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from the Joint Norwegian/Russian Ecosystem Survey in the Barents Sea, August – October 2011

Institute of Marine Research - IMR

Polar Research Institute of Marine Fisheries and Oceanography - PINRO

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Survey Report

from the Joint Norwegian/Russian Ecosystem Survey in the Barents Sea, August – October 2011

Bergen, December 2011

Contents

Preface

The 8th joint survey was carried out during the period 10 August to 5 October 2011. The survey plans and tasks were agreed upon at the annual IMR-PINRO Meeting in March 2011 and all joint work was executed according to this plan.

In 2011, a nearly total coverage of the Barents Sea was obtained, apart from small areas south and north of the "Loophole", where the jurisdiction changed in July 2011 in accordance with the new Norwegian-Russian division line. As there were doubts about exactly where the Russian and Norwegian vessels could operate non of the vessels could enter these areas.

The weather conditions were favourable during most of the survey. "Helmer Hanssen" (9-24/8) covered the Spitsbergen/Svalbard area, while "Vilnyus" (10/08-3/10) first covered the southeastern part of the Barents Sea and then continued to cover the REEZ from south to north. "Christina E" (25/08-18/09) covered the central parts of the NEEZ and "Johan Hjort" (31/8- 05/10) covered the southwestern and western part. From the 18 September and to the end of the survey at the 05 October, only "J.Hjort" and "Vilnyus" took part in the survey, and covered the northern areas east of Spitsbergen/Svalbard.

The demersal fish and benthos investigations were more comprehensive compared to the previous years and were on level of 2009, and there was a small reduction in the oceanographic sampling on the standard sections. The other investigations were kept at the same level as in previous year. Consequently, a joint, but somewhat reduced, ecosystem survey was carried out by IMR and PINRO also in 2011.

The contents of this report cover many but not all aspects of the survey. The content will be updated and available in electronic form in the Internet (www.imr.no).

This report was prepared at a joint meeting in Murmansk, Russia 10-13 October, followed by inputs during November and December 2011. The following specialist and experts participated, either in person or by correspondence:

Alexander Trofimov	Oceanography
Anatoliy Chetyrkin	Capelin stock prognosis
Bente Røttingen	Pelagic fish stocks estimation, preparation of data.
Bjarte Bogstad	Capelin stock analyses and prognosis (AFWG chairman)
Dmitry Prozorkevich	0-group, pelagic fish (survey and meeting coordinator)
Elena Eriksen	0-group fish
Ekaterina Murashko	Sampling information, pollution
Gjert E. Dingsør	Demersal fish data analyses
Harald Gjøsæter	Pelagic fish analyses, methods and descriptions (main editor)
Hilde Elise Heldal	Pollution
Jamie Alvarez	Pelagic fish stock estimation, data analyses

Konstantin Drevetnyak	Demersal fish data analyses
Lis Lindal Jørgensen	Benthos (survey coordinator, responsible editor)
Mette Mauritsen	Sea mammals
Nikolay Lukin	Sea mammals
Nikolay Ushakov	Completing and editing report
Padmini Dalpadado	Zooplankton
Pavel Lubin	Benthos
Pavel Murashko	Demersal fish data analyses
Randi Ingvaldsen	Oceanography
Sigurd Tjelmeland	Capelin stock analyses and prognosis
Tatyana Prokhorova	Sampling information, data fitness checking, pollution
Tor Knutsen	Zooplankton
Torild Johansen	Genetic
Yuri Kovalev	Capelin stock analyses and prognosis

A list of the participating vessels with their respective scientific crews is given in Appendix I.

Synopsis

The main aim of the ecosystem survey was to collect data about distribution and abundance of all sea organisms, including phytoplankton, zooplankton, pelagic and demersal fish species, benthos, seabirds and mammals. An important task was also to collect information about sea environment, pollution and several fish-parameters (age, stomach content, etc).

The water temperatures below 50 m depth were higher (0.2–0.7 °C) than the long-term mean and similar to what was observed in 2010. At the surface, the temperatures were much higher than both the long-term mean and the previous year.

The zooplankton biomass (western part of the Barents Sea) was close to the long-term mean in 2011. There is evidence of distinctly higher biomass south of Spitsbergen/Svalbard and between the Bear island and Norwegian mainland. In the eastern Barents Sea the highest biomass were observed in the central part of the sea (northern areas not covered).

The invertebrate benthic biomass distribution was generally the same as in previous years. Echinoderms make up the largest proportion in the central and northern part of the Sea, the crustaceans in the central and eastern parts, the cnidarians in the north-eastern, and sponges in the south-western and north-eastern Barents Sea and along the western and northern coasts of Spitsbergen/Svalbard.

The king crab was distributed between 28 and 45° E with max. 6 individuals per nmi. The area and number of king crab has slightly increased.

An eastern distribution of the snow crab was, as previous years, recorded with abundances up to 2400 individuals per nmi. This is an increase from 2010 when it was recorded with 8-10 individuals per trawl.

Northern shrimp is widely distributed in the Barents Sea with 0-164 kg/nmi. The average catch was lower than in previous years, but the densest concentrations were found around Spitsbergen/Svalbard and in the central parts of the Barents Sea.

The 2011 year-classes (0-group) of cod, capelin and haddock were rich. Herring, redfish, saithe and long rough dab were estimated as poor. The 0-group year-class of polar cod is slightly above average and Greenland halibut is somewhat below the long term mean level.

The total capelin stock was estimated at 3.71 million tonnes, which is 6% higher than last year. About 2.1 million tonnes were assumed to be maturing. Estimated maturing stock is 3% above the last year's estimate and higher than the long term mean level. The polar cod stock was estimated to be 0.86 million tonnes, that is 40% less than in 2010 but somewhat above the long term mean level. The number of juvenile Norwegian spring spawning herring in the Barents Sea has slightly decreased compared to last year and was estimated to be 1.6 billion individuals. Spring spawning herring was not found in the south-eastern part. Blue whiting of age groups 1 to 9, but mostly age 5 - 7, were observed in the western part of the surveyed area. The biomass of this stock, estimated to be 0.13 million tonnes, is still decreasing compared to 2010.

Cod were distributed far to the north. The abundance index for age groups 1 year and older was at the same level as in 2009 and 2010. Haddock had a distribution similar to in 2010.

The white-beaked dolphin is the most frequent toothed whale and mainly found along the polar front. Minke and humpback whales were the most frequently baleen whales found, and were mainly located on shallow banks north of the polar front. Few harp seals were observed in the northern area.

Investigations from the area adjacent to the sunken nuclear submarine “Komsomolets” do not indicate significant leakages.

1 Methods

1.1 Data exchange

Data on cruise tracks, hydrography, trawl catches, integrator values etc. were exchanged by e-mail between all vessels during the survey. All the Russian survey data were transmitted to "J. Hjort", while the Norwegian hydrographic data were transmitted to "Vilnyus". The final survey data from all vessels were collected during the meeting after the survey, which was arranged in Murmansk on 10-13 October 2011.

1.2 Hydrography

The oceanographic investigations consisted of measurements of temperature and salinity in depth profiles distributed over the total investigated area and along the sections Fugløya–Bear Island, Vardø–North, Kola, and Kanin (fig 2.2). All vessels used CTD-probes.

1.3 Pelagic trawl survey for 0-group fish

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

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

1.3.1 Abundance indices

The history of development of 0-group investigation, assessment methods and recalculation of abundance indices is described in details in earlier versions of the survey report (Anon. 1980, Anon. 2004) and in Eriksen et al., 2009.

In 2011 the abundance indices (with and without correction for capture efficiency) was recalculated for the period 2004-2010 due to mistakes of input data in to the calculation program. Recalculation of abundance indices led to some changing, but of very small degree.

1.3.2 Biomass indices

The 0-group fish biomass was calculated for the period 1993-2009 by Eriksen et al. (2011), and the computation of biomass indices is made using the stratified sample mean method of swept area estimates (Dingsør 2005). The capture efficiency of the sampling trawl differ between species and decreases with decreasing 0-group length (Godø et al. 1993; Hylen et al. 1995). The capture correction factor for cod, haddock and herring biomass was found by calculating the ratio between abundance indices (with and without capture efficiency). For capelin, which is small and not herded to any extent by the net walls, we chose to calculate the biomass according to the effective wingspread of the trawl.

1.4 Acoustic survey for pelagic fish

All regions of the Barents Sea and adjacent areas of the Norwegian Sea were covered by an acoustic survey, with course lines about 35 nautical miles apart.

All participating vessels used ER-60 echo sounders (with ER-60 software). "Christina E", "J. Hjort" and "Helmer Hanssen" used LSSS ("Large scale survey system"), while "Vilnyus" used FAMAS for postprocessing of acoustic data. "J. Hjort" and "Helmer Hanssen" were equipped with transducers on adjustable keels that can be lowered in rough weather to avoid the damping effect of bubbles. Echo intensities per nautical mile were integrated continuously, and mean values per 1 nautical mile 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 patterns and the frequency responses of the echograms and the composition of the trawl catches. For pelagic species, 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. For demersal species, mostly bottom trawl stations were used.

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.

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).

Acoustic registrations of demersal fish were carried out along all cruise tracks, with division of s_A-values by species based on trawl catches data. Acoustic stock size estimates have, however, not been calculated for these species.

1.5 Bottom trawl survey for demersal fish

More bottom trawl stations were made by the Norwegian vessels in 2011 compared with 2010. The number and biomass of demersal fish calculated from bottom trawl catches using the "swept-area" method (Jacobsen et al 1997, Dickson 1993a, Dickson 1993b). In this report, preliminary calculations of numbers and biomass are shown for the total stocks.

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

1.6 Plankton investigations

Data on phytoplankton abundance was obtained in several ways during the joint Russian-Norwegian Survey. On the Norwegian vessels "RV Johan Hjort" and "Helmer Hansen" 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. On the Norwegian vessel "Christina E", no CTD with rosette sampler was available and the chlorophyll ***a*** and nutrient samples were collected with standard closable water bottles attached to a wire for predetermined depth sampling. A total of 11 water bottles were used simultaneously, slightly depending on maximum bottom depth. The total number of samples varied slightly depending on bottom depth at the specific localities. Sea water samples were filtered using GFC filters, and samples were frozen for later analysis of chl ***a*** content at the IMR laboratory. For the vessels mentioned above 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, in 2011 no such measurements were undertaken from the Norwegian vessels.

Samples for phytoplankton species composition and abundance have been obtained from the Norwegian vessels "Christina E", "RV Johan Hjort" and "Helmer Hansen". 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 qualitative phytoplankton samples. 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 parallel sample was taken and fixated in 2 ml lugol.

On Russian vessels species composition, diversity, size structure, abundance/biomass and vertical and spatial distribution of microalgae were studied. Phytoplankton samples were obtained at the oceanographic stations using seawater rosette sampler from three depths or depth layers: the surface, a layer of 5 meters above the pycnocline, and the bottom layer (only on "Vilnyus"). Samples were preserved with buffered 40 % formalin to a final concentration of 2-4% immediately after sampling.

Zooplankton sampling on all three Norwegian vessels was carried out by WP-2 plankton nets with a 0.25 m^2 opening and 180 µm mesh size. On "Helmer Hansen" samples were collected from 200-0m, while on the other vessel "RV Johan Hjort" and "Christina E", samples were obtained from bottom-0m, omitting the 100-0m haul in 2010. In addition, stratified sampling was conducted with the MOCNESS multinet plankton sampler on board "RV Johan Hjort". 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-0-m, 100-0-m and 50-0-m layers.

In addition, sampling of macroplankton were taken by plankton net BR (with a 0.2 m^2 opening and 564 µm mesh size) connected with bottom trawl on the Russian vessel "Vilnyus", and with a new macroplankton trawl on the Norwegian vessels "Christina E" and "RV Johan Hjort" as described in the Ecosystem manual.

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

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

Processing of Juday net samples from the Russian vessels included weighing of wet samples to within 0,0001 g, with removal of excessive moisture by a filtering paper for species identification and abundance determination. 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. As most of the samples are worked up after the survey, the final results will be presented at a later stage.

1.7 Fish stomach investigations

According to agreement at the Russian-Norwegian meeting in March 2006, capelin and polar cod stomachs were collected at the Norwegian ("Christina E", "J. Hjort" and "Helmer Hanssen") and Russian ("Vilnyus") vessels in August-October 2011. Also stomach samples of cod were taken according to standard protocol on Norwegian vessels.

On board "Vilnyus", the stomach samples were taken both from commercial (cod, haddock, saithe, capelin, polar cod) and non-commercial (thorny skate) fish species, and 645 stomachs were taken. A total of 101 stomachs were taken from 0-group cod, haddock and saithe. At the same time 3752 stomachs was taken from 23 fish species and a "short analyse" was carried on the stomachs out at sea during the survey.

The capelin and polar cod stomachs from 2010 are in the final phase of analyses. At IMR 330 and 180 stomachs of capelin and polar cod has been analysed respectively. These data are exchanged with PINRO. The aim is to establish a "stomach database" similar to the one existing for demersal fish.

1.8 Marine mammal and seabird observations

Marine mammals observations (species and numbers observed) were recorded onboard the Norwegian research vessels "Christina E.", "Johan Hjort" and the Russian research vessel "Vilnyus". Seabirds were observed from the same vessels, but also included "Helmer Hanssen".

Onboard the Norwegian vessels visual observations were made by three observers from the vessel bridges; one dedicated sea bird observer and two dedicated marine mammal observers. As no marine mammal observers participated on the "Helmer Hansen", the observations recorded from this vessel were obtained from the seabird observer and a master student.

The marine mammal observers covered approximately the front 90° sector (45° each) and the sea bird observer covering one 90° sector 300 m wide along the ship side. 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 45^o sector from roof of the bridge about 9-10 m above the sea surface level. The observer was recording only along transects between stations, and the ship-following seabird species (northern fulmars and gulls) were counted every hour.

Both observer activity and observer conditions (Beaufort Sea State, visibility and weather) were recorded continuously. Observer activity was limited by weather conditions. When the weather conditions were not sufficiently good for observations observation effort was stopped.

1.9 Benthos investigation

The purpose of the benthos investigation is to monitor benthic habitats and communities in the Barents Sea by analysing the bycatch of the Campelen trawl on all Norwegian and Russian vessels. 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.

All invertebrates from the bottom trawl hauls of the Russian RV “Vilnyus” and the Norwegian RV “Christina E”, “Johan Hjort”, “Helmer Hanssen” was processed to species level in 2011. All individuals was counted and weighed per species. The measures of the invertebrate-group (see survey manual, Jørgensen (2006), was recorded in Reg-Fisk, while the identification down to species was recorded in the IMR-PINRO benthos-database.

1.10 Investigations of pollutantspollutants and observation of garbage

Every third year (last time in 2009), IMR carries out thorough investigations of the levels of pollutantspollutants in sea water, sediments and marine biota in the Barents Sea. The analysis includes different hydrocarbons, persistent organic pollutants (POPs) (PCB, DDT, HCH, HCB) and radionuclides. Monitoring of radionuclides is performed within the monitoring programme “Radioactivity in the Marine Environment” (RAME), which is coordinated by the Norwegian Radiation Protection Authority (NRPA). Monitoring of organic pollutants is performed in close cooperation with NGU (The Geological Survey of Norway) and National Institute of Nutrition and Seafood Research (NIFES). In addition, IMR investigate once a year the levels of radioactive contamination in the vicinity of the Russian nuclear submarine “Komsomolets”, which sank in 1989 in international waters in the Norwegian Sea 180-190 km south-southwest of Bear Island at 73°43’16’’ N and 13°16’52’’ E (e.g. Høibråten et al., 1997.

