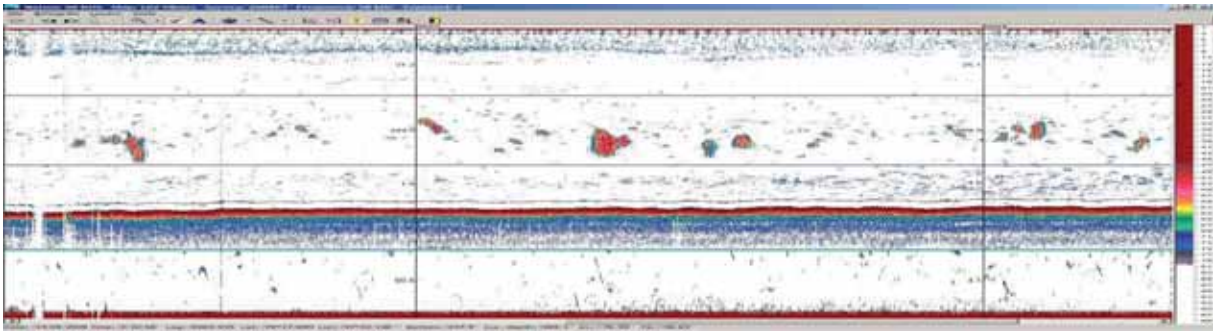

Figure 2.3.5. Echo-records of capelin (75 %) and polar cod (25 %) 14.09.2008 (79º17´ N, 47º32´ E, depth 248 m)

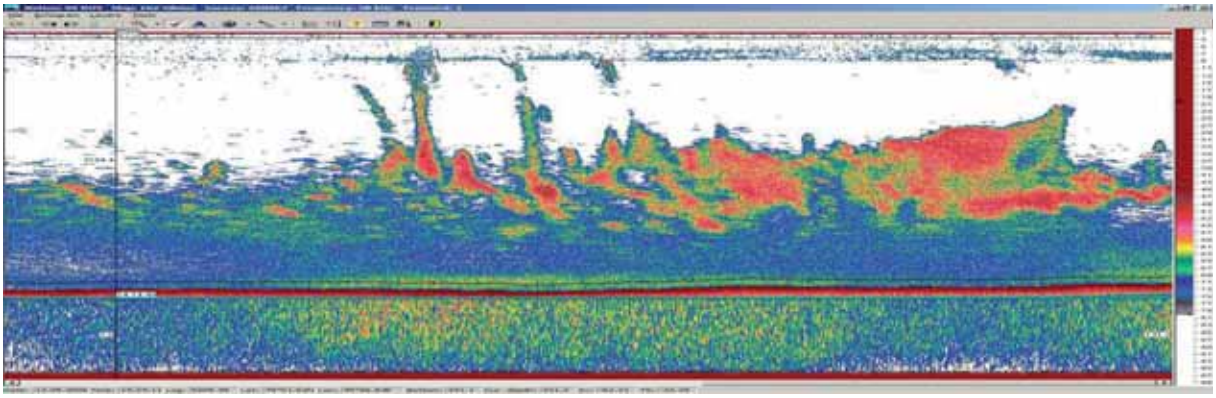

Figure 2.3.6. Echo-records of capelin (25 %) and polar cod (75 %) 13.09.2008 (79º01´ N, 49º56´ E, depth 341 m)

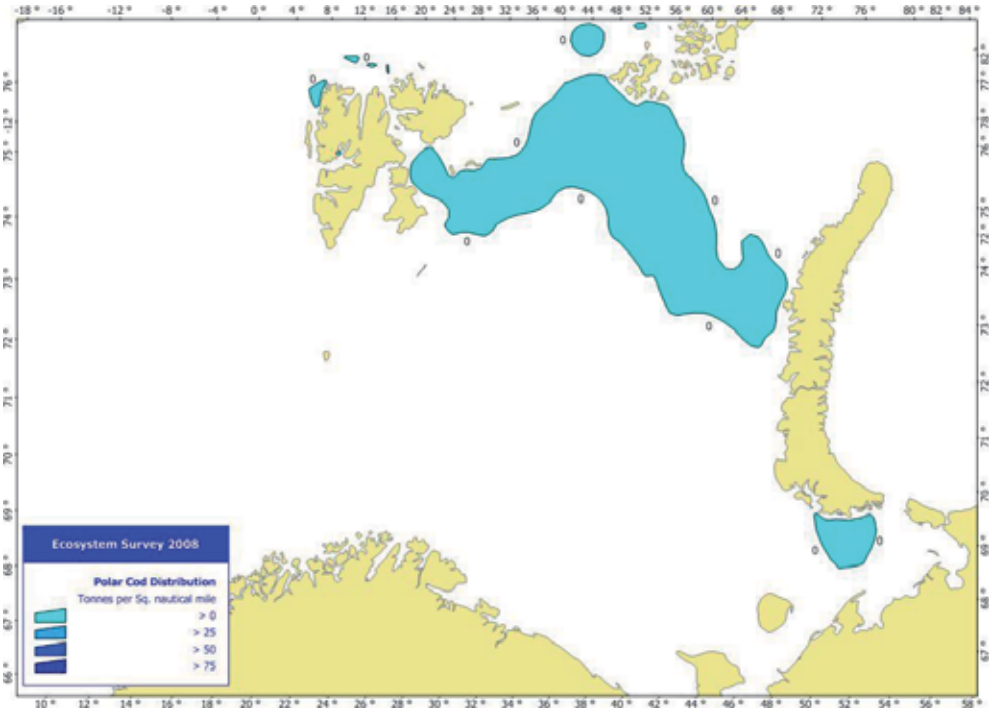

Figure 2.3.7. Estimated density distribution of one year old polar cod (t/nautical mile^2), August - October 2008

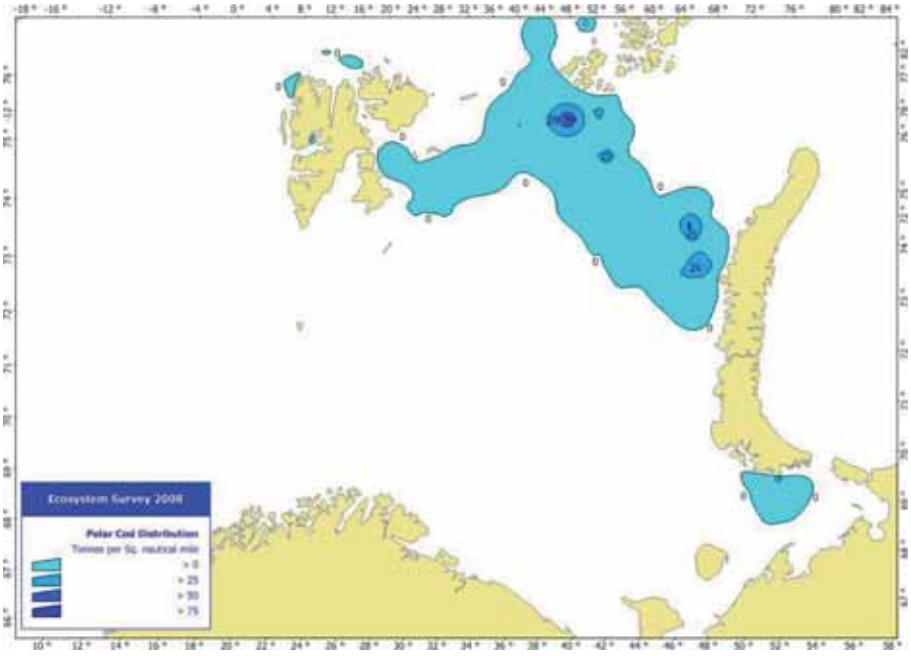

Figure 2.3.8. Estimated total density distribution of polar cod (t/nautical mile^2), August-October 2008

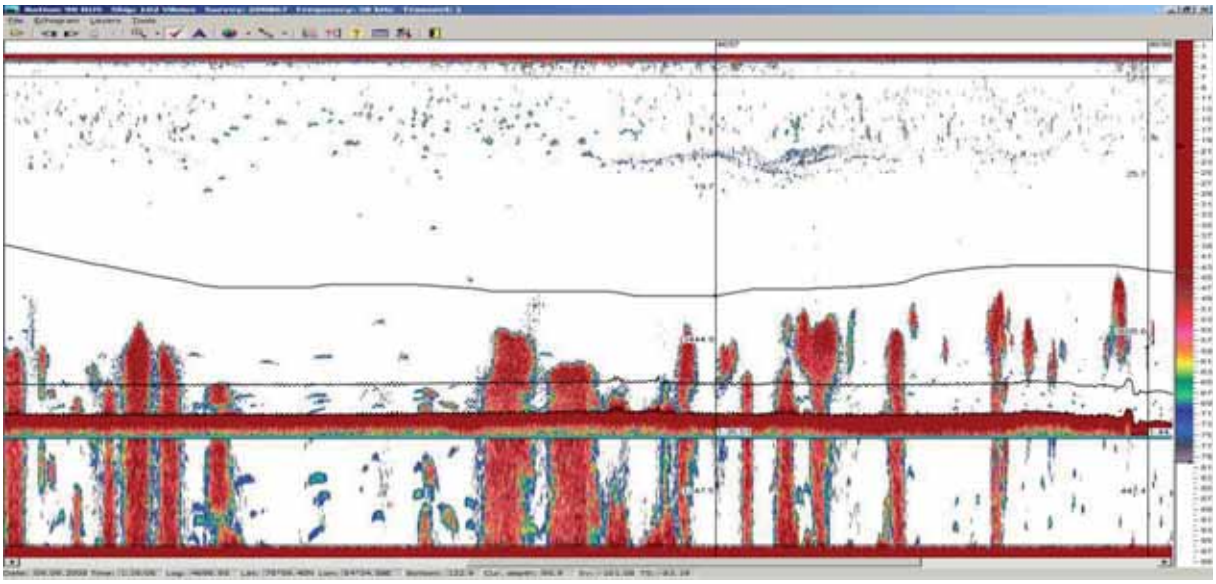

Figure 2.3.9. Typical echo-records of polar cod in eastern Barents Sea (75º59´ N, 54º34´ E, depth 123 m)

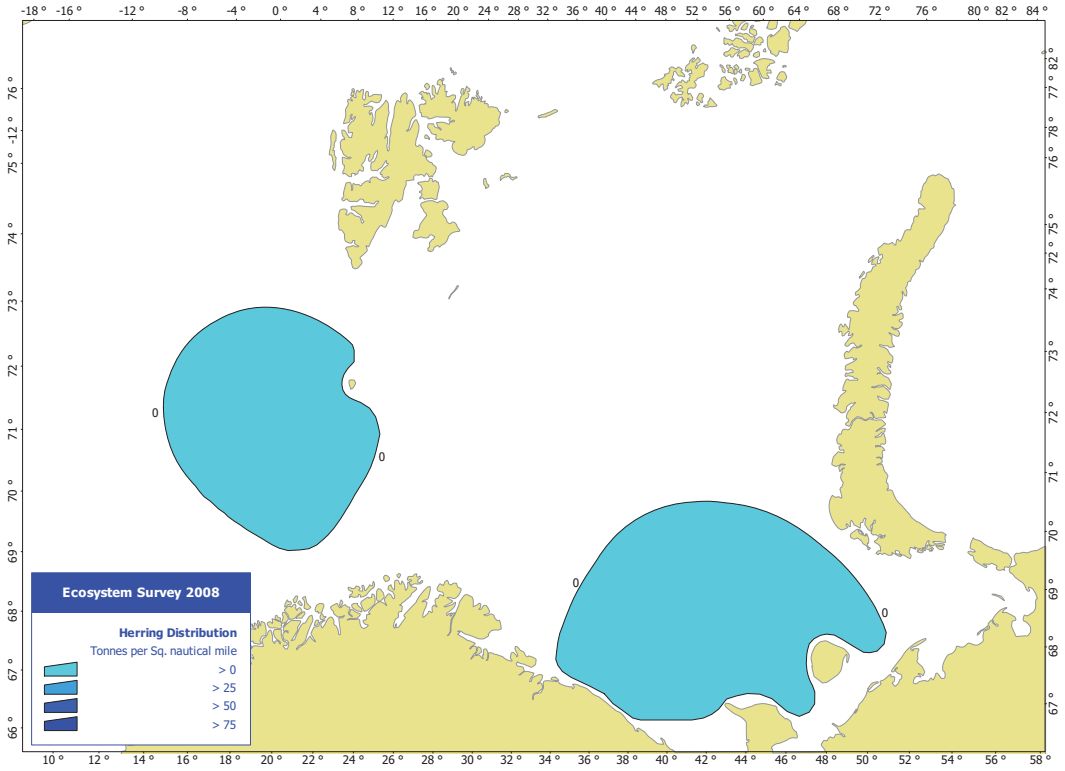

Figure 2.3.10. Estimated total density distribution of herring (t/nautical mile^2), August - October 2008

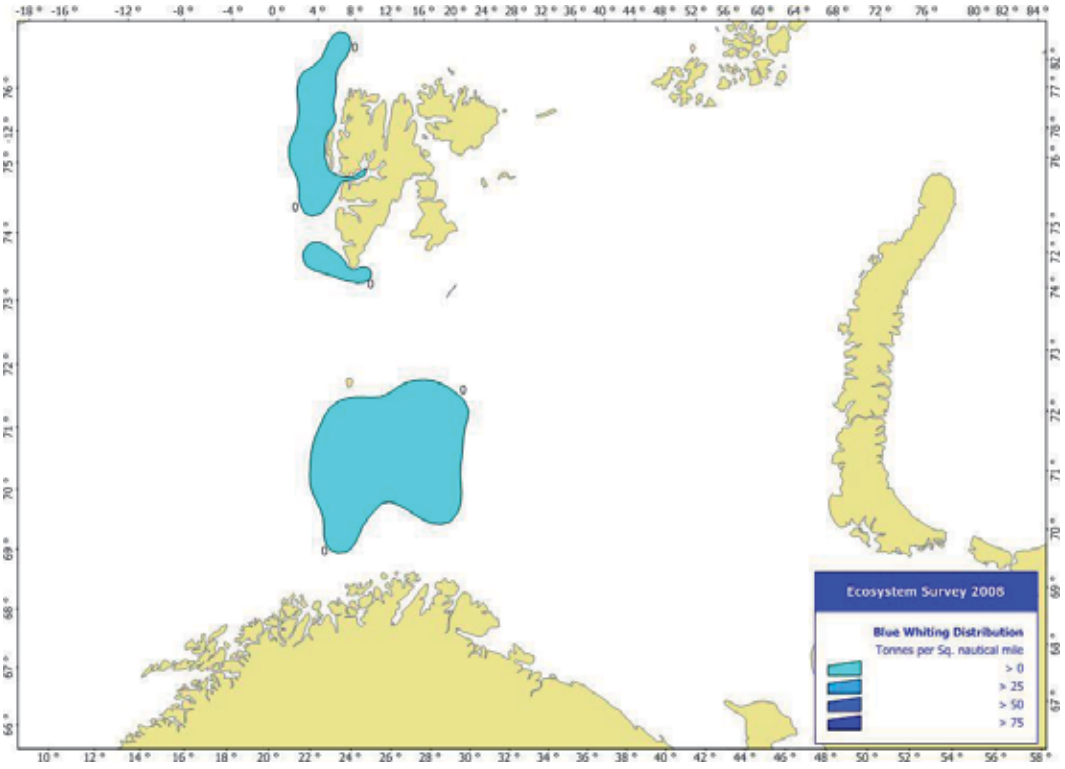

Figure 2.3.11. Estimated total density distribution of blue whiting (t/nautical mile^2), August - October 2008

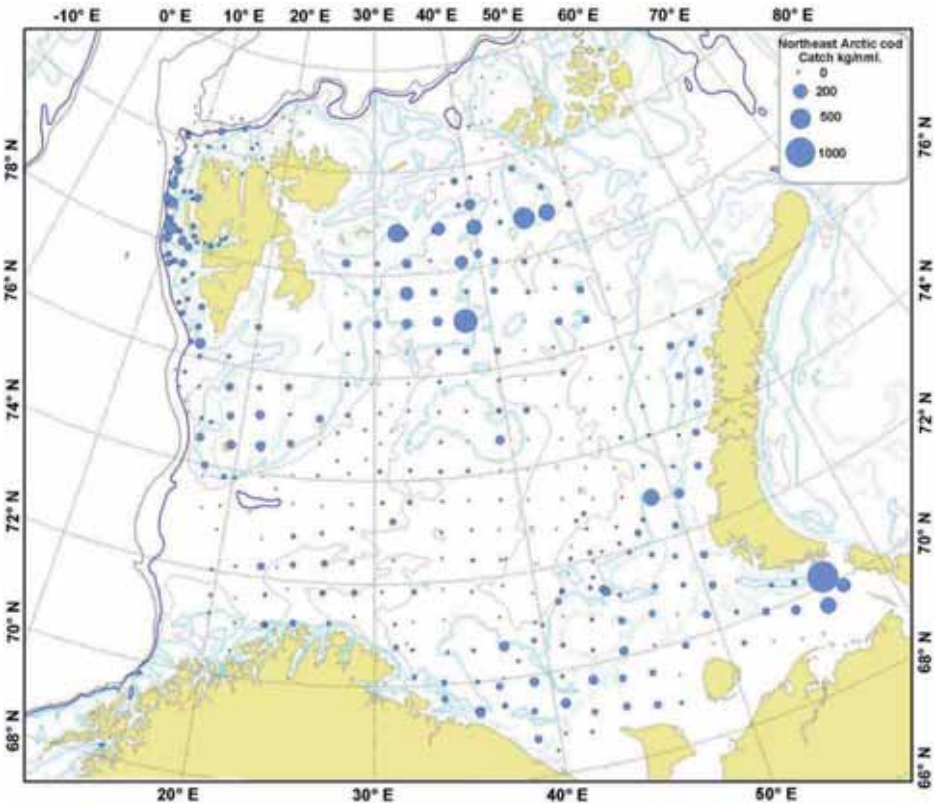

Figure 2.4.1. Distribution of cod, August - October 2008

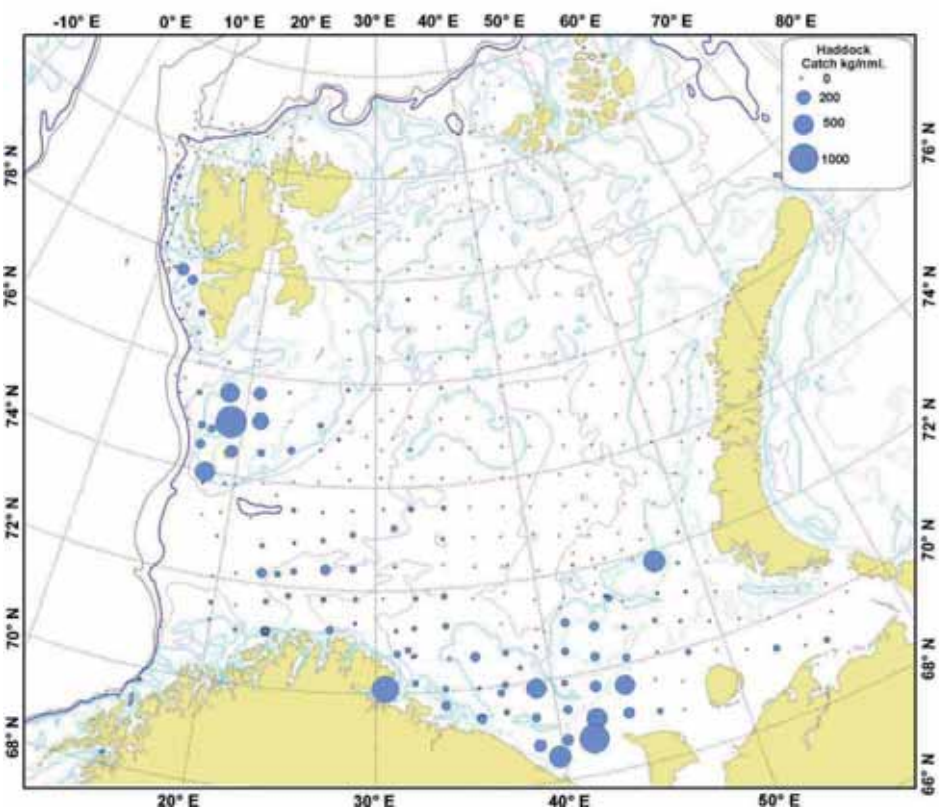

Figure 2.4.2. Distribution of haddock, August - October 2008

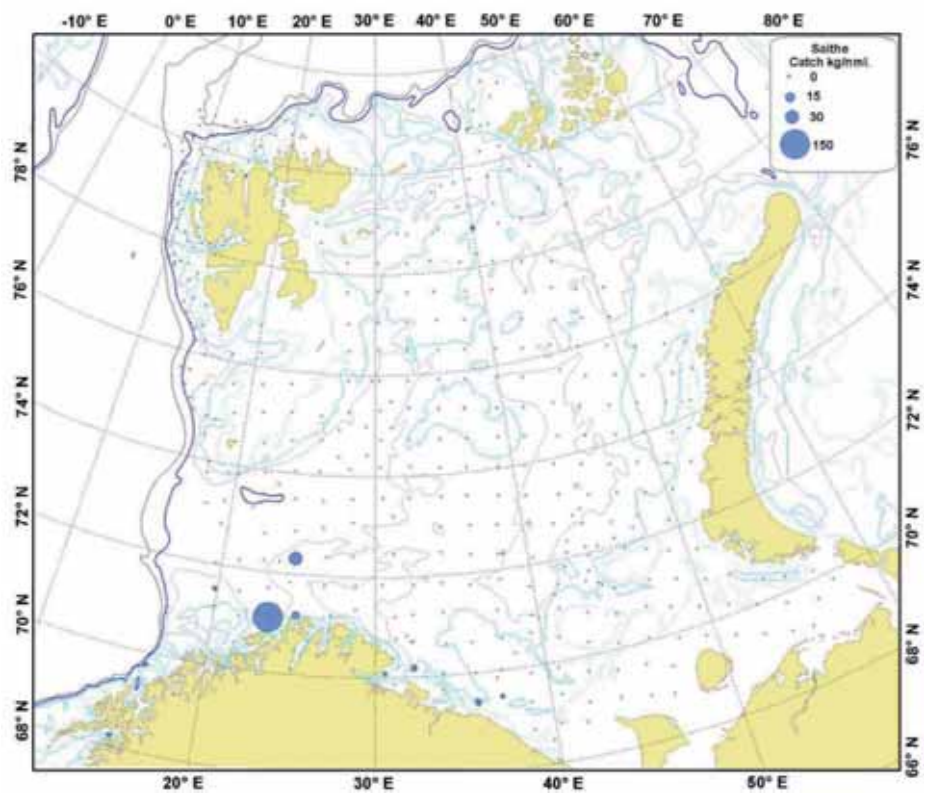

Figure 2.4.3. Distribution of saithe, August - October 2008

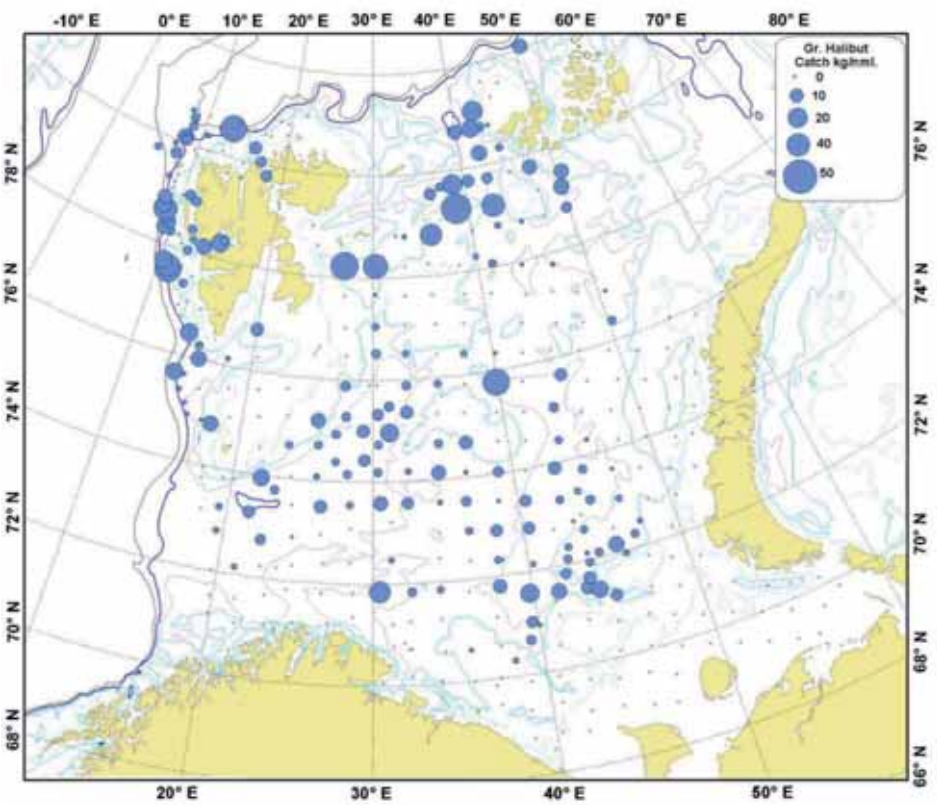

Figure 2.4.4. Distribution of Greenland halibut (WCPUE, based on weight of fish), August - October 2008