In 2011, IMR’s monitoring of pollutants in the Barents Sea was restricted to the sampling from “Komsomolets”. At CTD station 626, samples of surface water (approximately 500 L) were collected from the seawater intake on F/F Johan Hjort and bottom seawater (approximately 500 L) was collected with a CTD-rosette multi bottle sampler with large (10

L) water samplers. Sediment samples were collected with a sediment sampler of the type "Smøgen Boxcorer". The samples will be analysed for a range of radionuclides (e.g. plutonium-238, plutonium-239,240, cesium-137 and strontium-90).

Onboard "Vilnyus" were taken 10 complex sampling from different parts of REEZ include water, bottom sediments and biota for analyses the PCB, DDT, HCH, HCB and radionuclides. During the survey the amount and types of man-made garbage in the survey area were observed. During analysis of trawl catches all types of pollutant (according to the OSPAR Commission (Protection of the marine Environment of the North-East Atlantic Commission) codes were registered and weighted.

The marine mammals observers on the two research vessels («Cristina E» and «Vilnyus») registered the presence of floating man-made garbage on the sea surface. Type of pollutant (according to the OSPAR Commission codes) and approximate volume or size were indicated and noted.

After all types of pollutant were combined into the 8 groups (metal, plastic, glass, paper, oil, wood, rubber, textile) to build maps.

1.11 Collection of samples for genetic analysis

Genetic sampling of cod. As part of a large Norwegian sampling program (project "Bestands-komplekser") gill samples were collected from juvenile cod from the total Barents Sea onboard the three Norwegian vessels "Christina E", "Helmer Hanssen" and "Johan Hjort". The plan was to collect samples along transects going east-west and north-south (in total 600 juveniles) to identify possible sub-structures within the Northeast arctic cod stock and to identify possible coastal cod recruitment in the Barents Sea. It was also collected adult cod from the Spitsbergen/Svalbard region onboard "Helmer Hanssen". Samples of adult cod were collected from all cod where also biological information and otoliths were samples.

Genetic samples from shrimps (Pandalus borealis). As part of an ongoing project funded by the Norwegian Research Council to study stock structure of *P. borealis* in the North Atlantic we collected shrimps from the northwest and south west of Spitsbergen/Svalbard. Only females were collected for this population genetic study. In addition to the genetic sample (muscle tissue from tail region conserved in ethanol), Carapax length was measured from the female shrimps. In addition some shrimp was frozen whole for the same study.

Genetic samples from Sebastes sp. On behalf of Spanish colleagues we collected genetic samples (Gills in ethanol) from the two species of Genus *Sebastes: S. mentella* and *S. marinus.* These data will be used to study species structure in this genus.

RNA samples from cod species. On behalf of the University of Bergen (UIB) we collected samples on RNA-later. Small liver samples were cut fresh from the fish immediately after catch and stored in RNA-later in the fridge for one day (to conserve the tissue) and then transferred to freezer for storage until the samples reached Bergen. The purpose of the project is to extract RNA from samples to study gene expression in relation to genes expressed in polluted fish. The study organisms are cod, haddock and capelin. (For further details contact the project manager professor Anders Goksøyr at Bio, UIB.)

1.12 Recommendations for station sampling

- The surveys design should not have neighbouring surveys tracks, which are separated in time with more than 1week.
- One should avoid cutting two or more neighbouring stations if lack of time forces some stations to be taken out.
- 0-group investigation: Trawling procedures must be followed, which is based on trawling a **distance of 0.5 nautical miles for each depth** (Anon 1980 and Anon 2004). Duration at each depths should not be decided by elapsed time, since the vessels speed may vary during trawling.

2 Results and discussion

Altogether, 127 vessel-days were spent at the joint survey in 2011. A comparison with previous years is shown in the text table below. In 2011, the vessels observed about 500000 square nautical miles, and carried out 775 trawl hauls and 487 CTD stations.

Year	No of vessel days	No of trawl hauls	No of CTD
2004	215	1123	1144
2005	208	1008	1028
2006	205	999	1052
2007	210	1007	610
2008	141	776	776
2009	127	754	428
2010	134	710	462
2011	127	775	486

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

2.1 Hydrographical conditions

2.1.1 Standard sections

Figure 2.1.1 shows the temperature and salinity conditions along the oceanographic sections: Fugløya – Bear Island, Vardø–North, Kola, and Kanin. The mean temperatures in the main parts of these sections are presented in Table 2.1.1, along with historical data back to 1965.

Anomalies have been calculated using the long-term means for the periods 1954–1990 (Kanin section) and 1951–2000 (Kola section).

The Fugløya–Bear Island section covers the Atlantic inflow from the Norwegian Sea to the Barents Sea. The southern part of the Vardø-North section covers the Norwegian Coastal Current and the Murman Current containing both coastal and Atlantic water masses, while the northern part covers the Central and Northern Branches of the North Cape Current that carries Atlantic Water. The mean temperature in the 50–200 m in the Fugløya–Bear Island sections was 0.6 °C higher than the long-term mean for the period 1965–2011 and 0.2 °C higher than in 2010. The mean temperature in the 50–200 m in the Central Branch of the North Cape Current was about 0.8 °C above the long-term mean for the period 1965-2011.

The Kola and Kanin sections cover the flow of Coastal and Atlantic waters in the southern Barents Sea. At the middle of August 2011, the mean temperature in the 0–200 m in the inner and central parts of the Kola Section was 0.3 °C higher than usual, and it was 0.5–0.6 °C lower than in 2010. The upper 50 m layer had higher positive anomalies (0.4–0.5 °C) than the deeper layer of 50–200 m (0.1–0.2 °C). In the outer part of the section, the anomalies in the layers of 0–50, 0–200 and 50–200 m were 0.7 °C like in 2010. Towards the end of September, the positive temperature anomalies in the upper 50 m layer of the Kola section increased significantly (about three times), while they remained almost unchanged in the 50–200 m layer. The increase was probably due to more intensive warming of the upper layers.

At the end of August 2011, the shallow inner part of the Kanin section had a positive temperature anomaly of 0.8 °C in the 0–bottom layer, which was 0.1 °C higher than in 2010. The outer part had a positive temperature anomaly of 0.7 °C in the 0–200 m, which was 0.6 °C lower than in 2010.

2.1.2 Horizontal distribution of water masses

Horizontal distributions of temperature and salinity are shown for depths of 0, 50, 100 m and near the bottom in Figures 2.1.2–2.1.9, and anomalies of temperature at the surface and near the bottom are presented in Figures 2.1.10–2.1.11. Anomalies have been calculated using the long-term means for the period 1929–2007.

As usual, the temperature near the surface gradually decreased northwards and temperatures below 0 °C were observed only in the far northern surveyed areas (Figure 2.1.2). Compared to earlier observations the surface temperatures were both higher (1.7–2.6 °C) than in 2010 and higher (1.1–1.9 °C) than the long-term mean. This shows that the summer heating of the surface this year has been much more than normal, or less extensive downward mixing has taken place. The only area with negative surface anomalies (< –0.5 °C) was west of the Spitsbergen/Svalbard Archipelago (Figure. 2.1.10).

Arctic waters were, as usual, most dominant in 50 m depth north of 76°N (Figure 2.1.4). At the 50 m depth the temperatures were mainly higher (0.1–0.8 °C) than normal but lower (by 0.1–1.3 °C) than in 2010.

In 100 m depth and close to the bottom, only small areas with temperatures below –1 °C were observed (Figure 2.1.6 and 2.1.8). The temperatures in the depths below 100 m were in general close to those in 2010, and still above the long-term mean (0.2–0.7 °C) in most of the Barents Sea (Figure 2.1.11). The high temperature in the Barents Sea is mostly due to the inflow of water masses with high temperatures from the Norwegian Sea and due to more intensive summer heating of the upper layer of the sea. During the last 9 years the inflow to the Barents Sea has been warm.

2.2 Distribution and abundance of 0-group fish

The distribution of eleven 0-group fish species (capelin, cod, haddock, herring, polar cod, saithe, redfishes, Greenland halibut, long rough dab, wolffish, sand eel) are shown in Figs 2.2.1-2.2.11 and *Gonatus* – in Figure 2.2.12. The density grading in the figures is based on the catches, measured as number of fish per square nautical mile. More intensive colouring indicates denser concentrations. Abundance indices calculated for most ecologically important species (capelin, cod, haddock, herring, polar cod, saithe, redfishes, Greenland halibut and long rough dab) from 1980-2011 are shown in Tables 2.2.1 - 2.2.2. Length frequency distributions of the main species are given in Table 2.2.3. Biomass indices of 0-group capelin, cod, haddock and herring for 1993-2009, were calculated from abundance indices corrected for capture efficiency (Eriksen et al. 2011) and presented in Table 2.2.4.

The 2011 year class of cod is the highest on record, 0-group capelin and haddock were also found to be strong year classes. The 2011 year classes of herring, redfish, saithe and long rough dab are poor, while polar cod is slightly above, and Greenland halibut is somewhat below, the long term mean level. The total biomass of four most abundant 0-group fish (cod, haddock, herring and capelin) reach 2.5 million tonnes in August-September.

2.2.1 Capelin (Mallotus villosus)

Capelin were distributed over a wide area - from the Norwegian and Russian coast until 79˚N and between 15˚E and 57˚E (Figure 2.2.1). The dense concentrations were observed in the southeastern area (between 70-73° N, 33-43° E) and to the east of Hope Island. The boundary of capelin distribution was not found in the north, east, south and west.

Fish otoliths were taken at stations when it was difficult to separate of 0-group capelin from older fish. In most samples (about 70%) length of 0-group capein were between 4.0 and 5.5 cm, with an average of 4.6 cm, that is some smaller than the long term mean length (4.8 cm). Very small capelin with length about 3 cm (Table 2.2.3) were found to the northeast from the Kildin Island (Murman coast), what indicate that summer spawning has taken place in this area.

The calculated density varied from 174 to 65 million fish per square nautical mile. Mean catch per trawl was 2150 fish.

The 2011 year class is strong year class. The 0-group capelin biomass was about 228 thousand tonnes, and this is much higher than the long term mean (for period 1993-2011). The capelin biomass is shown in Table 2.2.4.

2.2.2 Cod (*Gadus morhua*)

0-group cod were distributed over a wide area, except eastern and southeastern parts along Novaya Zemlya (Figure 2.2.2). The main dense concentrations were registered in the central part of the sea between 72˚N-76˚N and 20˚-35˚E, and to the southwest of Spitsbergen/Svalbard. Scattered registrations were observed further north than in the previous years, and were found along western and northern coast of the Spitsbergen/Svalbard up to 82˚N. Along the Novaya Zemlya and in the southeastern part of the Barents Sea 0-group cod was observed only in the bottom trawls, that indicates more early their bottom settlement in this region. Although the densities of cod from bottom component at these stations was not higher than 30 fish per square nautical mile, and therefore have no influence on abundance index.

The fish length of 0-group cod were between 5 and 11 cm. Most of the fish were between 6.5 and 9.5 cm, with mean length of 8.0 cm (Table 2.2.3). The mean length was lower than in 2010 but was higher than the long term mean. Good fish growth in autumn may indicate suitable feeding condition during first months of fish life.

The highest calculated density was about 21 million fish per square nautical mile, which is 4 times higher than in 2010. Mean catch was 1664 fish per trawl haul.

The abundance index of 2011 year-class is record high and much higher than 1995 year class, which dominated in the fishery over the long time. Therefore, the 2011 year class will probably add strong recruitment to the fishery from 2014. The 0-group cod biomass was also record high; about 2 million tonnes (Table 2.2.4).

2.2.3 Haddock (Melanogrammus aeglefinus)

The occupation area of 0-group haddock was found in the central and western areas of the Barents Sea and to the west and north of the Spitsbergen/Svalbard. To the east of 39˚E 0-group haddock were not observed (Figure 2.2.3).

Length of 0-group haddock varied between 3.9 and 16.0 cm and length of most fish was between 9.0 and 11.0 cm (Table 2.2.3). Mean length of haddock was 10.1 cm, which is higher than the long term mean. Larger growth of fish indicates suitable feeding conditions this year. Small 0-group haddock with mean length of 3.9-5.5 cm were found in the north and northwest of Spitsbergen/Svalbard, indicating late spawning of haddock.

The calculated density varied from 174 to 732 thousand fish per square nautical mile. Mean catch per trawl was 107 fish, which is higher than in 2010.

The 2011 year class is almost twice as high as the long term mean level, and can be characterized as strong. Since 2004 several strong year classes occurred, the 2005 year class being the strongest. These year classes may secure the fishery for years to come. The 0-group haddock biomass was about 215 thousand tonnes that is higher than the long term mean (for period 1993-2011); (Table 2.2.4).

2.2.4 Herring (*Clupea harengus*)

0-group herring were distributed in the south, central and western parts of the Barents Sea. The occupation area of herring was much smaller than in previous years, although somewhat larger than in 2010. The main dense concentration of herring were located between 72-75˚N and 30-35˚E (Figure2.2.4). Scattered concentrations were observed along the Norwegian and Murman coast and between Spitsbergen/Svalbard and Bear Island.

Mean length of herring was 6.9 cm, and this is somewhat lower than in previous years. The length of herring varied between 3.5 and 11.0 cm, and most of the fish were 6.0-8.0 cm long (Table 2.2.3). The smaller fish were found along northeast of Murman coast, and were not larger than 5 cm.

Mean catch per trawl haul was 185 fish, which is lower than in 2007-2010. The calculated density varied from 134 to 1.4 million fish per square nautical mile.

The 0-group herring biomass was very low; 151 thousand tonnes (Table 2.2.4). This is about 5 times lower than the long-term mean (for period 1993-2011).

The 2011 year-class of herring is lower than the average level, and therefore can be characterized as poor. Since 2004 no strong year classes has been observed, and low herring abundance may negatively influence the recruitment to the fishable stock.

2.2.5 Polar cod (*Boreogadus saida*)

In 2011 the distribution of 0-group polar cod was split into two components. Eastern component distributed along western coast of the Novaja Zemlya and western component allocated around Spitsbergen/Svalbard (Figure 2.2.5). Densest concentrations were observed close to the coast of Novaja Zemlya, while around Spitsbergen/Svalbard only scattered concentrations were found. Very small polar cod with length about 3 cm were found to the east from Spitsbergen/Svalbard, which indicate that spawning has taken place in this area.

The abundance indices for both components were calculated separately. Abundance of eastern component was at the long term average level, while abundance index of western component was about 4.5 times lower.

The mean length of 0-group polar cod was 4.9 cm, and was higher than in the last three years and the long term mean of 3.9 cm. Most of the fish had lengths between 4.5 and 6.0 cm (Table 2.2.3).

During survey 0-group polar cod distributed further north and east than the surveyed area and only a part of the total distribution was covered.

2.2.6 Saithe (*Pollachius virens*)

The 0-group saithe was found on local stations in the central and western parts of the Barents Sea (Figure 2.2.6).

Length of 0-group saithe varied between 6.5 and 14.5 cm, and most of fish (about 60%) was between 7.0 and 7.5 cm. Mean length of saithe was 8.4 cm and was lower than in 2010 and the long term mean of 9.1 cm (Table 2.2.3).
The maximum of calculated density reached 12.7 thousand fish per nautical mile and the maximal catch was 59 fish only. Both density and catch rates were much lower than in previous years.

Since 2005 (except 2010) abundance indices of 0-group saithe were lower than the long term average. The 2011 year class is also about 9 times lower than the long term mean and therefore the 2011 year-class of saithe in the Barents Sea may be characterized as poor.