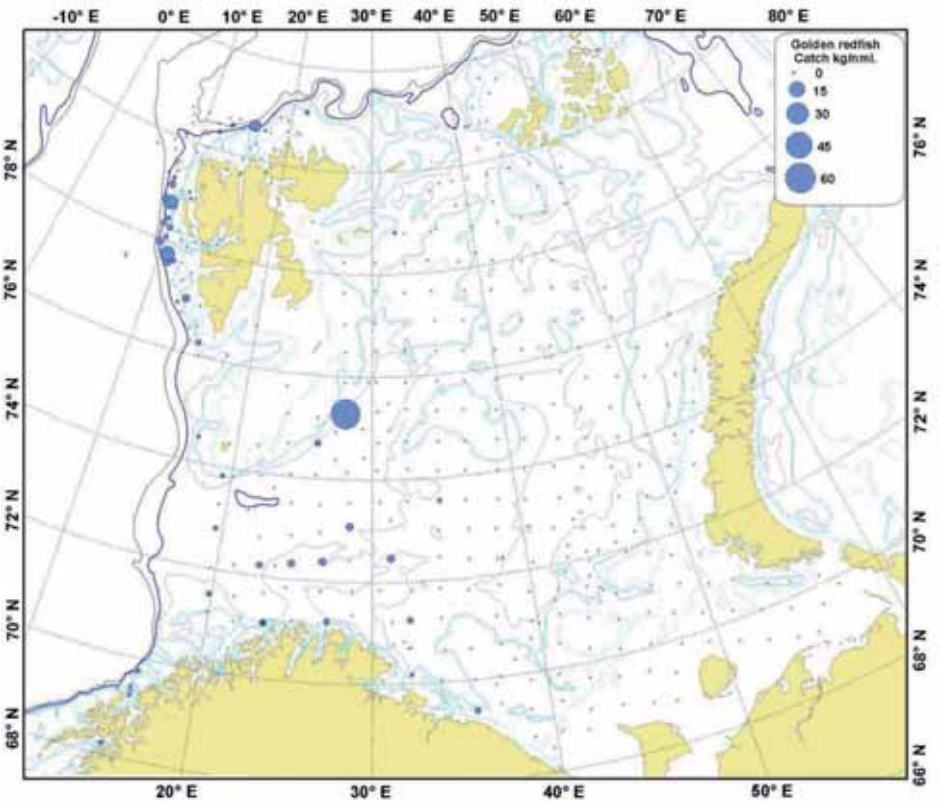

Figure 2.4.5. Distribution of *Sebastes marinus*, August - October 2008

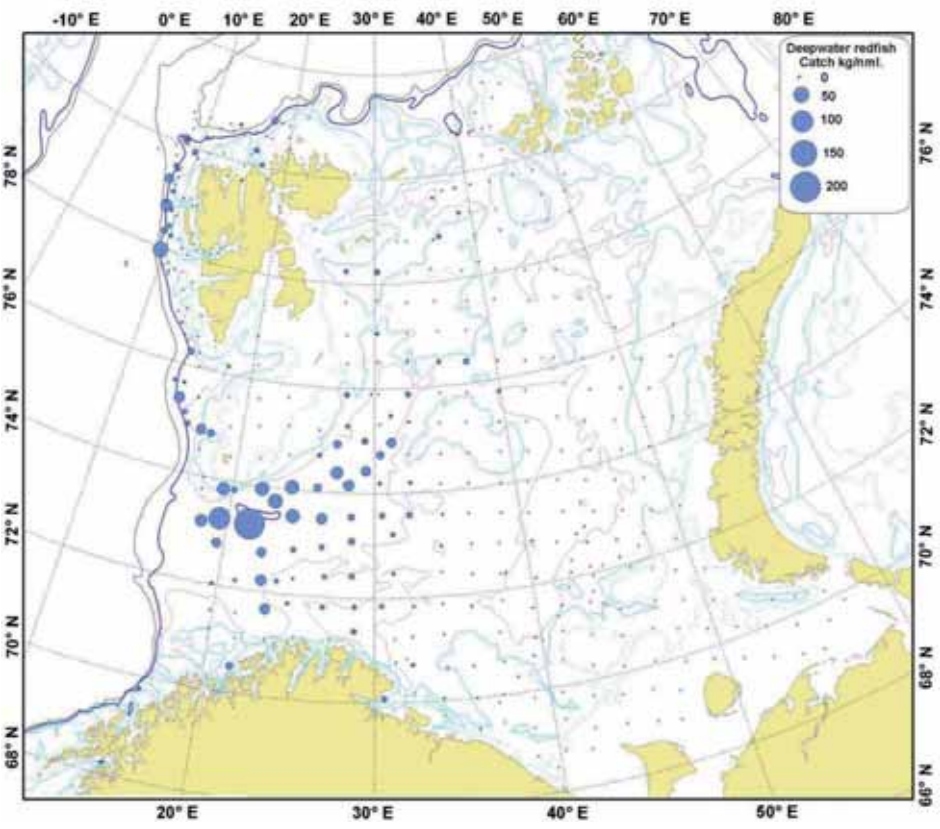

Figure 2.4.6. Distribution of *Sebastes mentella*, August - October 2008

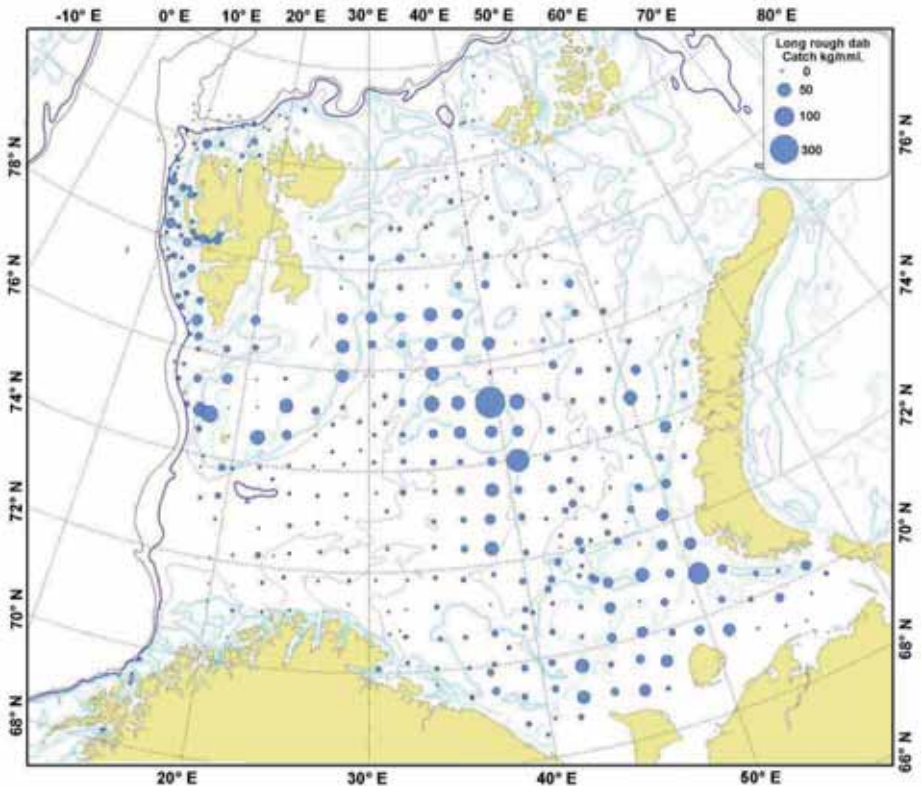

Figure 2.4.7. Distribution of long rough dab, August - October 2008

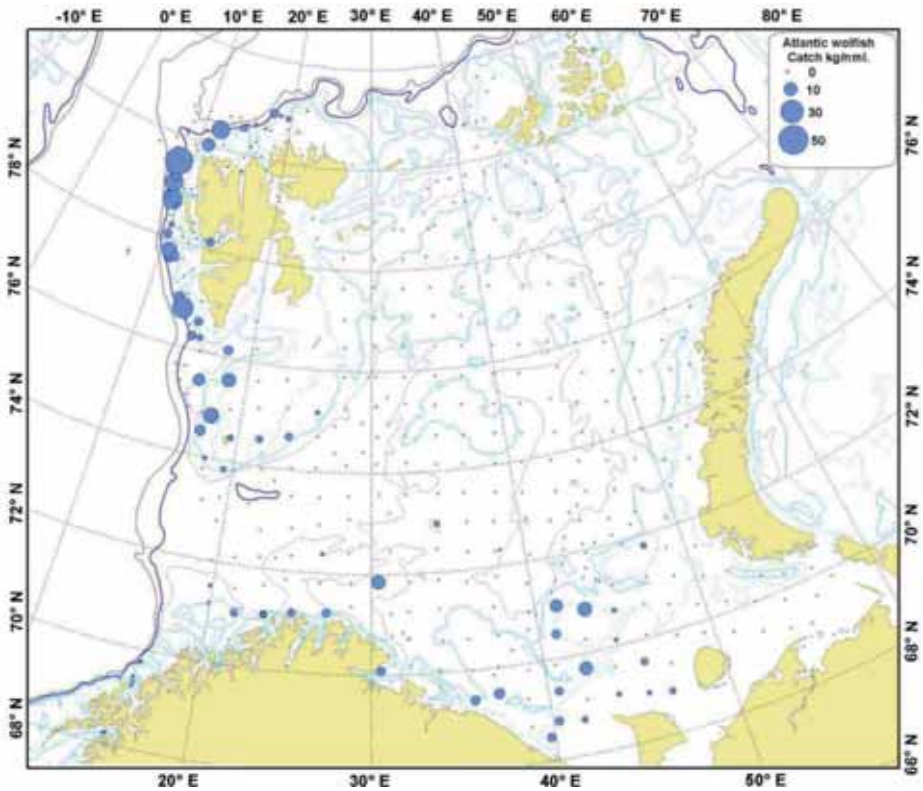

Figure 2.4.8. Distribution of Atlantic wolffish, August-October 2008

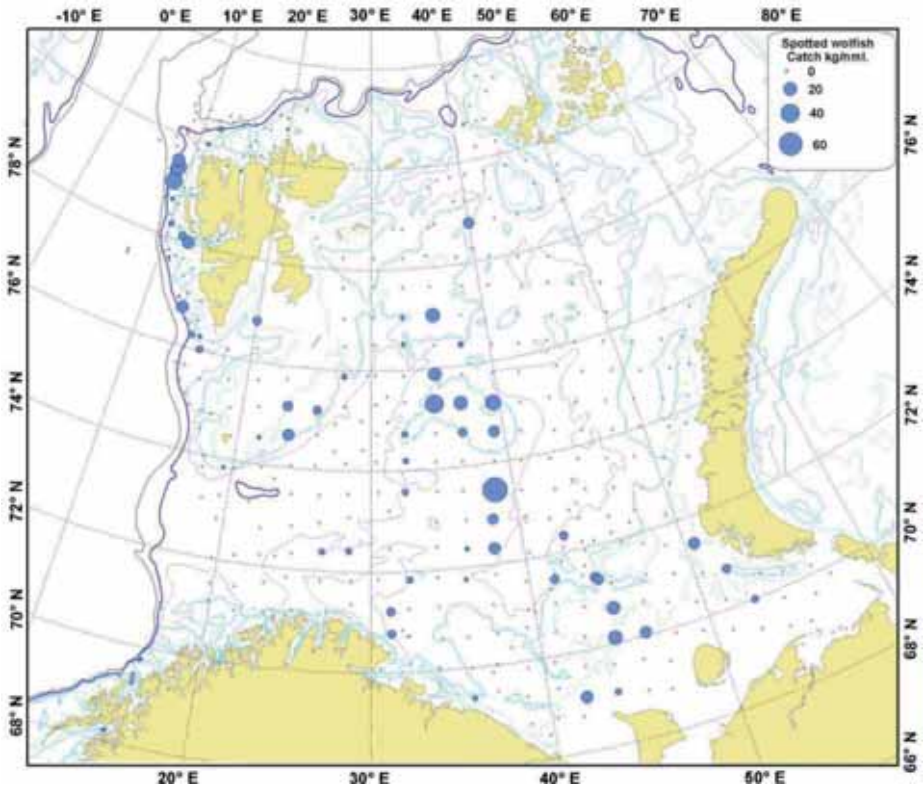