2.2.7 Redfishes (Sebastes sp.)

0-group redfish was observed in the western part of the Barents Sea (Figure 2.2.7). The distribution area and dense concentrations were smaller than in 2009-2010.

In 2011 the mean fish length was 4.0 cm, which is lower than in 2010, but somewhat higher than the long term mean (3.8 cm). Relatively large 0-group redfish in this year indicated better-than-average feeding condition during the first months of its life.

Mean catch per trawl haul was 109 fish. The calculated average density reached 18.5 million fish per square nautical mile.

The abundance of 0-group redfish is about 9 times lower than the long term average. So the 2011 year-class can be characterized as very poor.

2.2.8 Greenland halibut (*Reinhardtius hippoglossoides*)

As in previous four years, 0-group Greenland halibut were found in very low densities and in small areas north, west and south of Spitsbergen/Svalbard (Figure 2.2.8). Greenland halibut starts to settle to the bottom before the ecosystem cruise is carried out, and there might be a strong variation in the timing of larvae settling. Therefore the calculated 0-group Greenland halibut is probably not reflecting the real year-class strength.

Fish length varied between 4.0 and 9.5 cm, while most of fish were between 5.5 and 7.5 cm. The mean length of fish was 6.4 cm, which was close to the long term mean (Table 2.2.3).

Calculated density concentration reached 3.7 thousand fish per square nautical mile while an average is 72.5 fish per square nautical mile.

Since 2007 abundance of Greenland halibut continuously increased, but index of 2011 year-class not yet reached the long term average.

2.2.9 Long rough dab (*Hippoglossoides platessoides*)

Long rough dab were distributed in several local areas of the Barents Sea (Figure 2.2.9). Dense concentrations of 0-group long rough dab were not observed.

Mean length of fish was 3.7 cm which is the highest since 2005. In most catches fish lengths between 3.0 and 4.5 cm dominated (Table 2.2.3). Mean catch was lower than in 2010, and only some catches reached up to 65 fish. The calculated mean density was 162 fish per square nautical mile.

The 2011 year-class of long rough dab is approximately 10 times lower than the long term mean and lowest since 2005. The year class is characterized as very poor.

2.2.10 Wolffishes (Anarhichas sp.)

There are three species of wolffish found in the Barents Sea: Atlantic wolffish (*Anarhichas lupus*), spotted wolffish (*Anarhichas minor*) and northern wolffish (*Anarhichas denticulatus*). Due to uncertainty in species identification at the 0-group stage it was decided to combine the species into a larger group (Genus) during the 0-group investigations.

In total 0-group wolffish were found in scattered distribution to the north and south of Spitsbergen/Svalbard (Figure 2.2.10).

The calculated mean density was about 74 fish per square nautical mile, which was lower than in 2008-2010. No index is calculated for this species.

2.2.11 Sandeel (Ammodytes sp.)

In the Barents Sea *Ammodytidae* are represented by *Ammodytes marinus* which is distributed along the Norwegian coast, and *Ammodytes tobianus* which distributed in the southeast and between Novaya Zemlya and Bear Island. Due to uncertainty in species identification at the 0-group stage it was decided to combine species into larger groups (Genus).

0-group sandeel were found in south-eastern part of the Barents Sea and around Bear Island (Figure 2.2.11).

Mean catch was 13 fish per trawl haul. The calculated density reached 158 thousand fish per square nautical mile with an average of 78 fish per square nautical mile. This is lower than in 2008-2010. No index was calculated for this species.

2.2.12 *Gonatus fabricii*

In the Barents Sea *Gonatus fabricii* is observed in the pelagic water layer. In 2011 *Gonatus* was distributed in the western part of the Barents Sea (Figure 2.2.12).

Mean catch was 13 individuals per trawl haul. The calculated density reached 16.7 thousand individuals per square nautical mile with an average of 357 fish per square nautical mile. No index was calculated for this species.

2.3 Distribution and abundance of pelagic fish

Number of fish sampled during the survey is presented in Appendix 2.

2.3.1 Capelin (*Mallotus villosus*)

Distribution

The geographical density distribution of capelin at age 1+ and for the total stock are shown in Figures 2.3.1 and 2.3.2. The total distribution area of capelin was wider than in last year, and differed also in other respects, but the overall distribution resembled quite closely that found in 2008-2010. In 2011, very little capelin were detected in the areas to the west of Spitsbergen/Svalbard, and practically no capelin north of Spitsbergen/Svalbard. However, the distribution area reached further to the north in the areas east of 40º E, and contrasting the distribution in most years during the last three decades, quite dense concentrations were found north of 77ºN and east of 50° E. The main dense concentrations were found to the north-east of the Hopen island and northwards to beyond the King Karls Land, and the dense concentrations continued eastward to about 58º E. Some capelin schools were observed until the Kara sea (St. Anna Trough) above the 400 m depth and it is absolutely northeastern distribution record during all research period.

Young capelin were mainly found to the south of 77º N, and dense concentrations were located eastward of the Hopen island stretching south-eastwards in the Central Bank. Sample echograms of capelin distribution in the northern area are shown in Figures 2.3.3 - 2.3.5.

Abundance estimate and size by age

A detailed stock size estimate is given in Appendix Table 1, and the time series of abundance estimates is summarized in Appendix Table 2. The main results of the abundance estimation in 2011 are summarized in the text table below. The 2010 estimate is shown on a shaded background for comparison.

Summary of stock size estimates for capelin

Year class		Age	Number (10^9)		Mean weight (g)		Biomass (10^3 t)	
2010	2009	1	209.6	247.8	2.4	3.0	495.9	740.8
2009	2008	2	181.2	127.9	9.7	10.2	1764.0	1305.0
2008	2007	3	55.3	60.9	21.9	23.4	1213.9	1426.9
2007	2006	4	8.0	0.9	29.1	26.3	233.7	23.5
Total stock in:								
2011	2010	1-4	454.1	437.5	8.2	8.0	3707.7	3496.4

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

The total stock is estimated at about 3.7 million tonnes. It is about 6% higher than the stock estimated last year and higher than the long term mean level. About 57 % (2.1 million tonnes) of this stock is above 14 cm and considered to be maturing. The 2010 year class (1-group) consists, according to this estimate, of about 210 billion individuals. This estimate is somewhat lower than that obtained for the 1- group last year, but is slightly above the long-term mean. The mean weight (2.4 g) is 0.6 g lower than that measured last year, and 1.2 g below the long-term average. The biomass of the 2010 year class is about 0.5 million tonnes, which is 33% lower than one year olds in last year and below the long term mean. It should be kept in mind that, given the limitations of the acoustic method concerning mixed concentrations of small capelin and 0-group fish and near-surface distribution, the 1-group estimate might be more uncertain than that for older capelin.

The estimated number of the 2009 year class (2-group) is about 181 billion, which is about 1.4 times the size of the 2008 year class measured last year. Consequently the biomass of the two years old fish is about 1.8 million tonnes. The mean weight at this age is 9.7 g, which is lower than in last year (10.2 g), and is one gram below the long-term average (Table 2.3.2).

The 2008 year class is estimated at about 55 billion individuals, which is slightly below the three-year-olds last year. This age group with mean weight 21.9 g (about 1.5 g below the long-term average) has a biomass of about 1.2 million tonnes, which is well above the long-term average. The 2007 year class (now 4 years old) is estimated at 8 billion individuals. With a mean weight of 29.1g this age group makes up about 234 thousand tonnes, which is 10 times higher than last year, and above the long term average. Practically no capelin older than four years was found.

The capelin stock size estimate is used as input to the stock assessment and prognosis model for capelin (CapTool). The mature part of the stock is basis for the prognosis of spawning stock in spring 2012, where also mortality induced by predation enters into the calculations. The work concerning assessment and quota advice for capelin is dealt with in a separate report that will form part of the ICES Arctic Fisheries Working Group report for 2012.

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 (M) only. The estimates of M have varied considerably, and within survey uncertainties reflect quite well the predation on capelin. From 2006, the natural mortality started to decrease. In 2010 the M was estimated to a small negative value, as it was for the year classes 1992, 1994, and 2006, This shows that either the one-group are underestimated or the two-group is overestimated these years. Knowing that the measurement of the 1-group is more uncertain than the older age groups due to limitations in the acoustic method, the first mentioned possibility is the most probable. In 2011 the survey mortality was estimated at 27%.

2.3.2 Polar cod (*Boreogadus saida*)

Distribution

As in the previous year, the polar cod distribution in the Barents Sea was almost completely covered. The polar cod stock was widely distributed in the northern and eastern parts of the Barents Sea and adjoining part of the Kara Sea (to the north of Novaja Zemlja). The geographical density distribution for fish at age 1+ and for the total stock are shown in Figs. 2.3.6 and 2.3.7. The main concentrations of adult fish were found along west coast of Novaja Zemlja and northward toward Franz Josef Land. Small areas of scattered concentrations were observed to the west and to the east of Spitsbergen/Svalbard. Figure 2.3.8shows a typical acoustic registration of polar cod near the Novaja Zemlja.

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 2011 are summarized in the text table below. The 2010 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)	
2010	2009	1	34.5	27.3	8.2	8.6	282.3	234.2
2009	2008	2	14.5	18.3	21.1	29.7	304.4	543.1
2008	2007	3	4.7	13.0	50.1	45.8	237.1	594.6
2007	2006	4	0.5	1.3	71.3	46.8	36.7	58.6
Total stock in:								
2011	2010	1-4	54.2	59.8	15.9	23.9	860.5	1430.5

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 2010 year-class (the one-year-olds) is 25% higher than the one-group measured last year. The mean weight a bit lower, and therefore, the biomass of one-year-olds is 20% higher compared to last year. The abundance of the 2009 year class (the two-year-olds) is 14.5 billions. This is almost 20% lower than the two-group found last year and moreover, the mean weight was 8.6 g lower. The biomass, therefore, was reduced significantly compared to the 2008 year-class estimated last year. Also the three-years-old fish (2008 year class) is reduced by more than 60% by number compared to the three-group estimated last year. The mean weight is, however higher, and the biomass of this age group is 2.5 times lower than that for the corresponding age group during the 2010 survey. The four-year-olds (2007 year class) are scarcely found, but have a much higher mean weight than the four-year-olds had last year. No fish of age 5 or higher were found. The total stock, estimated at 0.9 million tonnes, is reduced by 40% compared to that found in 2010.

Total mortality calculated from surveys
Table 2.3.6 shows the "survey-mortality rates" of polar cod in the period 1985 to 2011. The mortality estimates are unstable during the whole period. Although unstable mortalities may indicate errors in the stock size estimation from year to year due to incomplete coverage and other reasons, 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 1 and 50 000 tonnes. Since there has been a minimum landing size of 13 cm in that fishery, a considerable amount of this could consist of two- and even one-year-olds, and this may explain some, but only a small part of the high total mortality. From 2003 to 2004, 2006-2007 and 2009-2010 there are negative survey mortalities for age groups 1-2 and in 1998-1999 with 2003-2004 also for age group 2-3, confirming the impression expressed previously that in some years the estimate for various reasons were underestimates. Apart from these years, the survey mortalities have been quite stable in recent period.

2.3.3 Herring (*Clupea harengus*)

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

In some cases it is difficult to assess the young herring stock size during autumn. The main problem is in distribution of herring schools close to the surface, above the range of the echo sounders. It is also problematic to get representative sampling of fish schooling near the surface.

Distribution
This year, only very scattered concentrations of herring were found along the coast of Finnmark and Kola (Figure 2.3.9). Herring in age groups 1-3 was registered but the two-year-olds dominated.

Abundance estimation
The estimated number and biomass of western and eastern components of NSS herring for total age- and length groups are given in Table 2.3.7. The time series of estimates is shown in Table 2.3.8. In the text table below the main results of the abundance estimation in 2011 are summarized for young herring only (1-4 years old). The 2010 estimate is shown on a shaded background for comparison. It is noted that because of insufficient sampling of herring, this estimate divided on age-groups should be considered highly uncertain.

The total abundance of herring aged 1-4 covered during the survey was estimated at $1.6 \cdot 10^9$ specimens (about 13% lower than the value estimated in 2010). The biomass of $0.11 \cdot 10^6$ t is 29% lower than what was found in 2010. The same year class totally dominated both in last year and this year. During recent years, the amount of young herring entering the Barents Sea has steadily decreased (table 2.3.8), and the estimated stock size in 2011 is only about 10% of the average stock size during the period 1999 to 2011.

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)	
2010	2009	1	0.09	1.047	30.4	32.9	2.9	34.5
2009	2008	2	1.50	0.315	70.2	106.9	105.5	33.7
2008	2007	3	0.01	0.234	126.0	157.7	0.8	37.0
2007	2006	4	0	0.251	-	191.1	0	48.1
Total stock in:								
2011	2010	1-4	1.61	1.847	68.0	82.8	109.2	153.3
Based on TS value: 20.0 log L – 71.9, corresponding to σ = 8.1·10-7 · L2.00								

2.3.4 Blue whiting (*Micromesistius poutassou*)

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

Distribution

The distribution of blue whiting (all age groups) is shown in Figure 2.3.10. As in previous years the distribution area stretches eastward from the western boarder of the covered area up to 30˚E and from northern coast of Norway up to 77° N to the west of Spitsbergen/Svalbard.

Abundance estimation

The estimated number and biomass of blue whiting per age- and length group is given in Table 2.3.9. Total abundance was estimated to be $0.6 \cdot 10^9$ individual fish and the biomass to $0.130 \cdot 10^6$ t. Since 2003-2004, when more than one million tonnes of blue whiting was found in this area, there has been a steady decrease in biomass (Table 2.3.10), and the age distribution has been shifted towards older fish. The main bulk of this stock component in 2011 consisted of 2004-2006 year-classes at age 5-7. Older fish were found in smaller quantities and only small numbers of fish younger than 4 years old were found.

2.4 Distribution and abundance of demersal fish

Figs. 2.1-2.13 shows the distribution of demersal fish. Numbers of fish sampled during the survey are presented in Appendix 2. Preliminary estimation of abundance and biomass of main demersal fish are presented in Table 2.4. Final results will be presented after age reading.

2.4.1 Cod (*Gadus morhua*)

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 reach the limits of its natural habitat and could spread far north, east and northeast. Total distribution of cod was similar to 2010, but it stretched even further northwards. There were several observations north of Spitsbergen/Svalbard and such high abundance has never been found to the north of 80° N. The main concentrations were observed in two areas: one was to the west and south-west of the Novaja Zemlja archipelago, and the other one was in the central and northern parts of the Barents Sea. The main biomass of cod was concentrated in the depth range from 50 m down to 250 m (74%). The abundance indices divided on age groups for the period since 2004 are shown in Table 2.4.2.

2.4.2 Haddock (*Melanogrammus aeglefinus*)

The haddock distribution (Figure 2.4.2) was very similar to last year observation, but to the north of Spitsbergen/Svalbard it was found more often. Haddock were distributed in a large area from Norwegian and Russian coast up to 81° N and as far east as 57° E in south-eastern Barents Sea. The main concentrations of haddock were found around Bear Island and in shallow areas in the south-eastern part of the Barents Sea which coincide with the distribution in 2010 and 2009. The preliminary abundance and biomass estimates show a strong reduction from the 2010 estimates (see table below). The greatest concentrations (76 % of total) were distributed in depths down to 100 m. The abundance indices divided on age groups for the period since 2004 are shown in Table 2.4.3.

2.4.3 Saithe (*Pollachius virens*)

During survey only a small part of saithe distribution has covered Saithe were mostly caught along the northern coast of Norway to the west of 25° E (Figure 2.4.3). 90% of the observations were found in the depth range 150-250 m. The main distribution of saithe in 2011 coincides with the distributions in 2010 and 2009.