Figure 2.4.9. Distribution of spotted wolffish, August-October 2008

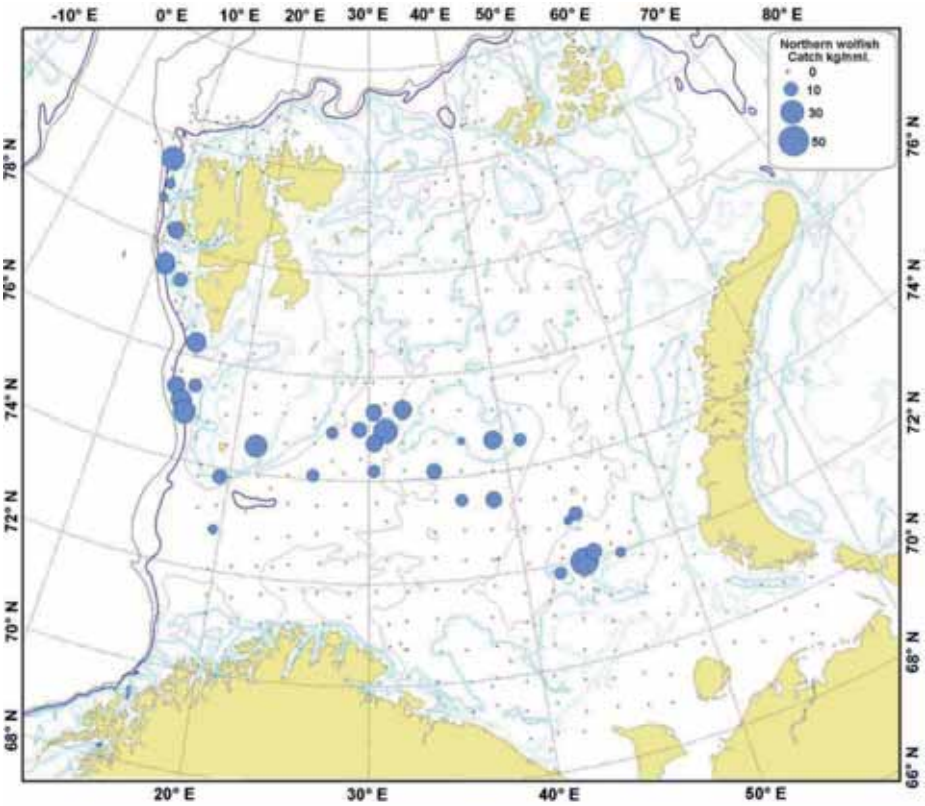

Figure 2.4.10. Distribution of northern wolffish, August-October 2008

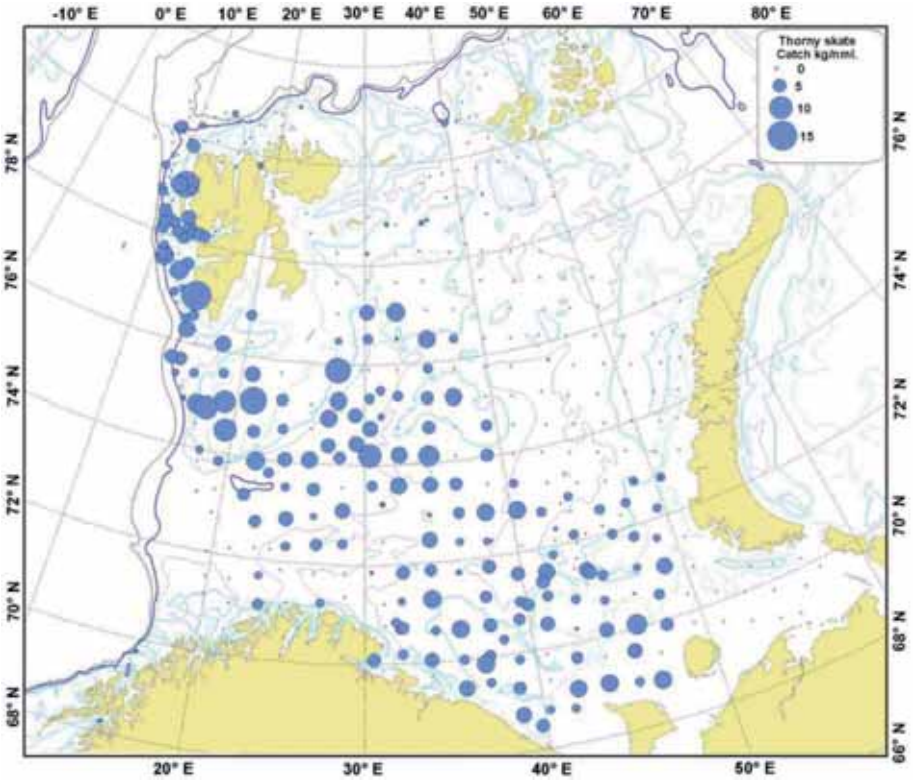

Figure 2.5.1. Distribution of thorny skate, August - October 2008

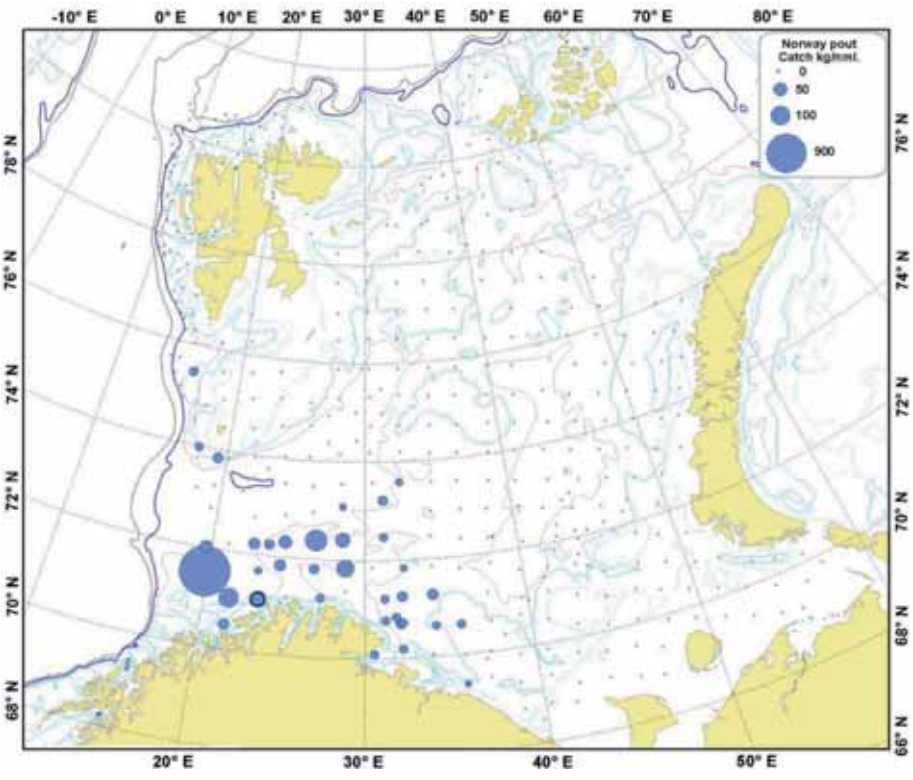

Figure 2.5.2. Distribution of Norway pout, August-October 2008

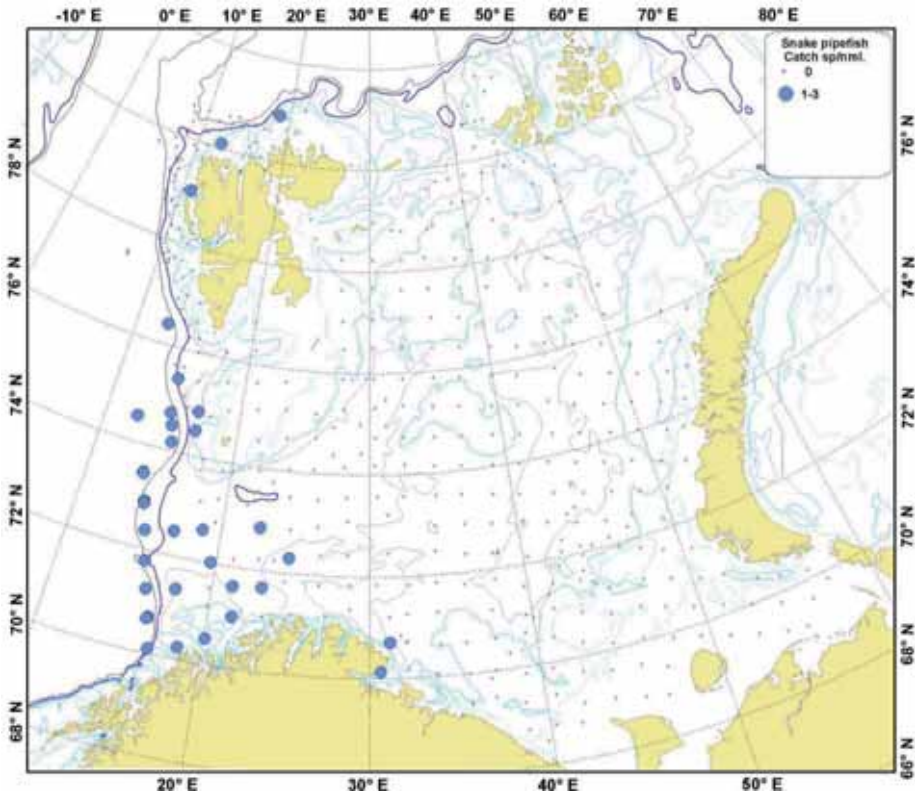

Figure 2.5.3. Distribution of snake pipefish (*Entelurus aequoreus*), August-October 2008