2.4.4 Greenland halibut (*Reinhardtius hippoglossoides*)

During survey mainly young age groups of Greenland halibut were observed. The adult part of the stock was distributed outside of the survey area. Greenland halibut were distributed in traditional areas along the shelf slope in the western Barents Sea, in deeper areas of the Barents Sea, in the deeper part around Spitsbergen/Svalbard and Franz Josef Land and in the northern part of the Kara Sea (Figure 2.4.4). The main biomass (77 %) of Greenland halibut has been concentrated in the depth range from 250 m to 550 m.

2.4.5 Golden redfish (*Sebastes norvegicus*)

Golden redfish were distributed in the same part of the Barents Sea basin as in previous years. The main densities were observed along the shelf slope to the north and west of Spitsbergen/Svalbard and in deeper waters in the south-western part of the Barents Sea (Figure 2.4.5). The main part (66 %) was concentrated at depths from 150 down to 300 meters.

2.4.6 Deep-water redfish *(Sebastes mentella)*

The main concentrations of deep-water redfish were distributed in traditional areas and were found in western and north-western parts of the Barents Sea, and to the west of Spitsbergen/Svalbard (Figure 2.4.6). Mainly young age groups of *Sebastes mentella* were found in deep-water zones in the eastern part of the Barents Sea. The main biomass of Deep-water redfish (95 %) was concentrated in the depth range from 250 m down to 500 m.

2.4.7 Norway redfish (*Sebastes viviparus*)

Norway redfish were distributed in the south-western part of the Barents Sea (Figure 2.4.7). The main biomass of Norway redfish (95 %) concentrated at depths from 200 m down to 350 m.

2.4.8 Long rough dab (*Hippoglossoides platessoides*)

As in previous years, long rough dab was found in all surveyed areas and the catches were generally high (Figure 2.4.8). Catches of long rough dab were taken as far east as 77° E and north of 80° N in area of Saint Anna trench. The greatest catches of long rough dab were in an area stretching from eastern coast of Spitsbergen/Svalbard to the south-western coast of Novaja Zemlja. The main biomass of long rough dab (64%) concentrated in the depth range from 150 m down to 300 m.

2.4.9 Wolffishes (Anarhichas spp)

The greatest catches of Atlantic wolffish (*Anarhichas lupus*) were to the south from Spitsbergen/Svalbard, near Bear Island, and on shallow sites in the southern part of the Barents Sea (Figure 2.4.9). The main biomass of Atlantic wolffish (70%) was concentrated in the depth range from 100 m down to 200 m.

Spotted wolffish (*Anarhichas minor*) was distributed similar to that observed in 2010, but was more abundant. The greatest catches of Spotted wolffish were to the east from Bear Island, and on shallow sites in the southeastern and in the central parts of the Barents Sea (Figure 2.4.10). The main biomass of Spotted wolffish (60%) was concentrated in a range of depths from 100 m down to 200 m.

The distribution of Northern wolffish (*Anarhichas denticulatus*) was similar to that observed in 2009 and 2010, but was more abundant. Most concentrations were located in the central areas (Figure 2.4.11). The main part of the catches (67 %) were in the depth range 250-400 m.

2.4.10 Plaice (*Pleuronectes platessa*)

Plaice was mainly distributed (73 % of total) in the depth range from 50 down to 100 m to the northwest from Kanin peninsula (Figure 2.4.12).

2.4.11 Norway pout (*Trisopterus esmarkii*)

The main concentrations of Norway pout were observed in the south-western part of the Barents Sea (Figure 2.4.13). In some trawl stations Norway pout were observed to the west and north of Spitsbergen/Svalbard, as far north as 81° N, which is 2° N further north than observed in 2010. In the southern part of the Barents Sea Norway pout were distributed eastward until 40° E. The main biomass of Norway pout (95 %) was concentrated in the depth range from 150 m down to 350 m.

2.4.12 Non target fish species

Some species were chosen as indicator species to demonstrate the distribution patterns of fishes from the different zoogeographic groups: the Thorny skate (*Amblyraja radiata*) and Northern skate (*Amblyraja hyperborea*) (Figs. 2.4.14-2.4.15).

Thorny skate (Amblyraja radiata), boreal zoogeographic group

As in 2009 and 2010, this species was quite widely distributed in the Barents Sea excluding southeastern and northeastern regions (Figure 2.4.14). Most large catches were in the central area, around Bear Island, to the west of Spitsbergen/Svalbard and on shallow sites in the southeast corner of the Barents Sea. Catches of thorny skate were more common to the north and northeast of Spitsbergen/Svalbard this year than in previous years. The Thorny skate preferred to stay in a wide range of depths from 50 m down to 150 m (44 % of total was found there).

Northern skate (Amblyraja hyperborea), arctic zoogeographic group

Northern skate was distributed in the deeper waters of the eastern Barents Sea and in the trench of Saint Anna (Figure 2.4.15). The main catches were from range of depths from 200 m down to 350 m (57 % of total).

2.5 Ecological interactions

2.5.1 The effect of bottom temperature and depth on the distribution of cod and haddock and their biological parameters within these ranges

When comparing 2011 with 2010, the area with bottom temperatures between 0 and 1°C have increased considerably while the area, with temperature above 3 °C, have decreased (red lines in Figures 2.5.1 and 2.5.2).

Characteristic to the cod distribution in August-September 2011 was that the largest catches of cod (~140 kg in average per nautical mile) were recorded in areas with a temperature range of 0-2 C (blue lines in Figure 2.6.1). In 2010 the catches were highest in areas with a temperature range from -1 °C to 1 °C (~150 kg in average per nautical mile). In 2010, larger catches was taken in areas with bottom temperatures 2-4 °C when compared to 2011, and lower catches was taken in 2010 in areas where the temperature range was from -1 °C to 0 °C when compared with 2011

For haddock (Figure 2.5.2) the largest catch was made in the temperature range 3-4 °C in both 2010 and 2011. However, haddock mean catches were an order lower in 2011 when compared to 2010.

Both mean length of the cod and the mean hepatosomatic index (*the ratio of liver weight to body weight, providing an indication on status of energy reserve in an animal, in a poor environment, fish usually have a smaller liver*) decreases with increasing temperatures (Figure 2.5.3). The hepatosomatic index of cod is highest (indicating good energy reserve) when the temperature is below zero and where the cod most probably also feeds on capelin and polar cod.

In 2011 the largest mean length of haddock were found in the areas with bottom temperature of 1-2 °C (Figure 2.5.4). At the same time, the greatest hepatosomatic index was registered in the areas with 3-4 °C temperature range where also the haddock catches were highest.

In 2010 most cod was found at 240-260 m depth (green circles in Figure 2.5.5), but in 2011 cod were more widely distributed by depth (green circles in Figure 2.5.6). For haddock there was not significant changes in haddock distribution by depth between 2010 (yellow triangles in fig 2.5.5) and 2011 (yellow triangles in fig 2.5.6). In 2011, large concentrations of cod and haddock were observed at 50-200 m depths, with bottom temperatures of 2-4 °C.

2.6 Phyto- and zooplankton

Data on chlorophyll **a**, nutrients and phytoplankton species composition are now being processed and analyzed at the IMR and PINRO laboratories. A summary and some preliminary results will be presented in an electronic attachment after the data have been worked up in the laboratories.

The map of zooplankton sampling localities and sampling gear (Russian and Norwegian vessels) are shown in Figure 2.6.1. The main results of the zooplankton observations will be presented in an electronic attachment after the data have been worked up in the laboratories.

The figure indicates that the investigated area is covered very well as seen from the number of CTD stations (Figure 2.2) taken. A total of 221 WP2 net hauls were obtained by the Norwegian vessels “Christina E”, “Johan Hjort” and “Helmer Hanssen”. For the third time the area north of Spitsbergen/Svalbard was covered with respect to mesozooplankton distribution and abundance. Stratified sampling targeting slightly larger zooplankton (i.e. krill/amphipods) was conducted with the Mocness system, while a new Macroplankton trawl was operated in a double oblique haul from both “Christina E” and “Johan Hjort”, particularly in the central and northern regions of the Barents Sea to obtain integrated samples of krill and amphipods to better assess their population structure. The WP2 vertical net coverage is very satisfactory and comparable to the years 2009 and 2010. In addition vertical hauls from 50 m depth to surface were conducted by a slightly modified WP3 net (inner diameter 118 cm, mesh size 1000 µm, with a non-filtering cod-end) both on “Christina E” and “Johan Hjort” on a couple of occasions to obtain quantitative samples of cnidarians and ctenophores. The table below gives an overview of total zooplankton hauls for different types of zooplankton sampling gear during the Ecosystem survey.

Total number of plankton net hauls obtained during the Norwegian and Russian surveys in the Barents Sea in August-September 2011

Net	Norwegian ships			Russian ship
	«Christina E»	«J.Hjort»	«Helmer Hanssen»	«Vilnyus»
WP-2	67	94	60	-
WP-3	4	2	-	-
Juday	-	-	-	241
MOCNESS	-	16	-	-
Macroplankton trawl	12	13	-	-
BR*	-	-	-	96
Algae net	15	24	23	

* BR net: Macroplankton net with a 0.2 m^2 opening and 564 µm mesh size

A map of the zooplankton biomass distribution based on Norwegian data is shown in Fig 2.6.1. From the Norwegian data, sampled in the western part it is evident that a greater region of the Barents Sea has very low biomass in 2011, similar to what was observed in 2009 and 2010 (not shown in this report). There is evidence of distinctly higher biomass regions south of Spitzbergen and between the Bear island and Norwegian mainland. The average zooplankton biomass in 2011, based only on Norwegian data (i.e. the western half of the Barents Sea, excluding the area west and north of Spitsbergen/Svalbard) is 6.05 g/m^2, compared to 5.87 g/m^2 for 2009 and 6.6 g/m^2 for 2010. A particular feature are scattered higher biomass regions associated with west Spitsbergen/Svalbard fjords. The average biomass around the Spitsbergen/Svalbard archipelago, 7.04 g/m^2, is somewhat higher compared to the standard area of the central Barents Sea. These data are compiled from the research vessel "Helmer Hanssen" only.

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. However, because of limited availability of sampling in the north there was no Russian data on the condition of zooplankton for this part of the sea. In the northern areas the basic biomass is formed of the Arctic species.

From the Norwegian vessel "Christina E" a total of 67 WP-2 hauls (bottom-0 m) were conducted at 70 CTD stations. From the Norwegian vessels no Juday net was deployed during the ecosystem survey in 2011. Hauls conducted west of the 500 m depth contour at the entrance to the Barents Sea as well as 200-0m net hauls where bottom depth significantly exceeds 200 m are not included. On "Johan Hjort" a total of 94 WP-2 hauls (bottom-0 m) were conducted. A total of 229 hauls from all three Norwegian ships satisfied the extraction criteria for the bottom-0m stratum, the region around Spitsbergen/Svalbard included.

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

In 2007, based on joint experience back to 2004, a dual WP2 and a Juday net system was taken in use for better performance and more efficient comparisons between the sampling gears. 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.

2.7 Marine mammals and seabirds

2.7.1 Marine mammals

The marine mammal observations are presented in Table 2.7.1. and Figure 2.7.1-2.7.3.

In total 2338 individuals of marine mammals, comprising 12 identified species, were observed in the Barents Sea during the ecosystem survey in 2011. This number amounts to about 70% of the number of individuals observed in 2010, when 14 species were observed. Species not observed this year, but was observed last year, include white whales and walrus.

Like in previous years, the most frequently observed marine mammal species was the white-beaked dolphin (about 66% of the total numbers observed). White-beaked dolphins were distributed along the polar front, although a few observations were north of the front in the eastern Barents Sea. Among the toothed whales, also harbour porpoises, killer whales and sperm whales were observed. The harbour porpoises inhabited shallower areas in the south-eastern Barents Sea, and killer whales were observed both in the northern and southern Barents Sea. The sperm whales were observed along the shelf edge. However, a few sperm whale observations were recorded far into the Barents Sea from Johan Hjort, but still in the deeper areas of the Bear Island Trough.

Among the baleen whales, blue, fin, humpback and minke whales were observed. The most frequently observed was the minke and humpback whales (about 9% of the marine mammal observations). Minke whales were observed with humpback and fin whales on shallow banks north of the polar front, and towards Franz Joseph Land. Fin and minke whales were also observed in the south-western Barents Sea, as in previous years. However, minke whales were more frequently observed in the south-eastern Barents Sea than in previous years.

Also this year few harp seals (33 individuals) were observed, in the northern range limit of the Barents Sea, and some individuals in the Kara Sea. Two bearded and 1 ringed seal were observed north of Spitsbergen/Svalbard.

One polar bear was observed east of Franz Joseph Land, in the Kara Sea.

2.8 Seabirds

The observed birds from the participating Ecosystem vessels are shown in Table 2.7.2. The distribution of birds observed from the Norwegian vessels are shown in Figure 2.7.4 and 2.7.5.

2.9 Benthos

All four vessels involved in the ecosystem survey in 2011 recorded benthos and shellfish in bottom trawl hauls. A standard bottom trawl (Campelen-trawl) was used on all the vessels to cover the whole Barents Sea area (Fig 2.1). The invertebrate biomass varied from 6.9 g to 1752 kg between trawl hauls (standardised to 15 minutes), with maximum biomass recorded in the north eastern part.

2.9.1 Invertebrate benthos

The total biomass of all registered invertebrate catch (except northern shrimp, *Pandalus borealis*) was summarized per station and is presented in Figure 2.8.1.

The benthos biomass distribution in 2011 was generally the same as in previous years. The highest biomass (1369 and 1973 kg/nml of sponges “Porifera”) was recorded in the northern part of the Kara Sea in the Saint Anna trough. In the southwestern part of the Barents Sea up to 4 tons of *Geodia* (sponges) were recorded in previous years (2006-2009). But in this part of the Barents Sea, a dramatic reduction in catches was observed of this animal group in 2010 (235 kg/nml) and 2011 (450 kg/nml). This might partly be caused by increased effort to avoid such catches. Another highest biomass catch in 2011 was of the brittle star *Ophiocantha bidentata* with 462 kg/nml.

The benthos was split into eight animal groups: Annelida, Bryozoa, Coelenterata, Crustacea, Echinodermata, Mollusca, Porifera and Varia. Their distribution patterns (Fig 2.8.2) were similar to previous years. The echinoderms (sea stars, sea urchins, brittle stars, sea cucumbers and sea lilies) make up the largest proportion of the biomass in the central and northern part of the Barents Sea. Most of the crustacean biomass is found in the central and eastern parts of the Barents Sea, and, as the crustaceans, the cnidarians (sea anemones, corals, hydroids) are present with their largest biomasses in the north-eastern part of the Barents Sea. Porifera are dominating in the southwestern Barents Sea, along the western and west and northern coast of Spitsbergen/Svalbard and in the north Kara Sea.

2.9.2 Red King crab (Paralithodes camtschaticus)

The Ecosystem Survey shows that the distribution area for the red king crab was located between 28 and 45° E, and therefore close to the coast (Fig 2.8.3). The westernmost catch was near the North Cape. The maximum quantity of king crab was 6 specimens per nautical mile. Compared with previous years, the total area and number of king crab catches on the Ecosystem Surveys was the same (Figure 2.8.4).

2.9.3 Snow crab (Chionoecetes opilio)

The Ecosystem Surveys in the Barents Sea shows an eastern distributed of the snow crab (Fig 2.8.5). This was also shown in previous years. In 2011 snow crab consists mainly (87%) of young individuals with 40 mm length of carapace (Figure 2.8.6). The snowcrab was registered on 84 stations with abundances up to 2.4 thousand individuals per nautical mile and 5-25.3 kg/nml. In 2010 the snow crab was registered on 53 stations with abundances of 8-10 individuals in nearly all trawls.

2.9.4 Northern shrimp (Pandalus borealis)

Northern shrimp is widely distributed in the Barents Sea and was registered at 75 % of the stations (Fig 2.8.7). The density ranged between 0 and 164 kg/nml. The average catch of Northern shrimp was 8 kg/nml, which is less than previous year. As in previous years, the densest concentrations were found round Spitsbergen/Svalbard and in the central parts of the Barents Sea.

2.10 Pollution

2.10.1 The sunken submarine "Komsomolets"

The potential sources for radioactive contamination from "Komsomolets" are the reactor and the nuclear torpedoes. Accurate information about the inventory of radionuclides is not publicly available. Gladkov et al. (1994) estimated, however, that the reactor core contained $2.8 \cdot 10^{15}$ Bq strontium-90 and $3.1 \cdot 10^{15}$ Bq cesium-137, which are the most important radionuclides. Further, Gladkov et al. (1994) estimated that the torpedoes contain $1.3 \cdot 10^{13}$ Bq plutonium-239.

Based on hydrographic observations, current measurements and numerical models the potential radioactive pollution has been assessed by Blindheim et al. (1994) and Heldal et al. (accepted for publication). They conclude that the submarine represent a minor radioactive pollution problem. Høibråten et al. (1997) has made the same conclusion. Despite of this fact, it is important to monitor the area around the wreck to document the radionuclide levels.

Levels of cesium-137 (Cs-137) in sediments and seawater in the vicinity of "Komsomolets" in the period 1993-2010 are shown in Figure 2.9.1. These results do not indicate a leakage of significance from the submarine, and the levels are comparable to those found in adjacent areas. The samples collected in 2011 will be analysed in November/December 2011.

2.10.2 Garbage

Analyze of man-made garbage from trawl catches and surface investigations demonstrated that intensive fishery and navigation areas are the most polluted (Figure 2.9.2 and 2.9.3). Plastic dominated among pollutants in the central part of the Barents Sea. According to the distribution it is likely that this garbage is drifted into the area by the ocean currents. A large number of floating logs were observed in the central and north areas. The type of garbage observed floating at the surface is shown in Figure 2.9.4.

Plastic and wood prevailed among man-made garbage in the trawl catches (Figure 2.9.3). The occurrence of plastic in the catches increased in the northwest, northeast and east, which corresponds to the direction of the main currents. The wood might be brought to the area by ocean currents from the eastern seas because of the timber-rafting from the Siberian rivers, or it might possibly be lost from ships. This phenomenon is observed annually.

Because the bottom trawl catchability is low for small density polymer materials the amount of the anthropogenic garbage in the Barents Sea may be larger.

Dangerous and potential dangerous objects were seldom presented in the observations. In the majority of cases only inactive objects were found, which do not effect on the environment directly harmful.

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 of Biology, Copenhagen, 35:237-280.

Anon. 2004. Survey report from the joint Norwegian/Russian ecosystem survey in the Barents Sea in August-October 2004 (vol.1). IMR/PINRO Joint Report Series, No.3/2004.ISSN 1502-8828.67 pp.

Anon. 2006. Survey report from the joint Norwegian/Russian ecosystem survey in the Barents Sea in August-October 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.

Blindheim J, Føyn L, Martinsen EA, Svendsen E, Sætre Hjøllo S, Ådlandsvik B. 1994. In: Sætre, R. (Ed.). The sunken nuclear submarine in the Norwegian Sea – A potential environmental problem? Fisken og Havet 1994 (7).

Dickson W. 1993. Estimation of the capture efficiency of trawl gear. Testing a theoretical model. Fisheries Research 16(3): 255-272.

Dickson W. 1993. stimation of the capture efficiency of trawl gear. Development of a theoretical model// Fisheries Research 16(3): 239-253.

Jakobsen T, Korsbrekke K, Mehl S, Nakken O. 1997. Norwegian combined acoustic and bottom trawl surveys for demersal fish in the Barents Sea during winter. ICES CM 1997/Y: 17, 26 pp.

Eriksen E, Prozorkevich DV, Dingsør GE 2009. An evaluation of 0-group abundance indices of Barents Sea Fish Stocks. The Open fish Science Journal 2: 6-14.

Eriksen E, Bogstad B, Nakken O. 2011. Ecological significance of 0-group fish in the Barents Sea ecosystem. Polar Biology 34(5):647-657.

Gladkov GA, Sivintsev YuV. 1994. Radiation conditions near the sunken submarine “Komsomolets”. Atomic Energy 77(5): 865-871.

Høibraten S, Thoresen PE, Haugan A. 1997. The sunken nuclear submarine Komsomolets and its effects on the environment. The Science of the Total Environment 202 (1-3): 67-78.

Heldal HE, Vikebø F, Johansen GO. accepted for publication. Dispersal of the radionuclide cesium-137 (137Cs) from point-sources in the Barents and Norwegian Seas and its potential contamination of the Arctic marine food chain – coupling numerical ocean models with geographical fish distribution data. Environmental Pollution.

Jørgensen LL. 2006. Inndeling av bifangst i grove dyregrupper på økosystemtokt til bruk for Regfisk. Bunnhabitatgruppe, ver.2. Institute of Marine Research, Bergen, Norway.

4 Tables

Table 2.1 1. Mean water temperatures in the main parts of standard oceanographic sections in the Barents Sea and adjacent waters in August–September 1965–2011. The sections are: Kola (70º30´N – 72º30´N, 33º30´E), Kanin S (68º45´N – 70º05´N, 43º15´E), Kanin N (71º00´N – 72º00´N, 43º15´E), North Cape – Bear Island (NCBI, 71º33´N, 25º02´E – 73º35´N, 20º46´E), Bear Island – West (BIW, 74º30´N, 06º34´E – 15º55´E), Vardø – North (VN, 72º15´N – 74º15´N, 31º13´E) and Fugløya – Bear Island (FBI, 71º30´N, 19º48´E – 73º30´N, 19º20´E).

	Section and layer (depth in metres)								
	Kola	Kola	Kola	Kanin S	Kanin N	NCBI	BIW	VN	FBI
Year	0–50	50–200	0–200	0–bot.	0–bot.	0–200	0–200	50–200	50–200
1965	6.7	3.9	4.6	4.6	3.7	5.1	-	3.8	5.2
1966	6.7	2.6	3.6	1.9	2.2	5.5	3.6	3.2	5.3
1967	7.5	4.0	4.9	6.1	3.4	5.6	4.2	4.4	6.3
1968	6.4	3.7	4.4	4.7	2.8	5.4	4.0	3.4	5.0
1969	6.7	3.1	4.0	2.6	2.0	6.0	4.2	3.8	6.3
1970	7.8	3.7	4.7	4.0	3.3	6.1	-	4.1	5.6
1971	7.1	3.2	4.2	4.0	3.2	5.7	4.2	3.8	5.6
1972	8.7	4.0	5.2	5.1	4.1	6.3	3.9	4.6	6.1
1973	7.7	4.5	5.3	5.7	4.2	5.9	5.0	4.9	5.7
1974	8.1	3.9	4.9	4.6	3.5	6.1	4.9	4.3	5.8
1975	7.0	4.6	5.2	5.6	3.6	5.7	4.9	4.5	5.7
1976	8.1	4.0	5.0	4.9	4.4	5.6	4.8	4.4	5.8
1977	6.9	3.4	4.3	4.1	2.9	4.9	4.0	3.6	4.9
1978	6.6	2.5	3.6	2.4	1.7	5.0	4.1	3.2	4.9
1979	6.5	2.9	3.8	2.0	1.4	5.3	4.4	3.6	4.7
1980	7.4	3.5	4.5	3.3	3.0	5.7	4.9	3.7	5.5
1981	6.6	2.7	3.7	2.7	2.2	5.3	4.4	3.4	5.3
1982	7.1	4.0	4.8	4.5	2.8	5.8	4.9	4.1	6.0
1983	8.1	4.8	5.6	5.1	4.2	6.3	5.1	4.8	6.1
1984	7.7	4.1	5.0	4.5	3.6	5.9	5.0	4.2	5.7
1985	7.1	3.5	4.4	3.4	3.4	5.3	4.6	3.7	5.6
1986	7.5	3.5	4.5	3.9	3.2	5.8	4.4	3.8	5.5
1987	6.2	3.3	4.0	2.7	2.5	5.2	3.9	3.5	5.1
1988	7.0	3.7	4.5	3.8	2.9	5.5	4.2	3.8	5.7
1989	8.6	4.8	5.8	6.5	4.3	6.9	4.9	5.1	6.2
1990	8.1	4.4	5.3	5.0	3.9	6.3	5.7	5.0	6.3
1991	7.7	4.5	5.3	4.8	4.2	6.0	5.4	4.8	6.2
1992	7.5	4.6	5.3	5.0	4.0	6.1	5.0	4.6	6.1
1993	7.5	4.0	4.9	4.4	3.4	5.8	5.4	4.2	5.8
1994	7.7	3.9	4.8	4.6	3.4	6.4	5.3	4.8	5.9
1995	7.6	4.9	5.6	5.9	4.3	6.1	5.2	4.6	6.1
1996	7.6	3.7	4.7	5.2	2.9	5.8	4.7	3.7	5.7
1997	7.3	3.4	4.4	4.2	2.8	5.6	4.1	4.0	5.4
1998	8.4	3.4	4.7	2.1	1.9	6.0	-	3.9	5.8
1999	7.4	3.8	4.7	3.8	3.1	6.2	5.3	4.8	6.1
2000	7.6	4.5	5.3	5.8	4.1	5.7	5.1	4.2	5.8
2001	6.9	4.0	4.7	5.6	4.0	5.7	4.9	4.2	5.9
2002	8.6	4.8	5.8	4.0	3.7	-	5.4	4.6	6.5
2003	7.2	4.0	4.8	4.2	3.3	-	-	4.7	6.2
2004	9.0	4.7	5.7	5.0	4.2	-	5.8	4.8	6.4
2005	8.0	4.4	5.3	5.2	3.8	6.7	-	5.0	6.2
2006	8.3	5.3	6.1	6.1	4.5	-	5.8	5.3	6.9
2007	8.2	4.6	5.5	4.9	4.3	6.9	5.6	4.9	6.5
2008	6.9	4.6	5.2	4.2	4.0	6.2	5.1	4.8	6.4
2009	7.2	4.3	5.0	-	4.3	-	-	5.2	6.4
2010	7.8	4.7	5.5	4.9	4.5	-	5.4	-	6.2
2011	7.6	4.0	4.9	5.0	3.8	-	-	5.1	6.4
Average 1965–2011	7.5	4.0	4.8	4.4	3.4	5.8	4.8	4.3	5.8

Table 2.2.1. 0-group abundance indices (in millions) with 95% confidence limits, not corrected for capture efficiency. Record high year classes in bold.

	Capelin			**Cod**			**Haddock**			**Herring**			**Redfish**		
Year	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	16901	2619	31183	19408	14119	24696	19372	12727	26016	**136053**	97442	174664	862	0	1779
2005	42354	12517	72192	21789	14947	28631	**33637**	24645	42630	26531	1288	51774	12676	511	24841
2006	168059	103577	232540	7801	3605	11996	11209	7413	15005	68531	22418	114644	20403	9439	31367
2007	161594	87683	235504	9896	5993	13799	2873	1820	3925	22319	4517	40122	156548	46433	266663
2008	**288799**	178860	398738	52975	31839	74111	2742	830	4655	15915	4477	27353	9962	0	20827
2009	189747	113135	266360	54579	37311	71846	13040	7988	18093	18916	8249	29582	49939	23435	76443
2010	91730	57545	125914	40635	20307	60962	7268	4530	10006	20367	4099	36636	66392	3114	129669
2011	175836	3876	347796	**119736**	66423	173048	7441	5251	9631	13674	7737	19610	7026	0	17885
Mean	81400			23669			4260			27996			62387		

Table 2.2.1 cont.

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	**1400**	865	1936	72	29	115	36	20	52	37156	19040	55271	341	101	581
2005	55	37	74	10	4	15	200	109	291	6545	3202	9888	3231	1283	5178
2006	139	56	221	11	2	21	707	434	979	26016	9997	42036	2112	465	3760
2007	53	6	100	1	0	2	262	46	479	25883	8494	43273	2533	0	5135
2008	45	22	69	6	0	13	956	410	1502	6649	845	12453	91	0	183
2009	22	0	46	7	4	10	115	51	179	23570	9661	37479	21433	5642	37223
2010	402	126	678	14	8	20	128	18	238	31338	13644	49032	1306	0	3580
2011	27	0	59	20	11	29	58	23	93	37431	15083	59780	627	26	1228
Mean	183			28			556			35804			8496		

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

Year	Capelin Abundance index	Capelin Confidence limit		Cod Abundance index	Cod Confidence limit		Haddock Abundance index	Haddock Confidence limit		Herring Abundance index	Herring 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	54573	12182	96965	66846	48194	85498	42640	29282	55999	**801684**	572824	1030544
2005	150341	52238	248444	72989	51374	94603	**92536**	68572	116500	126836	21166	232507
2006	520553	328549	712557	24773	11204	38343	27639	18278	37000	302762	101583	503940
2007	490817	273482	708152	43412	27129	59696	8527	5680	11375	142871	24925	260817
2008	**995101**	627202	1362999	234144	131081	337208	9864	1144	18585	201046	68778	333313
2009	673027	423386	922668	185457	123375	247540	33339	19707	46970	104233	31009	177458
2010	318569	201973	435166	135355	68199	202511	23669	14503	32834	117087	32045	202129
2011	594248	58009	1130487	**448005**	251499	644511	19114	14209	24018	83051	48024	118078
Mean	279322			90167			11988			165961		

Table 2.2.2. cont.

Year	Saithe			Polar cod (east)			Polar cod (west)		
	Abundance index	Confidence limit		Abundance index	Confidence limit		Abundance index	Confidence limit	
1980	21	0	47	203226	69898	336554	82871	0	176632
1981	0	0	0	4882	1842	7922	46155	17810	74500
1982	296	0	699	1443	154	2731	10565	0	29314
1983	562	211	912	1246	0	2501	87272	0	190005
1984	2577	725	4430	871	0	2118	26316	6097	46534
1985	30	7	53	143257	39633	246881	6670	0	13613
1986	4	0	9	102869	16336	189403	18644	125	37164
1987	4	0	10	64171	0	144389	631	265	996
1988	32	11	52	2588	59	5117	41133	0	89068
1989	10	0	23	1391	0	2934	164058	15439	312678
1990	29	4	55	2862	879	4846	246819	0	545410
1991	9	4	14	823828	366924	1280732	**281434**	0	799822
1992	326	156	495	49757	0	104634	80747	12984	148509
1993	1033	0	2512	297397	0	690030	70019	12321	127716
1994	7	1	12	**2139223**	1230225	3048220	49237	0	109432
1995	415	196	634	6	0	14	195	0	390
1996	430	180	679	588020	368361	807678	46671	0	116324
1997	341	162	521	297828	164107	431550	62084	6037	118131
1998	182	91	272	96874	59118	134630	95609	0	220926
1999	275	139	411	1154149	728616	1579682	24015	3768	44262
2000	851	446	1256	916625	530966	1302284	190661	133249	248072
2001	47	0	106	29087	5648	52526	119023	0	252146
2002	2112	134	4090	829216	496352	1162079	215572	36403	394741
2003	286	0	631	82315	42707	121923	12998	0	30565
2004	**4795**	2825	6765	290686	147492	433879	2644	776	4511
2005	177	116	239	44703	22931	66474	26091	10097	42086
2006	276	112	440	182714	73646	291782	16232	3445	29018
2007	298	0	596	191111	57403	324819	22811	0	46531
2008	142	68	216	42657	5936	79378	619	25	1212
2009	62	0	132	168990	70509	267471	154687	37022	272351
2010	1066	362	1769	267430	111697	423162	12045	0	33370
2011	96	0	225	249269	100355	398183	4924	218	9629
Mean	525			289709			69358		

Table 2.2.3. Length distribution (%) of 0-group fish in the Barents Sea and adjacent waters, August-October 2011.