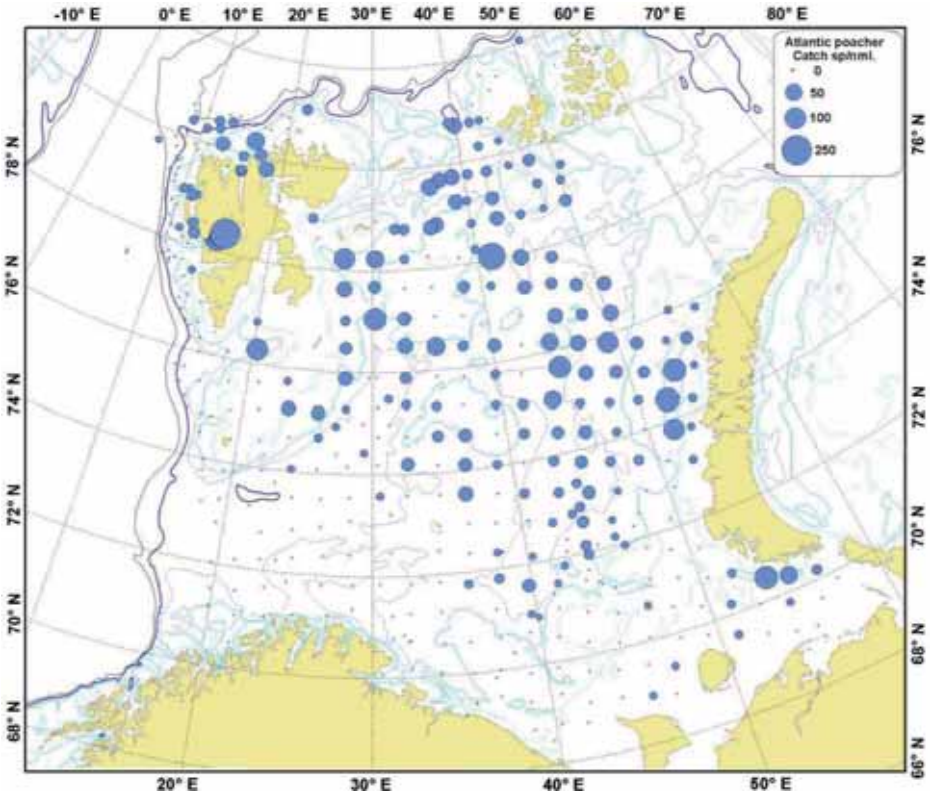

Figure 2.5.4. Distribution of Atlantic poacher, August-October 2008

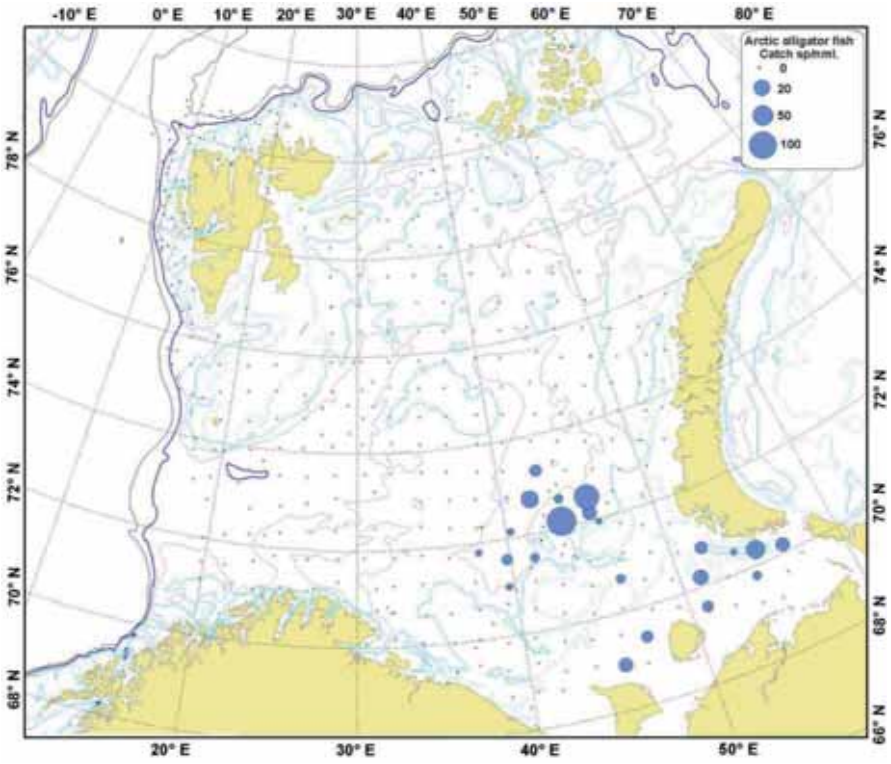

Figure 2.5.5. Distribution of Arctic alligator fish, August-October 2008

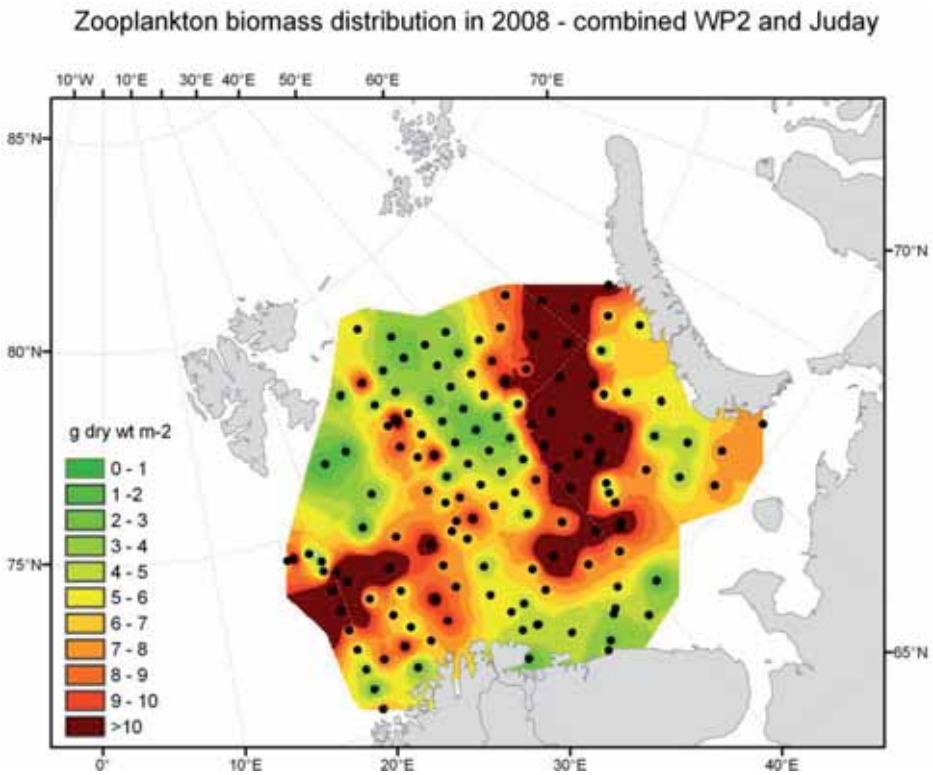

Figure 2.7.1. Zooplankton biomass during the Barents Sea Ecosystem cruise in August-October 2008, combined from WP2 and Juday net samples (bottom-0 m)

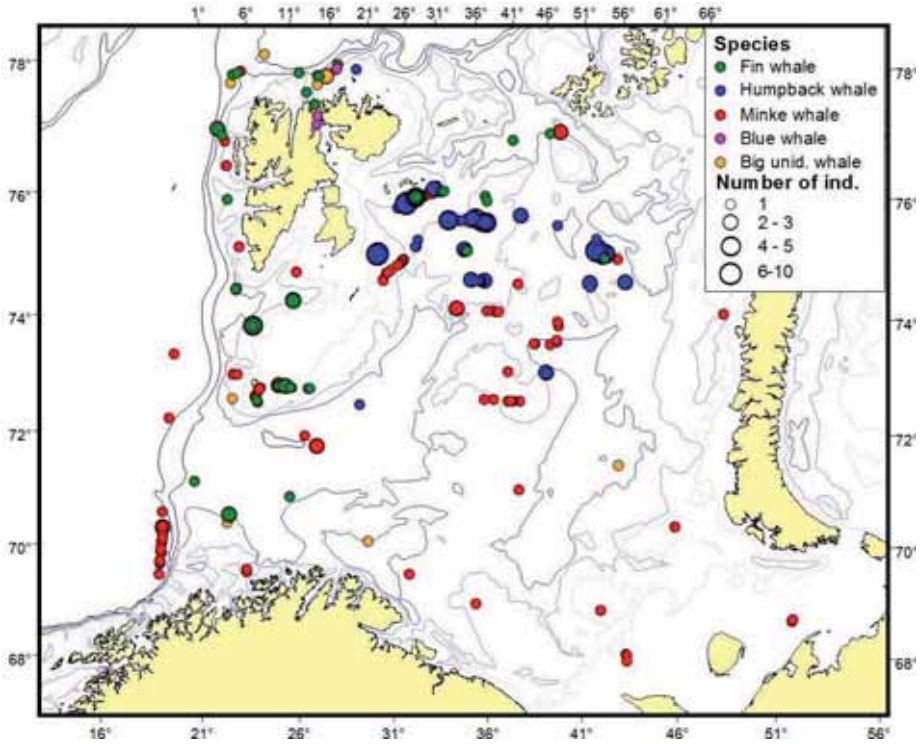

Figure 2.8.1. Distribution of baleen whales observed in August-September 2008

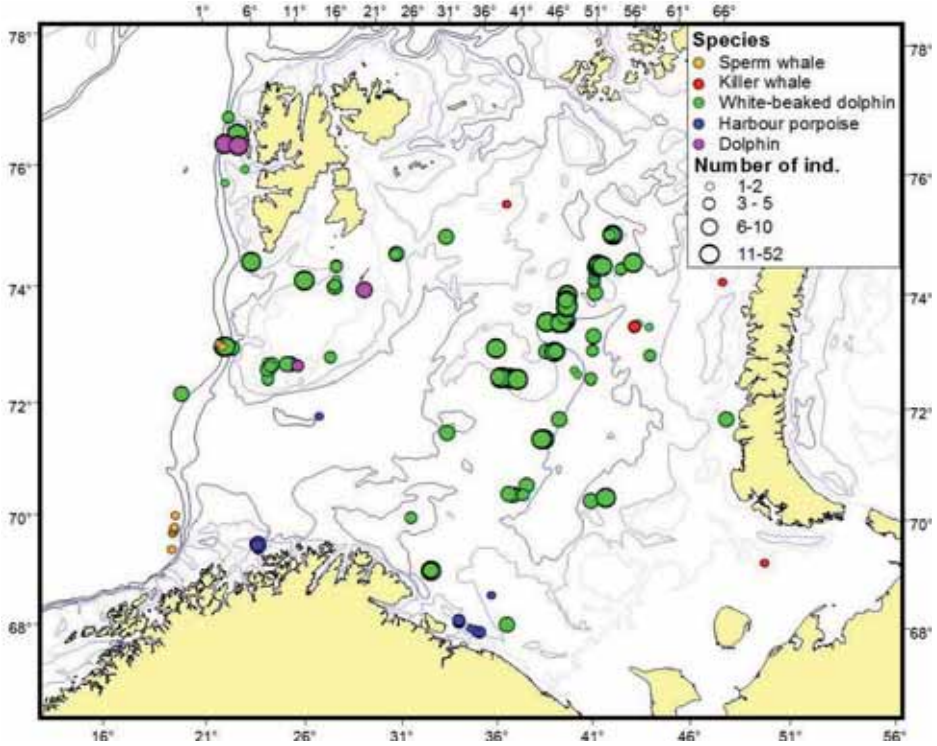

Figure 2.8.2 Distribution of toothed whales observed in August-September 2008

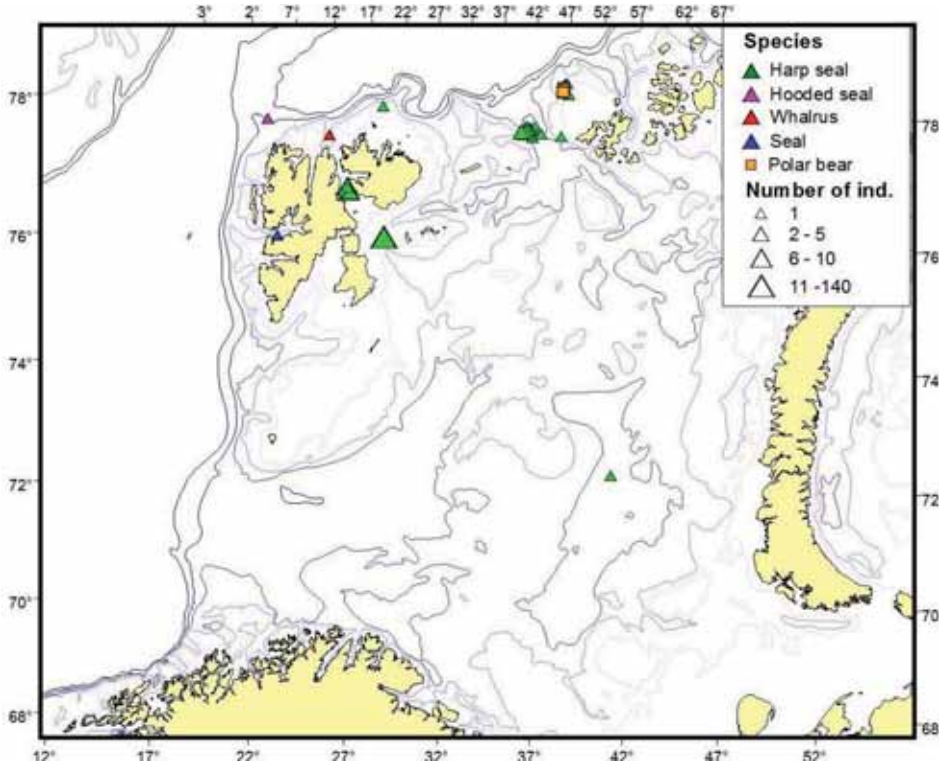

Figure 2.8.3. Distribution of seals observed in August-September 2008

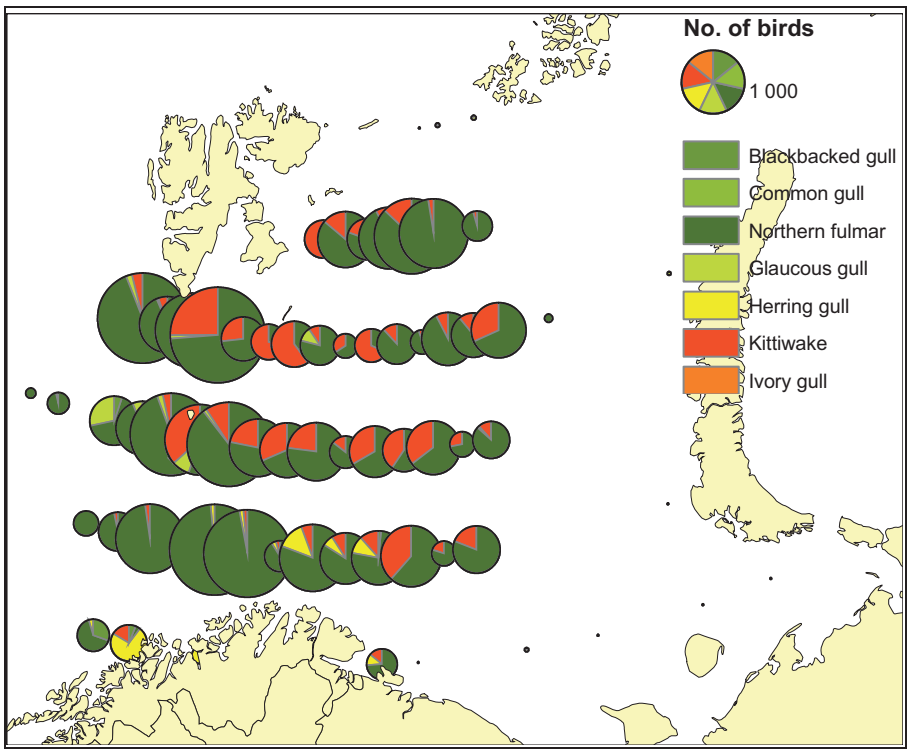

Figure 2.8.4. Distribution of northern fulmars and seven gull species observed during the ecosystem cruise in the Barents Sea 2007.
From the research vessels "Johan Hjort", "Jan Mayen" and "G.O. Sars". Note that gulls were not recorded by observers on "Vilnyus". Pie size reflects total number of birds observed, and colours reflect the different species observed, as shown in the figure legend.