Length mm	Cod	Haddock	Capelin	Herring	Saithe	Redfish	Polar cod	Greenland halibut	LRD	Sandeel
15 - 19						0.1				
20 - 24			0.1			0.8			2.7	
25 - 29	0.0		1.6			4.2	0.0		5.0	0.0
30 - 34	0.0	0.0	6.1	0.0		11.6	0.2		18.9	0.2
35 - 39	0.0	0.0	11.6	0.0		24.6	1.8		35.0	1.9
40 - 44	0.0	0.2	18.0	0.1		37.0	9.9	0.7	34.8	3.5
45 - 49	0.1	0.5	25.0	0.3		14.8	24.9	1.3	2.8	12.9
50 - 54	1.1	0.7	25.6	1.3		6.6	41.5	7.6		32.9
55 - 59	3.7	0.9	9.3	3.0		0.3	19.1	18.6	0.3	20.7
60 - 64	5.9	2.0	1.9	13.6			2.4	34.3	0.4	14.0
65 - 69	9.3	2.6	0.6	32.2	1.2		0.0	15.7		5.2
70 - 74	13.7	2.1	0.3	33.6	62.2		0.0	10.0		3.4
75 - 79	14.5	4.2	0.0	13.1	0.9			5.9		2.1
80 - 84	17.6	4.0		2.4	12.6			3.3		1.2
85 - 89	13.3	7.8		0.2	0.8			0.9		1.1
90 - 94	8.9	9.6		0.1	3.5			1.8		0.3
95 - 99	5.7	11.2								0.3
100 - 104	2.4	10.9			0.9					0.3
105 - 109	1.9	10.5		0.1	0.8					
110 - 114	0.9	8.7			2.5					0.0
115 - 119	0.6	7.3			0.8					
120 - 124	0.1	6.0			4.3					
125 - 129	0.2	3.9			4.3					
130 - 134	0.0	3.0			2.6					
135 - 139	0.0	1.8			0.9					
140 - 144	0.0	1.5			1.8					
145 - 149	0.0	0.4								
150 - 154		0.1								
155 - 159		0.2								
Mean, cm	8.0	10.1	4.6	6.9	8.4	4.0	4.9	6.4	3.7	5.4
Long term mean, cm	7.6	9.0	4.8	7.2	9.1	3.8	3.9	6.2	3.4	5.6

Table 2.2.4. Biomass indices (103 t) of 0-group capelin, cod, haddock and herring for 1993-2009, calculated from abundance indices corrected for capture efficiency (Eriksen et al. 2011).

Year	Capelin	Cod	Haddock	Herring	Total biomass 10^3 t
1993	3	475	34	1035	1547
1994	6	666	54	173	898
1995	2	1546	14	12	1573
1996	98	919	34	438	1489
1997	82	657	12	352	1103
1998	51	117	168	988	1323
1999	158	32	39	440	668
2000	55	319	44	404	822
2001	51	11	58	9	130
2002					
2003	149	160	115	471	894
2004	33	317	686	2243	3279
2005	60	431	749	406	1647
2006	335	181	329	1321	2166
2007	312	123	69	275	779
2008	396	632	54	106	1189
2009	197	955	346	289	1788
2010	100	786	134	254	1274
2011	228	1855	215	151	2449
Mean	129	566	175	520	1390

Table 2.3.1. Barents Sea capelin. Acoustic estimate in August-October 2011.

Length (cm)	Age/Yearclass 1 2010	2 2009	3 2008	4 2007	Sum (10^9)	Biomass (10^3 t)	Mean weight (g)
6.0 - 6.5	6.328				6.328	6.328	1.0
6.5 - 7.0	20.507				20.507	20.507	1.0
7.0 - 7.5	21.124				21.124	23.236	1.1
7.5 - 8.0	22.874				22.874	32.024	1.4
8.0 - 8.5	22.217	0.001			22.218	39.992	1.8
8.5 - 9.0	25.953	0.402			26.355	52.710	2.0
9.0 - 9.5	27.848	0.284			28.132	70.330	2.5
9.5 - 10.0	21.955	1.704			23.659	75.709	3.2
10.0 - 10.5	17.792	4.497			22.289	86.927	3.9
10.5 - 11.0	14.803	9.553			24.356	109.602	4.5
11.0 - 11.5	6.226	16.851			23.077	124.616	5.4
11.5 - 12.0	1.534	18.455			19.989	123.932	6.2
12.0 - 12.5	0.393	25.937	0.078		26.408	192.778	7.3
12.5 - 13.0	0.002	25.690	0.604		26.296	228.775	8.7
13.0 - 13.5	0.001	21.897	0.189		22.087	225.287	10.2
13.5 - 14.0	0.003	13.833	1.961		15.797	180.086	11.4
14.0 - 14.5	0.001	15.513	2.009		17.523	234.808	13.4
14.5 - 15.0		11.197	6.834		18.031	288.496	16.0
15.0 - 15.5		6.765	6.421	0.496	13.682	246.276	18.0
15.5 - 16.0		4.764	8.138	1.713	14.615	293.762	20.1
16.0 - 16.5		2.850	9.800	0.469	13.119	301.737	23.0
16.5 - 17.0		0.268	7.583	0.264	8.115	201.252	24.8
17.0 - 17.5		0.678	6.921	0.752	8.351	239.674	28.7
17.5 - 18.0		0.034	3.253	1.421	4.708	144.065	30.6
18.0 - 18.5			1.327	2.449	3.776	139.712	37.0
18.5 - 19.0			0.216	0.412	0.628	22.294	35.5
19.0 - 19.5				0.011	0.011	0.407	37.0
19.5 - 20.0				0.060	0.060	2.340	39.0
TSN (10^9)	209.561	181.173	55.334	8.047	454.115		
TSB (10^3 t)	495.9	1764.0	1213.9	233.7		3707.7	
Mean length (cm)	8.71	12.87	16.00	17.22	11.41		
Mean weight (g)	2.37	9.74	21.94	29.05			8.2
SSN (10^9)	0.001	42.069	52.502	8.047	102.619		
SSB (10^3 t)	0.2	697.2	1183.8	233.7		2114.8	

Table 2.3.2. Barents Sea capelin. Acoustic estimates of the 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+**
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	5.14
1974	1.06	3.5	3.06	5.6	1.53	8.9	0.07	20.8	+	25	5.73
1975	0.65	3.4	2.39	6.9	3.27	11.1	1.48	17.1	0.01	31	7.81
1976	0.78	3.7	1.92	8.3	2.09	12.8	1.35	17.6	0.27	21.7	6.42
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	4.16
1980	1.21	4.5	1.85	9.4	2.83	18.2	0.82	24.8	0.01	19.7	6.71
1981	0.92	2.3	1.83	9.3	0.82	17	0.32	23.3	0.01	28.7	3.90
1982	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			4.23
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			0.86
1986	0.02	3.9	0.05	10.1	0.05	13.5	+	16.4			0.12
1987	0.08	2.1	0.02	12.2	+	14.6	+	34			0.10
1988	0.07	3.4	0.35	12.2	+	17.1					0.43
1989	0.61	3.2	0.20	11.5	0.05	18.1	+	21.0			0.86
1990	2.66	3.8	2.72	15.3	0.44	27.2	+	20.0			5.83
1991	1.52	3.8	5.10	8.8	0.64	19.4	0.04	30.2			7.29
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	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			0.19
1996	0.24	2.9	0.22	18.6	0.05	23.9	+	25.5			0.50
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	0.65	4.2	1.38	13.6	0.71	26.9	0.03	29.3			2.77
2000	1.70	3.8	1.59	14.4	0.95	27.9	0.08	37.7			4.27
2001	0.37	3.3	2.40	11.0	0.81	26.7	0.04	35.5	+	41.4	3.63
2002	0.23	3.9	0.92	10.1	1.04	20.7	0.02	35.0			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			0.32
2006	0.29	4.8	0.35	16.1	0.14	24.8	0.01	30.6	+	36.5	0.79
2007	0.93	4.2	0.85	15.5	0.10	27.5	+	28.1			1.88
2008	0.97	3.1	2.80	12.1	0.61	24.6	0.05	30.0			4.43
2009	0.42	3.4	1.82	10.9	1.51	24.6	0.01	28.6			3.76
2010	0.74	3.0	1.30	10.2	1.43	23.4	0.02	26.3			3.50
2011	0.50	2.4	1.76	9.7	1.21	21.9	0.23	29.1			3.71
Average	0.67	3.57	1.36	10.74	0.86	19.47	0.22	24.96	0.07	28.05	3.02

Table 2.3.3. Barents Sea capelin. Survey mortalities from age 1 to age 2,

Year	Year class	Age 1 (10^9)	Age 2 (10^9)	Total mort. %	Total mort. Z
1984-1985	1983	154.8	48.3	69	1.16
1985-1986	1984	38.7	4.7	88	2.11
1986-1987	1985	6.0	1.7	72	1.26
1987-1988	1986	37.6	28.7	24	0.27
1988-1989	1987	21.0	17.7	16	0.17
1989-1990	1988	189.2	177.6	6	0.06
1990-1991	1989	700.4	580.2	17	0.19
1991-1992	1990	402.1	196.3	51	0.72
1992-1993	1991	351.3	53.4	85	1.88
1993-1994	1992	2.2	3.4	-	-
1994-1995	1993	19.8	8.1	59	0.89
1995-1996	1994	7.1	11.5	-	-
1996-1997	1995	81.9	39.1	52	0.74
1997-1998	1996	98.9	72.6	27	0.31
1998-1999	1997	179.0	101.5	43	0.57
1999-2000	1998	155.9	110.6	29	0.34
2000-2001	1999	449.2	218.7	51	0.72
2001-2002	2000	113.6	90.8	20	0.22
2002-2003	2001	59.7	9.6	84	1.83
2003-2004	2002	82.4	24.8	70	1.20
2004-2005	2003	51.2	13.0	75	1.39
2005-2006	2004	26.9	21.7	19	0.21
2006-2007	2005	60.1	54.8	9	0.09
2007-2008	2006	221.7	231.4	-	-
2008-2009	2007	313.0	166.4	47	0.63
2009-2010	2008	124.0	127.9	-	-
2010-2011	2009	247.7	181.1	27	0.31

Table 2.3.4. Barents Sea polar cod. Acoustic estimate in August-October 2011.

Length (cm)	Age/Yearclass 1 2010	2 2009	3 2008	4 2007	Sum (10^6)	Biomass (10^{-3} t)	Mean weight (g)
6.5 - 7.0	16	0	0	0	16	0.0	3.1
7.0 - 7.5	56	0	0	0	56	0.2	3.4
7.5 - 8.0	247	0	0	0	247	1.0	4.1
8.0 - 8.5	947	0	0	0	947	3.1	3.3
8.5 - 9.0	2361	0	0	0	2361	10.4	4.4
9.0 - 9.5	3206	0	0	0	3207	18.4	5.7
9.5 - 10.0	5510	0	0	0	5510	41.5	7.5
10.0 - 10.5	5592	823	1	0	6415	53.9	8.4
10.5 - 11.0	6151	6	0	0	6156	48.0	7.8
11.0 - 11.5	3862	3	0	0	3865	38.5	10.0
11.5 - 12.0	3201	0	2	0	3204	32.2	10.1
12.0 - 12.5	1539	550	6	0	2094	24.2	11.5
12.5 - 13.0	1161	671	2	0	1833	22.8	12.4
13.0 - 13.5	501	942	5	0	1448	21.3	14.7
13.5 - 14.0	91	1375	22	0	1489	23.4	15.7
14.0 - 14.5	8	1567	8	0	1583	27.6	17.4
14.5 - 15.0	1	2017	9	0	2026	43.3	21.4
15.0 - 15.5	0	1631	403	0	2034	45.7	22.5
15.5 - 16.0	3	1401	31	0	1436	35.2	24.5
16.0 - 16.5	9	954	56	8	1027	30.1	29.3
16.5 - 17.0	0	747	255	0	1003	27.9	27.9
17.0 - 17.5	0	521	134	0	655	20.8	31.8
17.5 - 18.0	0	500	145	0	645	19.5	30.2
18.0 - 18.5	0	316	234	1	551	20.3	36.8
18.5 - 19.0	0	238	522	4	764	32.3	42.3
19.0 - 19.5	0	170	225	42	438	18.9	43.2
19.5 - 20.0	0	9	584	20	613	30.5	49.7
20.0 - 20.5	0	7	340	41	389	22.2	57.2
20.5 - 21.0	0	7	376	50	433	25.3	58.5
21.0 - 21.5	0	1	418	43	462	27.8	60.2
21.5 - 22.0	0	0	337	87	423	28.1	66.3
22.0 - 22.5	0	0	242	28	271	19.4	71.8
22.5 - 23.0	0	0	178	10	188	14.6	77.8
23.0 - 23.5	0	0	104	2	106	8.6	81.4
23.5 - 24.0	0	0	87	31	118	8.8	74.3
24.0 - 24.5	0	0	1	58	58	5.4	93.0
24.5 - 25.0	0	0	0	14	14	1.2	82.0
25.0 - 25.5	0	0	0	30	30	2.7	88.1
25.5 - 26.0	0	0	0	0	0	0.0	111.0
26.0 - 26.5	0	0	0	15	15	1.6	106.0
26.5 - 27.0	0	0	0	14	14	1.5	108.0
27.0 - 27.5	0	0	0	0	0	0.0	
27.5 - 28.0	0	0	0	0	0	0.0	
28.0 - 28.5	0	0	0	0	0	0.0	145.5
28.5 - 29.0				14	14	2.1	145.0
TSN(10^6)	34460	14455	4728	514	54158		
TSB(10^3 t)	282.3	304.4	237.1	36.7		860.5	
Mean length (cm)	10.5	14.8	19.5	22.3	12.5		
Mean weight (g)	8.2	21.1	50.1	71.3			15.9

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

Year	Age 1		Age 2		Age 3		Age 4+		Total	
	TSN	TSB	TSN	TSB	TSN	TSB	TSN	TSB	TSN	TSB
1986	24038	169.6	6263	104.3	1058	31.5	82	3.4	31441	308.8
1987	15041	125.1	10142	184.2	3111	72.2	39	1.2	28333	382.8
1988	4314	37.1	1469	27.1	727	20.1	52	1.7	6562	86.0
1989	13540	154.9	1777	41.7	236	8.6	60	2.6	15613	207.8
1990	3834	39.3	2221	56.8	650	25.3	94	6.9	6799	127.3
1991	23670	214.2	4159	93.8	1922	67.0	152	6.4	29903	381.5
1992	22902	194.4	13992	376.5	832	20.9	64	2.9	37790	594.9
1993	16269	131.6	18919	367.1	2965	103.3	147	7.7	38300	609.7
1994	27466	189.7	9297	161.0	5044	154.0	790	35.8	42597	540.5
1995	30697	249.6	6493	127.8	1610	41.0	175	7.9	38975	426.2
1996	19438	144.9	10056	230.6	3287	103.1	212	8.0	33012	487.4
1997	15848	136.7	7755	124.5	3139	86.4	992	39.3	28012	400.7
1998	89947	505.5	7634	174.5	3965	119.3	598	23.0	102435	839.5
1999	59434	399.6	22760	426.0	8803	286.8	435	25.9	91463	1141.9
2000	33825	269.4	19999	432.4	14598	597.6	840	48.4	69262	1347.8
2001	77144	709.0	15694	434.5	12499	589.3	2271	132.1	107713	1869.6
2002	8431	56.8	34824	875.9	6350	282.2	2322	143.2	52218	1377.2
2003	15434	114.1	2057	37.9	2038	63.9	1545	64.4	21074	280.2
2004	99404	627.1	22777	404.9	2627	82.2	510	32.7	125319	1143.8
2005	71675	626.6	57053	1028.2	3703	120.2	407	28.3	132859	1803.3
2006	16190	180.8	45063	1277.4	12083	445.9	698	37.2	74033	1941.2
2007	29483	321.2	25778	743.4	3230	145.8	315	19.8	58807	1230.1
2008	41693	421.8	18114	522.0	5905	247.8	415	27.8	66127	1219.4
2009	13276	100.2	22213	492.5	8265	280.0	336	16.6	44090	889.3
2010	27285	234.2	18257	543.1	12982	594.6	1253	58.6	59777	1430.5
2011	34460	282.3	14455	304.4	4728	237.1	514	36.7	54158	860.5
Average	32105	255.2	16124	368.9	4860	185.6	589	31.5	53718	843.4

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

Year	Year class	Age 1 (10^9)	Age 2 (10^9)	Total mort. %	Total mort Z
1986-1987	1985	24.0	10.1	58	0.86
1987-1988	1986	15.0	1.5	90	2.30
1988-1989	1987	4.3	1.8	58	0.87
1989-1990	1988	13.5	2.2	84	1.81
1990-1991	1989	3.8	4.2	-	-
1991-1992	1990	23.7	14.0	41	0.53
1992-1993	1991	22.9	18.9	17	0.19
1993-1994	1992	16.3	9.3	43	0.56
1994-1995	1993	27.5	6.5	76	1.44
1995-1996	1994	30.7	10.1	67	1.11
1996-1997	1995	19.4	7.8	59	0.91
1997-1998	1996	15.8	7.6	52	0.73
1998-1999	1997	89.9	22.8	75	1.37
1999-2000	1998	59.4	20.0	66	1.09
2000-2001	1999	33.8	15.7	54	0.77
2001-2002	2000	77.1	34.8	55	0.80
2002-2003	2001	8.4	2.1	75	1.38
2003-2004	2002	15.4	22.7	-	-
2004-2005	2003	99.4	57.1	43	0.56
2005-2006	2004	71.7	45.1	37	0.48
2006-2007	2005	16.2	25.8	-	-
2007-2008	2006	29.5	18.1	39	0.50
2008-2009	2007	41.7	22.2	47	0.63
2009-2010	2008	13.2	18.3	-	-
2010-2011	2009	27.3	14.5	47	0.63
1986-1987	1984	6.3	3.1	51	0.71
1987-1988	1985	10.1	0.7	93	2.67
1988-1989	1986	1.5	0.2	87	2.01
1989-1990	1987	1.8	0.7	61	2.57
1990-1991	1988	2.2	1.9	14	0.15
1991-1992	1989	4.2	0.8	81	1.66
1992-1993	1990	14.0	3.0	78	1.54
1993-1994	1991	18.9	5.0	74	1.33
1994-1995	1992	9.3	1.6	83	1.76
1995-1996	1993	6.5	3.3	51	0.68
1996-1997	1994	10.1	3.1	69	1.18
1997-1998	1995	7.8	4.0	49	0.67
1998-1999	1996	7.6	8.8	-	-
1999-2000	1997	22.8	14.6	36	0.44
2000-2001	1998	20.0	12.5	38	0.47
2001-2002	1999	15.7	6.4	59	0.90
2002-2003	2000	34.8	2.0	94	2.86
2003-2004	2001	2.1	2.6	-	-
2004-2005	2002	22.8	3.7	84	1.83
2005-2006	2003	51.7	12.1	77	1.50
2006-2007	2004	45.1	3.2	93	2.64
2007-2008	2005	25.8	5.9	77	1.50
2008-2009	2006	18.1	8.3	54	0.78
2009-2010	2007	22.2	13.0	41	0.52
2010-2011	2008	18.3	4.7	74	1.33

Table 2.3.7. Norwegian spring spawning herring. Acoustic estimate in the Barents Sea in August-October 2011.

	Age / Year class									Mean
	1	2	3	4	5	6	7+	Sum	Biomass	weight
Length (cm)	**2010**	**2009**	**2008**	**2007**	**2006**	**2005**	**2004-**	**(10^6)**	**(10^3 t)**	**(g)**
14.0 - 14.4	22							22	0.5	20.8
14.5 - 14.9	7							7	0.2	24.0
15.0 - 15.4	19							19	0.5	25.4
15.5 - 15.9	0							0	0.0	
16.0 - 16.4	6							6	0.2	34.0
16.5 - 16.9	22							22	0.8	36.0
17.0 - 17.4	8	12						20	0.7	37.9
17.5 - 17.9	11	45						56	2.4	43.4
18.0 - 18.4		15						15	0.7	47.5
18.5 - 18.9		75						75	3.8	49.9
19.0 - 19.4		159						159	8.6	53.8
19.5 - 19.9		90						90	5.2	58.2
20.0 - 20.4		153						153	9.3	60.7
20.5 - 20.9		212						212	15.0	70.8
21.0 - 21.4		270						270	20.5	75.8
21.5 - 21.9		173						173	13.7	79.3
22.0 - 22.4		198						198	16.4	83.2
22.5 - 22.9		48						48	4.3	89.6
23.0 - 23.4		23						23	2.2	96.3
23.5 - 23.9		8						8	0.9	113.0
24.0 - 24.4		8						8	0.9	113.0
24.5 - 24.9								0	0.0	
25.0 - 25.4								0	0.0	
25.5 - 25.9			6					6	0.8	126.0
26.0 - 26.4								0	0.0	
26.5 - 26.9		15						15	1.6	108.2
TSN (10^6)	95	1504	6					1605		
TSB(10^3 t)	2.9	105.5	0.8						109.2	
Mean length (cm)	15.8	20.8	25.8					20.6		
Mean weight (g)	30.4	70.2	126							68.0

TS=20.0* log(L) - 71.9

Table 2.3.8. Norwegian spring spawning herring. Acoustic estimates by age in autumn 1999-2011. TSN and TSB are total stock numbers (10^6) and total stock biomass (10^3 t)

Age	**1**		**2**		**3**		**4+**		**Sum**	
Year	TSN	TSB	TSN	TSB	TSN	TSB	TSN	TSB	TSN	TSB
1999	48758.6	715.9	985.9	31.0	50.7	2.0			49795.2	748.9
2000	14731.0	382.6	11499.0	560.3					26230.0	942.9
2001	524.5	12.0	10544.1	604.3	1714.4	160.0			12783.0	776.3
2002	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
2003	99785.7	3090.3	4335.7	220.1	2475.6	325.5			106596.9	3636.4
2004	14265.0	406.4	36495.0	2725.3	901.0	106.6			51717.0*	3251.9*
2005	46380.0	983.7	16167.0	1054.5	6973.0	795.2			69520.0	2833.4
2006	1618.0	34.2	5535.0	398.4	1620.0	210.5			8773.0	643.0
2007	3941.0	147.5	2595.0	217.5	6378.0	810.1	250.0*	45.7*	13164.0	1220.9
2008	29.6	0.6	1626.4	76.9	3987.0**	287.3**	3222.6**	373.1**	8865.6	737.9
2009	1.538	48.4	433.0	51.8	1807	287.3	1686.0	393.0	5577.0	814.8
2010	1047.0	34.5	215.0	33.7	234.0	37.0	428.0*	104.2*	2025.0	207.3
2011	95.0	2.9	1504.0	105.5	6.0	25.8	0	0	1605.0	109.2
Average 1999-2011	17782.8	450.7	7071.9	467.6	2014.5	250.9	704.7	165.7	25411.2	1055.9

* - including older age groups not shown in the table

** - including Kanin herring

Table 2.3.9. Blue whiting. Acoustic estimate in the Barents Sea in August-October 2011.

	Age/Yearclass										Biomass	Mean weigt(g)
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Sum**		
Length (cm)	2010	2009	2008	2007	2006	2005	2004	2003	2002	**(10^6)**	**(10^3 t)**	
21.0 - 21.5	7									7	0.4	53.0
21.5 - 22.0										0	0.0	
22.0 - 22.5										0	0.0	51.0
22.5 - 23.0	14									14	0.9	66.0
23.0 - 23.5	3									3	0.2	60.0
23.5 - 24.0										0	0.0	
24.0 - 24.5										0	0.0	81.0
24.5 - 25.0	6	1								7	0.6	78.0
25.0 - 25.5										0	0.0	
25.5 - 26.0										0	0.0	
26.0 - 26.5		4								4	0.4	98.1
26.5 - 27.0		3								3	0.3	100.0
27.0 - 27.5		1								1	0.1	115.8
27.5 - 28.0		5	2							7	0.9	126.0
28.0 - 28.5		2	1							3	0.3	121.0
28.5 - 29.0										1	0.1	103.0
29.0 - 29.5						6				6	1.0	177.1
29.5 - 30.0			5			5				9	1.4	153.9
30.0 - 30.5			12							12	2.0	166.2
30.5 - 31.0			8	11	8					28	5.1	181.2
31.0 - 31.5							30			30	5.7	188.0
31.5 - 32.0							35	2		37	7.2	192.2
32.0 - 32.5				8	42				1	52	10.4	201.4
32.5 - 33.0			51			3	2			56	12.0	212.1
33.0 - 33.5									44	45	10.1	225.9
33.5 - 34.0						24			23	48	11.4	239.2
34.0 - 34.5						26	40			66	16.4	248.0
34.5 - 35.0						43				43	10.9	251.6
35.0 - 35.5					22	7			1	30	7.8	264.1
35.5 - 36.0						10		17		27	7.7	281.4
36.0 - 36.5						15				15	4.6	299.7
36.5 - 37.0								18		18	5.2	289.2
37.0 - 37.5							3	1	3	7	2.2	322.5
37.5 - 38.0								2	2	4	1.5	374.6
38.0 - 38.5							8			8	2.7	343.0
38.5 - 39.0										0	0.1	325.2
39.0 - 39.5										0	0.0	
39.5 - 40.0										0	0.1	376.0
40.0 - 40.5										0	0.1	393.5
TSN(10^6)	31	15	80	20	73	139	119	40	75	592		
TSB(10^3 t)	2	1.7	15.6	3.7	15.8	34.8	26.5	11.5	18.1		129.7	
Mean length	22.9	27.1	31.8	31.4	33.0	34.3	33.0	36.1	33.8	32.7		
Mean weight	65.0	110.0	194.5	189.8	218.3	249.8	223.4	284.2	239.4			218.9

TS=21.8* lg(L) - 72.7

Table 2.3.10. Blue whiting. Acoustic estimates by age in autumn 2004-2011. TSN and TSB are total stock numbers (10^6) and total stock biomass (10^3).

Age	**1**		**2**		**3**		**4+**		**Sum**	
Year	TSN	TSB	TSN	TSB	TSN	TSB	TSN	TSB	TSN	TSB
2004	5787	219.1	3801	285.5	2878	264.8	4780	606.5	17268	1376.8
2005	4871	132.0	2770	180.0	4205	363.0	3213	409.8	15058	1084.1
2006	371	21.2	2227	158.8	2665	238.1	2491	330.6	7754	748.8
2007	3	0.1	245	23.2	2934	292.2	2221	315.1	5666	657.6
2008	3	0.1	2	0.1	11	1.1	604	95.4	620	96.9
2009	2	0.1	2	0.2	2	0.2	1513	260.8	1519	261.4
2010	0	0.0	0	0.0	13	2.8	884	179.3	897	182.6
2011	31	2.0	15	1.7	80	15.6	466	110.4	592	129.7
Average 2004-2011	1384	46.4	1133	81.2	1599	147.2	2022	288.5	6172	567.2

Table 2.4.1. Preliminary total indices in 2011 based on swept area estimates.

Species	**Abundance, 10^6 specimens**	**Biomass, 10^3 t**
Cod	1837	2165
Haddock	1139	878
Saithe	9	10
Greenland halibut	175	88
Golden redfish	14	5
Deep-water redfish	1271	105
Norway redfish	83	9
Long rough dab	2507	322
Atlantic wolffish	20	13
Spotted wolffish	9	47
Northern wolffish	6	42
Plaice	36	26
Norway pout	5976	68

Table 2.4.2. Abundance indices for cod, based on swept area estimates (10^6 spec.)

year/age groups	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13+**	**1-13+**
2004	543	331	330	148	422	150	80	40	10	2	1	0	0	0	1513
2005	182	459	143	242	96	160	36	16	6	1	1	0	0	0	1159
2006	276	479	510	186	206	60	70	18	8	3	1	0	0	0	1539
2007	101	333	505	586	159	79	25	27	6	2	1	0	0	0	1724
2008	494	131	373	654	486	133	52	13	18	3	1	0	0	0	1864
2009	903	570	94	202	281	290	102	32	13	7	3	1	0	0	1593
2010	653	310	84	57	177	397	425	143	39	11	7	2	0	0	1651
2011	308	403	158	120	86	245	284	185	35	6	2	1	0.7	0.4	1528

Table 2.4.3. Abundance indices for haddock, based on swept area estimates (10^6 spec.).

year/age roups	0	1	2	3	4	5	6	7	8	9	10+	1-10+
2004	104	189	268	123	70	69	31	3	2	-	+	859
2005	155	626	114	323	89	29	31	15	+	+	+	1382
2006	283	2270	929	107	125	42	19	17	7	1	+	3800
2007	114	988	1819	1283	88	94	19	6	7	2	1	4421
2008	60	322	1292	1155	406	43	36	5	3	2	+	3324
2009	169	136	144	651	618	306	21	7	1	1	-	2054
2010	154	274	65	184	865	666	148	16	3	-	+	2375
2011	213	105	113	40	73	388	297	37	3 0.3	0.1	0.4	1057

Table 2.7.1. Number of marine mammals observed from the research vessels J. Hjort, Helmer Hansen, Christina E, and Vilynys during the ecosystem survey August-October 2011.

Order /suborder	Name of species (english)	Johan Hjort	Helmer Hansen*	Christina E	Vilnyus	Total	%
Cetacea/ Baleen whales	Blue whale	-	8	-	-	8	0.34
	Fin whale	83	56	9	8	156	6.67
	Humpback whale	190	12	1	6	209	8.94
	Minke whale	129	20	18	46	213	9.11
	Unidentified whale	-	13	4	1	18	0.77
Cetacea/ Toothed whales	Sperm whale	17	-	1	-	18	0.77
	Killer whale	40	-	25	5	70	2.99
	Harbour porpoise	-	-	2	63	65	2.78
	White-beaked dolphin	978	-	288	271	1537	65.74
	Dolphin spp.	-	-	4	-	4	0.17
	White whale	-	-	-	-	-	
Pinnipedia	Harp seal	-	17	-	16	33	1.41
	Ringed seal	-	1	-	-	1	0.04
	Bearded seal	-	2	-	-	2	0.09
	Walrus	-	-	-	-	-	-
	Hooded seal	-	-	-	-	-	-
Other	Polar bear	-	-	-	1	1	0.04
	Basking shark	**-**	**-**	3	**-**	**3**	0.13
Total sum		**1437**	**129**	**355**	**417**	**2338**	

*No dedicated marine mammal observers participated on Helmer Hansen, but the seabird observer and a master student recorded marine mammals when observed.