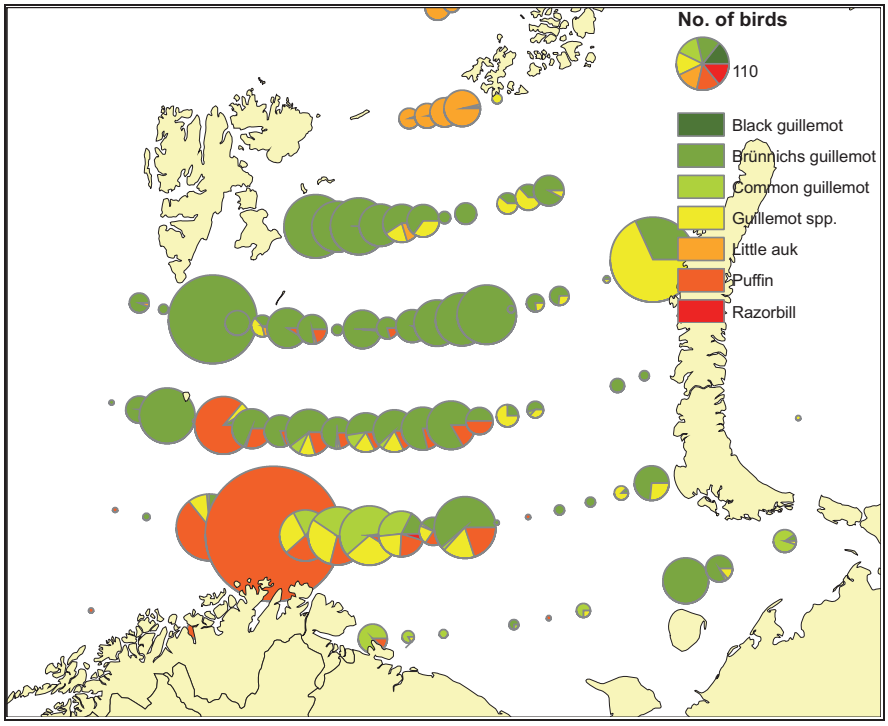

Figure 2.8.5. Distribution of the six species of alcids and non-specified guillemots (guillemot spp.) observed during the ecosystem cruise 2008 in the Barents Sea.
From the research vessels "Vilnyus", "Johan Hjort" , "Jan Mayen" and "G.O. Sars". Pie size reflects total number of birds observed, and colours reflect the different species observed, as shown in the figure legend.

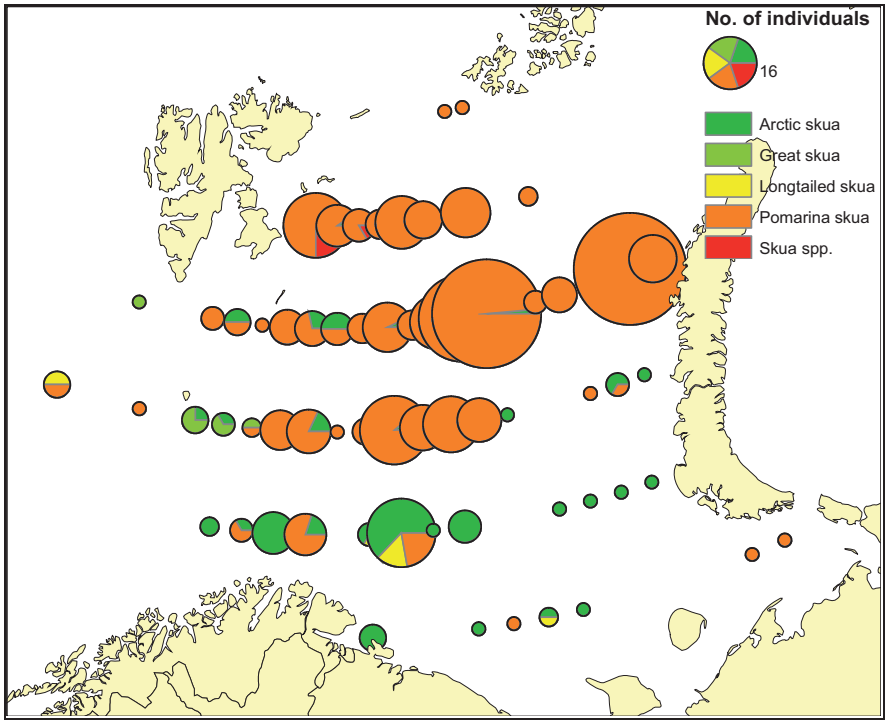

Figure 2.8.6. Distribution of the four species of skuas and non-specified skuas (skua spp.) observed during the ecosystem cruise 2008 in the Barents Sea.
From the research vessels "Vilnyus", "Johan Hjort" , "Jan Mayen" and "G.O. Sars". Pie size reflects total number of birds observed, and colours reflect the different species observed, as shown in the figure legend.

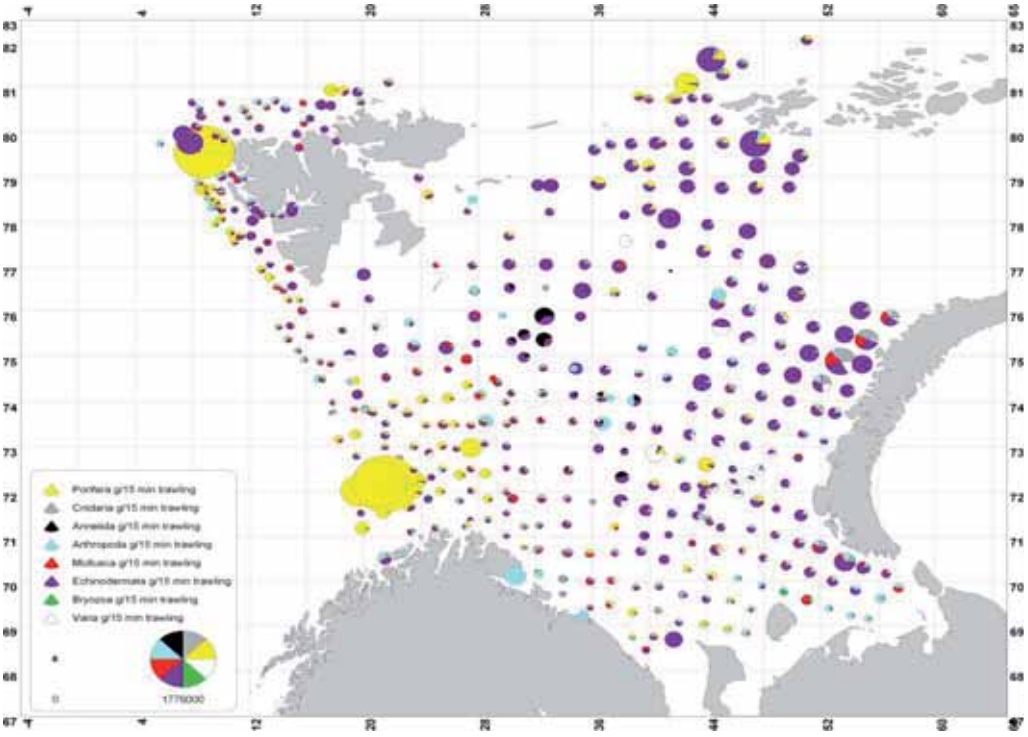

Figure 2.9.1. The total biomass of all registered bottom living evertebrate bycatch (except “nothern shrimp” *Pandalus borealis* , “red king crab” *Paralithodes camtschaticus* and “snow crab” *Chionoecetes opilio*) registered in Ecosytem Survey in August-October 2008.

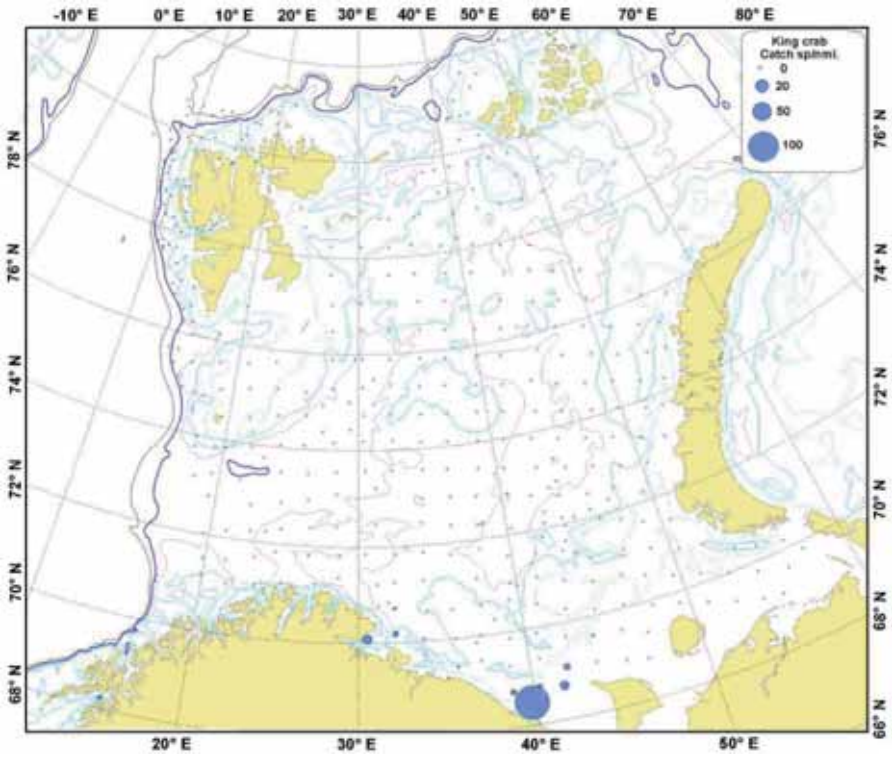

Figure 2.9.2. Distribution of king crab (*Paralithodes camtschaticus*) in Campelen bottom trawl, standardized to numbers/1 nm, August-October 2008

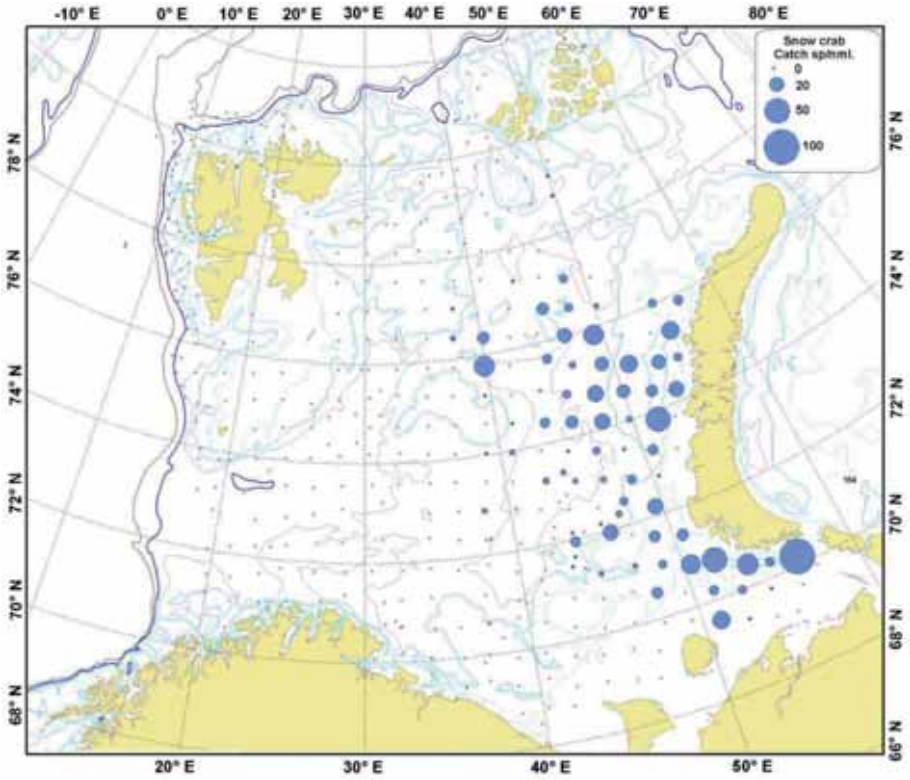

Figure 2.9.3. Distribution of snow crab (*Chionoecetes opilio*) in Campelen bottom trawl. Standardized to numbers/1 nm August-October 2008

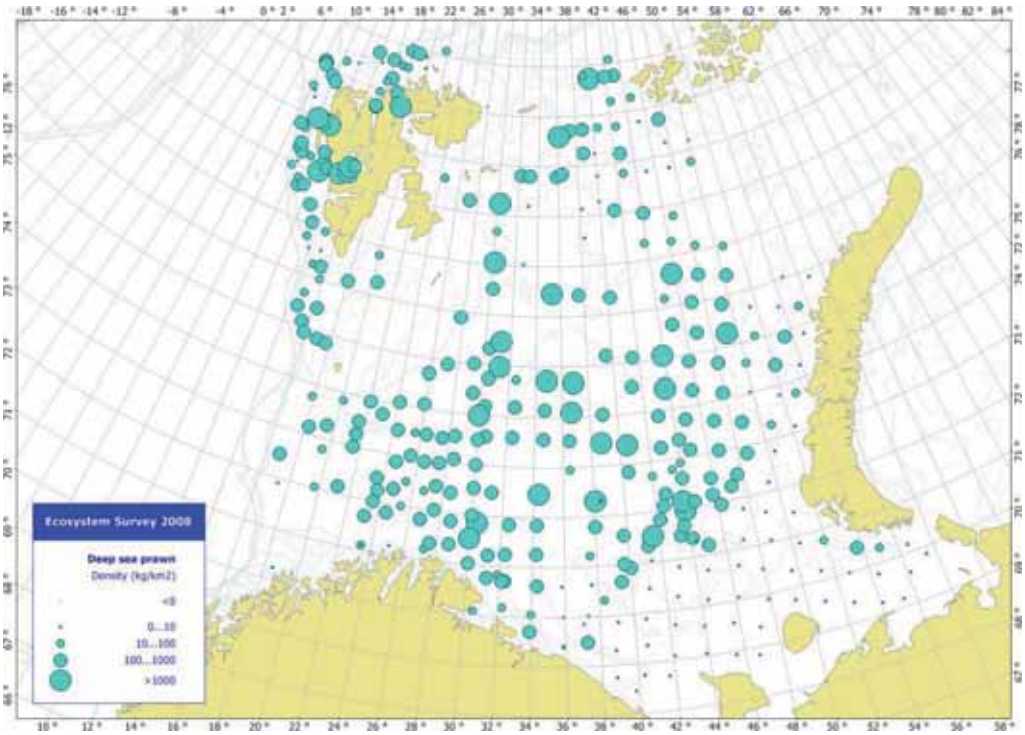

Figure 2.9.4. Distribution of northern shrimp (*Pandalus borealis*) in Campelen bottom trawl, August-October 2008

Appendix 1 Ecosystem Survey 2008 - Participants

Research vessel	Participants
"Vilnus" (08.08-26.09)	A. Amelkin, A.Yu. Astakhov, A.N. Benzik, I. Dolgolenko, Yu.L. Firsov, S.N. Kharlin, N.N. Lukin, A.V. Molchanov, P.A. Murashko, T.A. Prokhorova, D.V. Prozorkevich (cruise leader), A.V. Semenov, E. Timofeevskaja.
"G.O. Sars" (19.08-30.09)	Part 1 (19-31/08): S. Aanes (cruise leader), E. Bjørkvoll, A.L. Brungot, E. Grønningsæter, B.E. Grøsvik, T. Haugland, E. Hermanssen, M. Johannessen, S. Kolbeinsson, Jan de Lange, H. Langøy, H. Mjanger, M. Mjanger, S. Murray, J. Rønning, Th. Sivertsen, T. Sivertsen, T. Thangstad, N. Ushakov Part 2 (01-18/09): J. Alvarez, O.O. Arnøy, B. Ellertsen, Gwynn, T. Haugland, K. Hestnes, M. Hidalgo, K.E. Karlsen, T. Knutsen, S. Kolbeinsson, M. Mjanger, E. Olsen (cruise leader), B. Røttingen, A.B. Skiftesvik, T. Thangstad, N. Ushakov, T. Sivertsen, Th. Sivertsen Part 3 (19-30/09): O.O. Arnøy, E. Grønningsæter, I. Henriksen, L.L. Jorgensen (cruise leader), K.E. Karlsen, B. Kvinge, P. Lubin. M. Nilsen, J. Rønning, A. Steinsland
"J. Hjort" (01.09-16.09)	Part 1 (01-16/09): G. Bakke, J. Erices, E. Eriksen, H. Gjøsæter (cruise leader), H.E. Heldal, M. Kleiven, G. Lien, F. Midtøy, J. H. Nilsen, S. Seim, B. Skjold, Ø. Torgersen, O. N. Årbakke
"Jan Mayen" (08.09-24.09) (25.09-03.10)	Part 1 (08-24/09): A.-K. Abrahamsen, P. Dahl, J. Eert, R.A. Johannesen, A. L. Johnsen, G. Langhelle, H. Larsen, J.E. Nygård, W. Richardsen, L. Solbakken, M. Svenden, A. Sæverud, I. Waddington, T. de L. Wenneck (cruise leader). Part 2 (25.09-04.10): A.-K. Abrahamsen, F.R. Bogetveit, P. Dahl, E. Hermansen, R.A. Johannesen, G. Langhelle, H. Larsen, M. Llope, S. Murray, J.E. Nygård, W. Richardsen, L. Solbakken, T. de L. Wenneck (cruise leader).
"Atlantic Star" (01-10.08)	J. Alvarez (cruise leader), L. Austgulen, I.M. Beck, F.R. Bogetveit, H. Gill, R. Johannesen, L. Rey.

Appendix 2 Ecosystem survey 2007/2008 - Sphere calibration of echosounders

(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	12.05.2008	21.04.2008	08.09.2008	08.08.2008
Place	Sandviksflaket	Børøybukta, Lyngdalområdet	Svalbard	69°12.3/35°15.6
Bottom depth (m)	50	48	45	31
Depth to sphere (m)	21	15-20	6,5	19
Temperature (ºC)				8.57
Salinity (‰)				33.4
TS of sphere (dB)	-33.6	-33.68	-33.6	-33.6
Transducer type	ES38B	ES38B	ES38B	ES38B
Transducer depth (m)	6.0	5.0		0
Real sphere depth (m)		17.5		19
Sound velocity (m/sec)	1471.2	1467.6	1462.9	1482
Absorption coefficient (dB/km)	9.0	10.2	9.32	9.8
Pulse length (Short/Med./Long, ms)	1.024	1.024 (0.256 ms)	1.024	1.024
Bandwidth (Wide/Narrow)	2.425 kHz	3.68		2.43 kHz
Maximum power (W)	2000	2000	2000	2000
Transmit power (W)	2000	2000	2000	2000
Angle sensitivity	21.9	21.9	21.9	21.9
2-way Beam Angle ($10\lg\Psi$, dB)	-20.8	-20.6	-20.6	-20.60
Adjusted Sv Transducer Gain (dB)	-0.62 (Sa corr.)	-0.74 (Sa corr.)	-0.72	-0.65
Adjusted TS Transducer Gain (dB)	25.54	25.10	26.41	26.26
3-dB Beamwidth Alongship (deg.)	7.07	7.17	6.87	7.07
3-dB Beamwidth Athwartship (deg.)	7.08	7.18	7.00	7.03
Alongship (fore/aft.) Offset (deg.)	-0.16	-0.05	-0.02	-0.05
Athwartship Offset (deg.)	-0.08	0.12	-0.05	-0.04
Theoretical Sa (m /nm)				
Measured Sa (m /nm)				

$Sa=\sigma*1852^2/(r^2\Psi)$ $\sigma=4\pi*10^{0,1\,TS}$

Appendix 3 Sampling of fish

	Norwegian vessels	Russian vessels	Sum
Capelin			
No of stations with samples	364	160	
Nos. length measured	18792	8286	
Nos. aged	3042	1064	
Polar cod			
No of stations with samples	136	70	
Nos. length measured	3648	7667	
Nos. aged	611	644	
Herring			
No of stations with samples	11	27	
Nos. length measured	683	510	
Nos. aged	-	93	
Blue whiting			
No of stations with samples	83	-	
Nos. length measured	1960	-	
Nos. aged	154	-	
Cod			
No of stations with samples	483	272	
Nos. length measured	16499	10821	
Nos. aged	1308	1453	
Haddock			
No of stations with samples	288	92	
Nos. length measured	9653	7491	
Nos. aged	497	503	
Redfish (*Sebastes marinus*)			
No of stations with samples		-	
Nos. length measured		-	
Nos. taken for age		-	
Redfish (*Sebastes mentella*)			
No of stations with samples	155	30	
Nos. length measured	4623	639	
Nos. taken for age	424	190	
Saithe			
No of stations with samples	37	20	
Nos. length measured	156	48	
Nos. taken for age		13	
Greenland halibut			
No of stations with samples	218	63	
Nos. length measured	1148	1186	
Nos. taken for age	802	780	
Atlantic wolffish (Anarhichas lupus)			
No of stations with samples		17	
Nos. length measured		58	
Spotted wolffish (*Anarhichas minor*)			
No of stations with samples	58	15	
Nos. length measured	117	25	
Northern wolffish (*Anarhichas denticulatus*)			
No of stations with samples	37	6	
Nos. length measured	47	10	
Long rough dab			
No of stations with samples	254	140	
Nos. length measured	8106	7840	

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

Appendix 4 Sampling of fish stomachs

	Norwegian vessels	Russian vessels	Sum
Capelin			
No of stations with samples	17	7	
Nos. stomachs sampled	1481	588	
Polar cod			
No of stations with samples	9	9	
Nos. stomachs sampled	920	77	
Herring			
No of stations with samples	1	6	
Nos. stomachs sampled	100	39	
Blue Whiting			
No of stations with samples	1	-	
Nos. stomachs sampled	100	-	
Cod			
No of stations with samples	159	136	
Nos. stomachs sampled	1095	1453	
Haddock			
No of stations with samples	1	71	
Nos. stomachs sampled	1	503	
Redfish (Sebastes marinus)			
No of stations with samples		-	
Nos. stomachs sampled		-	
Redfish (Sebastes mentella)			
No of stations with samples		30	
Nos. stomachs sampled		190	
Saithe			
No of stations with samples		5	
Nos. stomachs sampled		13	
Greenland halibut			
No of stations with samples	2	63	
Nos. stomachs sampled	4	780	
Plaice			
No of stations with samples		3	
Nos. stomachs sampled		56	
Spotted wolffish (Anarhichas minor)			
No of stations with samples		-	
Nos. stomachs sampled		-	
Northern wolffish (Anarhichas denticulatus)			
No of stations with samples		-	
Nos. stomachs sampled		-	
Long rough dab			
No of stations with samples		47	
Nos. stomachs sampled		719	
Thorny skate			
No of stations with samples	1	56	
Nos. stomachs sampled	5	149	

Appendix 4 cont.

	Norwegian vessels	Russian vessels	Sum
Arctic skate			
No of stations with samples		3	
Nos. stomachs sampled		49	
Triglops murrayi			
No of stations with samples		7	
Nos. stomachs sampled		25	
Triglops pingeli			
No of stations with samples		5	
Nos. stomachs sampled		42	
Careproctus reinhardti			
No of stations with samples		36	
Nos. stomachs sampled		108	
Gymnocanthus tricuspis			
No of stations with samples		11	
Nos. stomachs sampled		105	
Myoxocephalus scorpius			
No of stations with samples		1	
Nos. stomachs sampled		2	
Cottunculus sadko			
No of stations with samples		10	
Nos. stomachs sampled		15	
Cottunculus microps			
No of stations with samples		6	
Nos. stomachs sampled		14	
Eumicrotremus spinosus			
No of stations with samples		4	
Nos. stomachs sampled		23	
Eumicrotremus derjugini			
No of stations with samples		1	
Nos. stomachs sampled		1	
Lycodes seminudis			
No of stations with samples		16	
Nos. stomachs sampled		102	
Lycodes reticulatus			
No of stations with samples		18	
Nos. stomachs sampled		103	
Lycodes vahli gracilis			
No of stations with samples		10	
Nos. stomachs sampled		40	
Liparis gibbus			
No of stations with samples		6	
Nos. stomachs sampled		28	
Liparis fabricii			
No of stations with samples		10	
Nos. stomachs sampled		105	
Leptagonus decagonus			
No of stations with samples		1	
Nos. stomachs sampled		1	

Appendix 5 Wcpue (kg per nautical miles towed, demersal trawls)

Number of bottom trawls stations where the fish registered and average length with length range for fish caught in demersal trawls at the ecosystem survey 2008. Fish classified to order, family or genus are marked in bold. The fish are sorted after their occurrence. The species with zero occurrence were caught in pelagic trawls only.

Family	Latin name	English name	wcpue	stas	Length (cm)
Gadidae	*Gadus morhua*	Cod	4.399	607	31.6 (2.8;132)
Osmeridae	*Mallotus villosus*	Capelin	0.198	530	14.5 (2.5;37.7)
Pleuronectidae	*Hippoglossoides platessoides*	long rough dab	1.304	505	20.1 (2;51)
Gadidae	*Melanogrammus aeglefinus*	Haddock	3.917	392	30.8 (3.5;74)
Gadidae	*Boreogadus saida*	Polar cod	0.627	284	16.5 (3.6;45)
Cottidae	*Artediellus atlanticus*	Atlantic hookear sculpin	0.018	251	9.3 (3;24.2)
Agonidae	*Leptagonus decagonus*	Atlantic poacher	0.007	227	13.5 (3;38)
Sebastidae	*Sebastes mentella*	Deepwater redfish	0.383	222	18.8 (6;54)
Rajidae	*Amblyraja radiata*	Thorny skate	0.136	214	40.3 (9;65)
Stichaeidae	*Leptoclinus maculatus*	Spotted snake blenny	0.012	210	13.1 (5;34)
Pleuronectidae	*Reinhardtius hippoglossoides*	Greenland halibut	0.327	197	35 (5.3;79)
Sebastidae	*Sebastidae*		0.017	167	10.5 (1.9;38.9)
Cyclopteridae	*Cyclopterus lumpus*	Lumpsucker	0.009	158	27.9 (5.1;50)
Liparidae	*Careproctus*		0.001	141	10.5(6;26)
Gadidae	*Trisopterus esmarkii*	Norway pout	0.371	131	17.6 (3.5;42)
Clupeidae	*Clupea harengus*	Herring	0.009	125	14 (4.9;20.9)
Zoarcidae	*Lycodes gracilis*		0.006	124	18.9 (7;39)
Stichaeidae	*Lumpenus lampretaeformis*		0.009	119	22.3 (4.5;38)
Gadidae	*Micromesistius poutassou*	Blue whiting	0.311	107	33.4 (7;56)
Zoarcidae	*Lycodes pallidus*	Pale eelpout	0.005	100	15.8 (5;39)
Cottidae	*Triglops nybelini*	Bigeye sculpin	0.026	91	10.1 (4.8;18)
Anarhichadidae	*Anarhichas lupus*	Atlantic wolffish	0.095	80	29.5 (5.6;103)
Anarhichadidae	*Anarhichas minor*	Spotted wolffish	0.166	77	60 (7;122)
Cottidae	*Triglops murrayi*	Moustache sculpin	0.007	74	10.8 (5;17)
Zoarcidae	*Lycodes rossi*	Threespot eelpout	0.003	70	17 (7;39)
Stichaeidae	*Lumpenus sp.*		0.000	65	6.8 (3;14)
Sebastidae	*Sebastes marinus*	golden redfish	0.071	64	18.5 (7;60)
Psychrolutidae	*Cottunculus microps*	Polar sculpin	0.002	60	13.5 (6;29)
Gadidae	*Pollachius virens*	Saithe	0.079	58	40.8 (7;105)
Zoarcidae	*Lycodes seminudus*	Longear eelpout	0.006	55	21.1 (9;39)
Zoarcidae	*Lycodes reticulatus*	Arctic eelpout	0.006	53	18 (7;52)
Paralepididae	*Arctozenus risso*	white barracudina	0.001	50	25 (13;30)
Rajidae	*Amblyraja hyperborea*	Arctic skate	0.038	49	41.2 (16;74)
Liparidae	*Liparis fabricii*	Gelantinous snailfish	0.013	49	10.7 (3;18)
Cottidae	*Gymnocanthus tricuspis*	Arctic staghorn sculpin	0.011	43	12.8 (4;22)
Ammodytidae	*Ammodytidae*		0.000	41	10.0 (3;28.5)
Gadidae	*Gadiculus argenteus thori*	Silvery pout	0.001	39	10.1 (7;18)
Anarhichadidae	*Anarhichas denticulatus*	Northern wolffish	0.126	36	78.2 (7;121)
Syngnathidae	*Entelurus aequoreus*	Snake pipefish	0.000	35	35.6 (24;51)
Rajidae	*Rajella fyllae*	Round ray	0.007	35	35.2 (9;59)
Argentinidae	*Argentina silus*	Greater argentine	0.007	34	18.7 (7;44)
Liparidae	*Liparis gibbus*	Variegated snailfish	0.002	34	13.3 (7;28)

Appendix 5 cont.

Family	Latin name	English name	wcpue	stas	Length (cm)
Cottidae	*Icelus bicornis*	Twohorn sculpin	0.000	33	7.6 (4;11)
Cottidae	*Triglops sp.*		0.002	32	7.0 (4;18)
Zorcidae	***Zorcidae***		**0.000**	**30**	**8.5 (8;9)**
Sternoptychidae	*Maurolicus muelleri*	Pearlsides	0.000	28	7.4 (3;30.5)
Cyclopteridae	*Eumicrotremus spinosus*	Atlantic spiny lumpsucker	0.001	25	7.2 (4;12)
Cottidae	*Icelus spatula*		0.001	24	9.0 (5;15)
Lotidae	*Brosme brosme*	cusk	0.019	23	39.4 (5;68)
Zoarcidae	*Lycodes esmarkii*	Greater eelpout	0.004	23	26.9 (11;62)
Agonidae	*Ulcina olrikii*	Northern alligatorfish	0.000	23	7.4 (5;10)
Sebastidae	*Sebastes viviparus*	Lesser redfish	0.020	21	21.4 (7;39)
Zoarcidae	*Lycodes eudipleurostictus*	Doubleline eelpout	0.003	20	22.4 (9;35)
Macrouridae	*Macrourus berglax*	Rough-head grenadier	0.027	19	17.8 (5;41)
Stichaeidae	*Anisarchus medius*	Stout eelblenny	0.000	18	8.6 (6;21)
Pleuronectidae	*Pleuronectes platessa*	plaice	0.068	18	37 (28;58)
Myctophidae	*Benthosema glaciale*	Glacier lanternfish	0.000	17	7.2 (3.9;19.9)
Zorcidae	*Lycodes polaris*		0.003	16	20.7 (11;42)
Gasterosteidae	*Gasterosteus aculeatus*	Threespine stickleback	0.000	15	6.5 (4;9)
Psychrolutidae	*Cottunculus sadko*		0.001	14	12.6 (6;23)
Liparidae	***Liparidae***		**0.000**	**14**	**8.3 (2.8;19.1)**
Lotidae	*Gaidropsarus argentatus*	Arctic rockling	0.002	13	30.3 (22;41)
Myctophidae	***Myctophidae***		**0.000**	**13**	**9.2 (3.5;34.5)**
Gadidae	*Arctogadus glacialis*	Arctic cod	0.000	11	17.6 (13;23)
Cottidae	*Triglops pingelii*	Ribbed sculpin	0.000	10	11.3 (6;16)
Lotidae	*Enchelyopus cimbrius*	Fourbeard rockling	0.000	8	9.2 (3.6;22)
Gadidae	*Merlangius merlangus*	Whiting	0.002	8	26.6 (5.6;44)
Pleuronectidae	*Limanda limanda*	Dab	0.008	7	25.1 (15;37)
Zorcidae	*Gymnelus retrodorsalis*		0.000	6	12 (10;15)
Zoarcidae	*Lycodes squamiventer*	Longear eelpout	0.000	6	17.6 (13;22)
Cottidae	*Myoxocephalus scorpius*	Shorthorn sculpin	0.000	6	13 (4.8;31)
Liparidae	*Paraliparis bathybius*	Black seasnail	0.000	5	22.6 (16;28)
Anarhichadidae	***Anarhichadidae***		**0.000**	**4**	**10.3 (7;13)**
Zoarcidae	*Lycenchelys kolthoffi*		0.000	4	17.8 (15;21)
Zorcidae	*Lycodes paamuiti*		0.000	4	18.3 (14;20)
Pleuronectidae	*Microstomus kitt*	Lemon sole	0.001	4	36.3 (30;51)
Cottidae	*Artediellus scaber*	rough hookear sculpin	0.000	3	9 (6;11)
Rajidae	*Bathyraja spinicauda*	Spinetail ray	0.013	3	87.8 (59;158)
Cyclopteridae	*Eumicrotremus derjugini*	Leatherfin lumpsucker	0.000	3	6.7 (6;8)
Pleuronectidae	*Glyptocephalus cynoglossus*	Witch	0.001	3	39.4 (32;45)
Pleuronectidae	*Hippoglossus hippoglossus*	halibut	0.005	3	71.2 (61;96)
Petromyzontidae	*Lethenteron camtschaticum*	Arctic Lamprey	0.000	3	34.3 (30;37)
Liparidae	*Liparis liparis*	Common seasnail	0.000	3	10.4 (4.3;18)
Liparidae	*Liparis tunicatus*	Kelp snailfish	0.000	3	12.6 (9;16)
Stichaeidae	*Lumpenus fabricii*	Slender eelblenny	0.000	3	20.6 (15;27)
Zoarcidae	*Lycodonus flagellicauda*		0.000	3	22.8 (21;24)
Chimaeridae	*Chimaera monstrosa*	rabbit fish	0.006	2	46.1 (28;72)
Gadidae	*Eleginus nawaga*	navaga	0.000	2	21.6 (18;26)
Zoarcidae	*Gymnelus viridis*	Fish doctor	0.000	2	10.2 (8;12)
Zorcidae	*Lycodes adolfi*		0.000	2	14.5 (10;21)
Dalatiidae	*Somniosus microcephalus*	Greenland shark	0.074	2	269.5 (208;331)

Appendix 5 cont.

Family	Latin name	English name	wcpue	stas	Length (cm)
Agonidae	*Agonus cataphractus*	Hooknose	0.000	1	13 (13;13)
Rajidae	*Dipturus linteus*	Sail ray	0.001	1	50.4 (13;78)
Pleuronectidae	*Liopsetta glaciale*		0.000	1	18.3 (18;19)
Liparidae	*Liparis montagui*	Montagu's sea snail	0.000	1	13.3 (10;16)
Lophiidae	*Lophius piscatorius*	anglerfish	0.006	1	107 (107;107)
Zoarcidae	*Lycodes frigidus*		0.000	1	38 (38;38)
Zorcidae	*Lycodes luetkeni*		0.000	1	30 (17;43)
Lotidae	*Molva molva*	Ling	0.001	1	93 (93;93)
Notoscopelus	*Notoscopelus elongatus kroyeri*		0.000	1	8 (8;8)
Phycidae	*Phycis blennoides*	Greater forkbeard	0.000	1	52 (52;52)
Scophthalmidae	*Zeugopterus norvegicus*	Norwegian topknot	0.000	1	8 (8;8)
Triglidae	*Eutrigla gurnardus*	grey gurnard		0	
Scombridae	*Scomber scombrus*	mackerel		0	
Trachipteridae	*Trachipterus arcticus*	Dealfish		0	

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