Table 2.7.2. Number of seabirds observed by species during the Joint Norwegain/Russian Ecosystem Survey 2011.

	Christina E.	Helmer Hansen	Johan Hjort	Vilnyus
Alca torda	8	0	7	10
Alle alle	0	249	217	286
Calidris maritima				9
Cephus grylle	1	92	0	
Clangula hyemalis	0	1	13	
Fratercula arctica	309	137	188	57
Fulmarus glacialis	5649	19880	21298	1295
Gavia arctica				10
Gavia sp.				1
Gavia stellata				2
Larus argentatus	493	0	442	204
Larus fuscus				9
Larus heuglini				9
Larus hyperboreus	27	127	249	95
Larus marinus	653	0	944	26
Melanitta fusca				2
Melanitta nigra				1
Pagophila eburnea				12
Plectrophenax nivalis				2
Puffinus griseus	12	0	14	32
Rissa tritactyla	2991	1208	4859	1076
Somateria mollissima	0	0	2	12
Somateria spectabilis				611
Stercorarius longicaudus	0	0	1	3
Stercorarius parasiticus	56	4	11	17
Stercorarius pomarinus	31	2	289	154
Stercorarius skua	1	4	4	3
Sterna paradisaea	1	63	14	50
Sula bassana				7
Uria aalge	159	0	29	417
Uria lomvia	1077	315	3380	1138
Uria spp	30	0	18	55

5 Figures

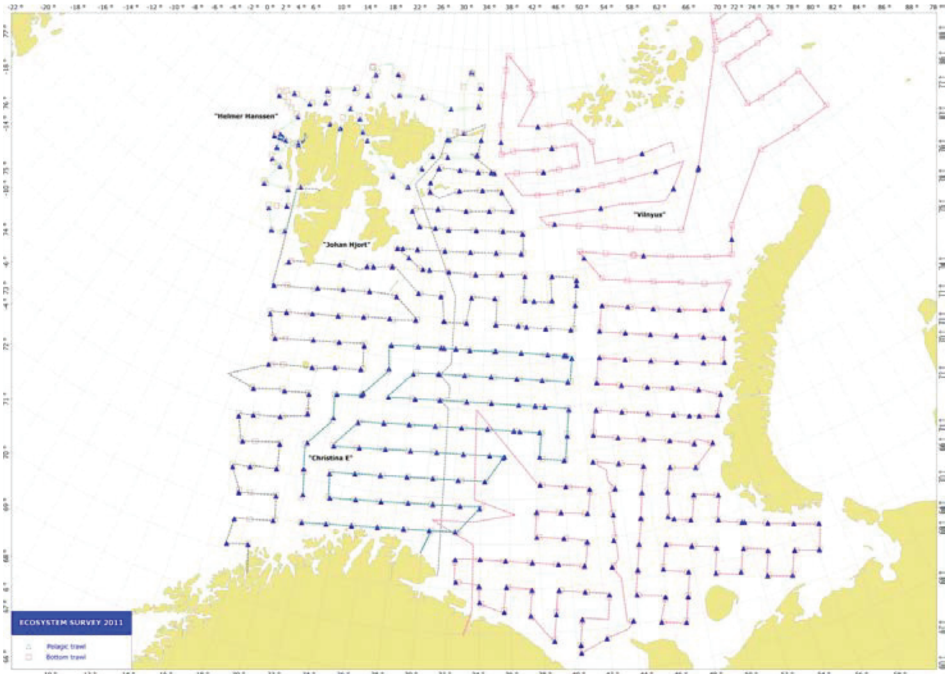


Figure 2.1.Trawl stations for "Christina E" "Johan Hjort", "Helmer Hanssen" and"Vilnyus", August **-** October 2011.

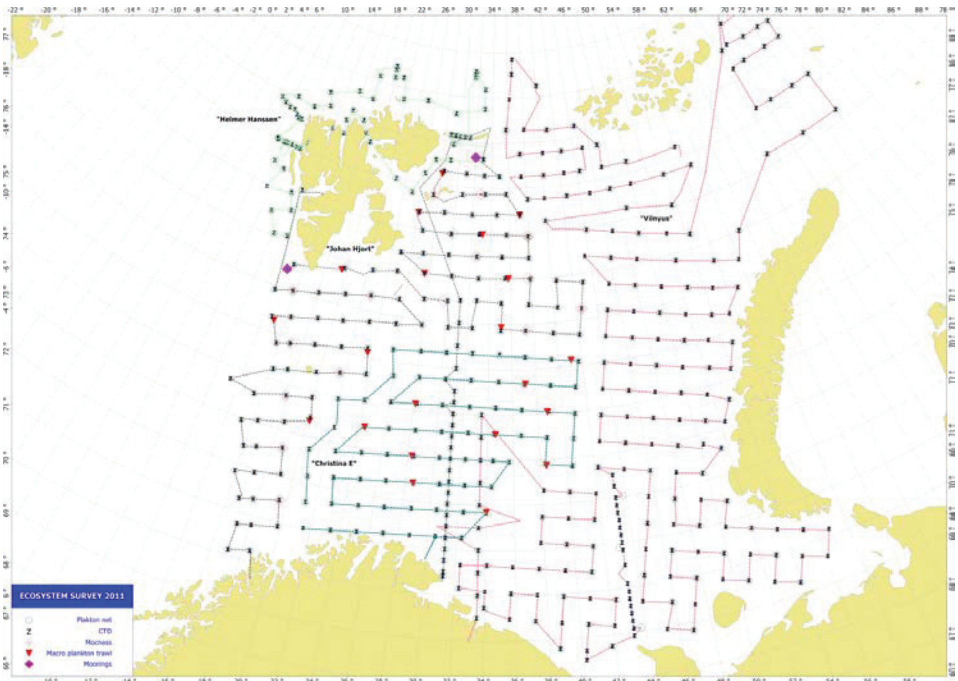


Figure 2.2. Hydrograhy and plankton stations for "Christina E" "Johan Hjort", "Helmer Hanssen" and "Vilnyus", August **-** October 2011.

Figure 2.3. Environmental stations for "Christina E", "Johan Hjort", "Helmer Hanssen" and "Vilnyus", August - October 2011.

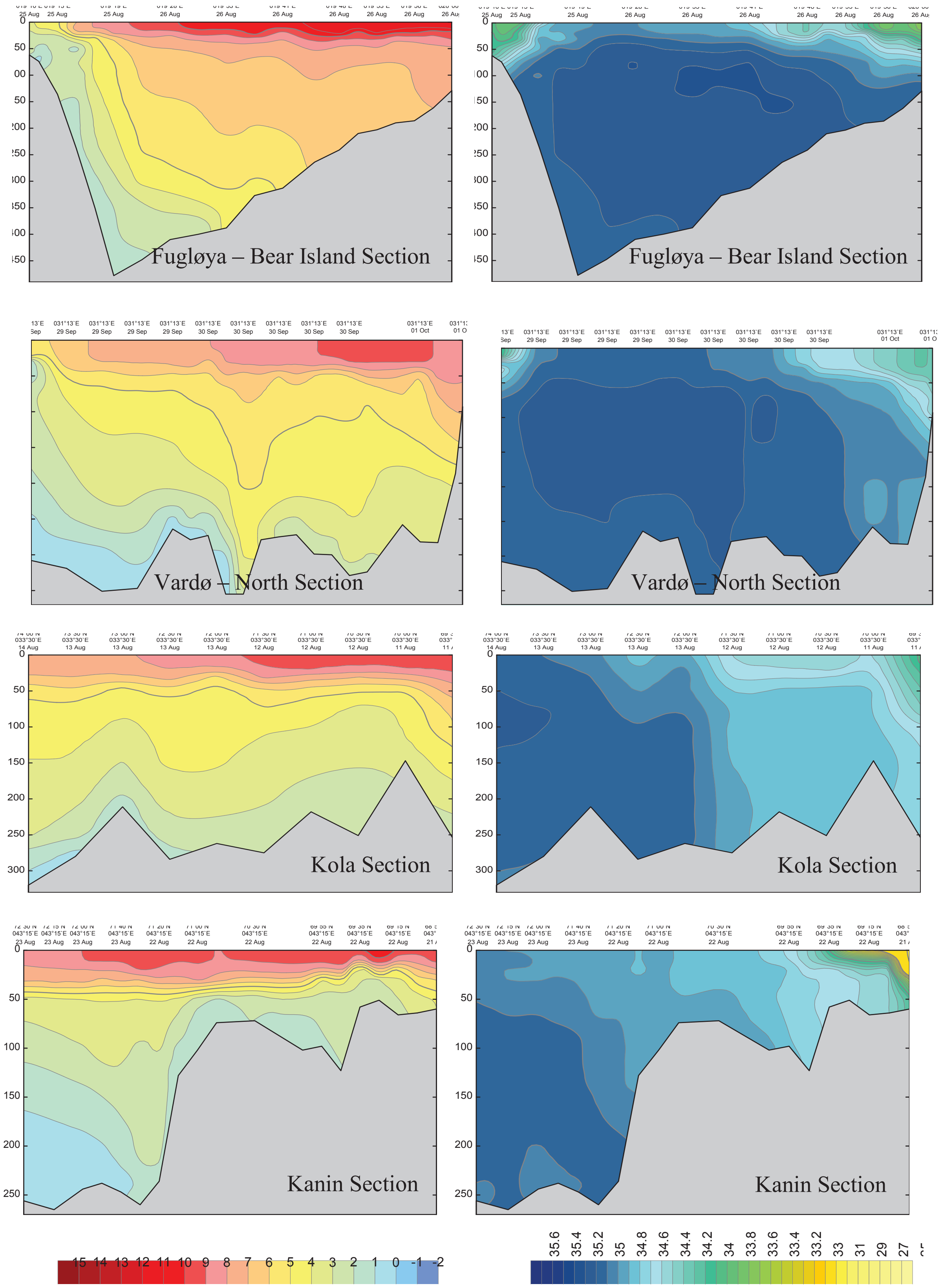


Figure 2.1.1. Temperature (°C, left panels) and salinity (right panels) along standard oceanographic sections in August–September 2011.

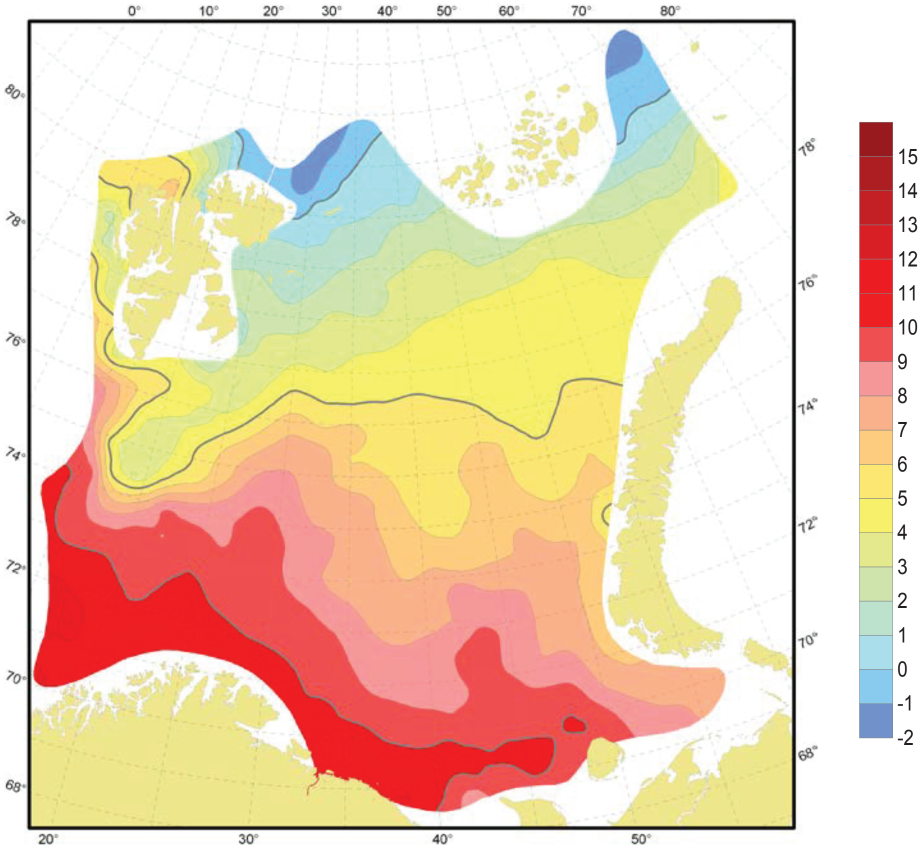


Figure 2.1.2. Distribution of surface temperature (°C), August–September 2011.

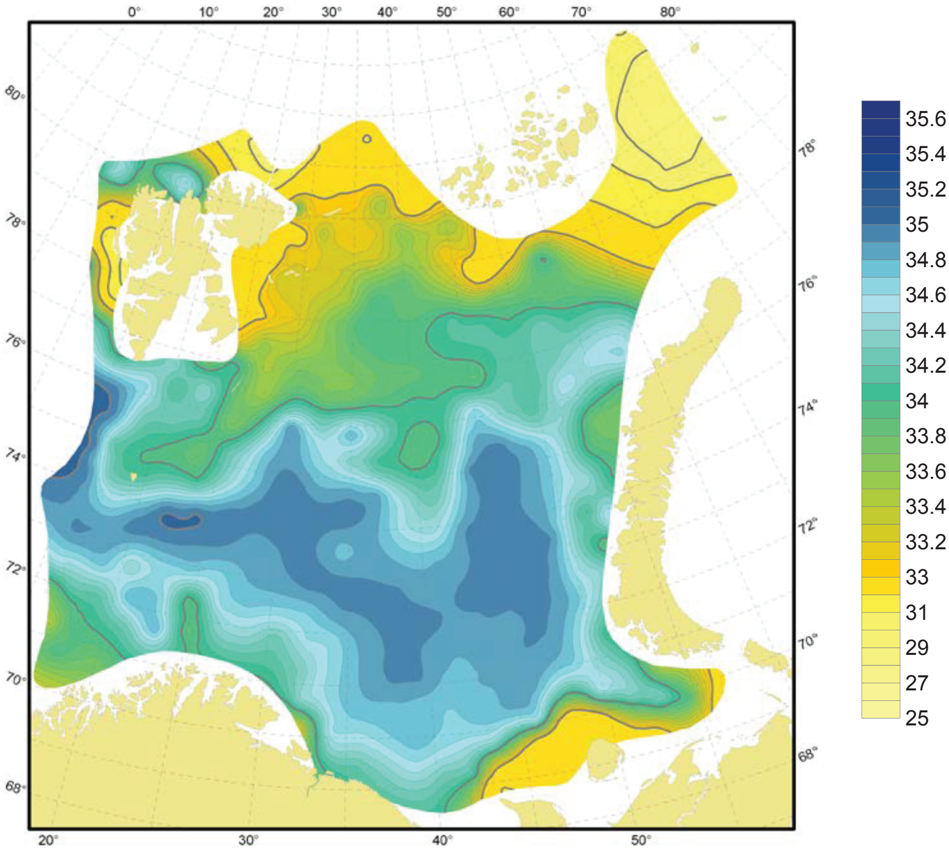


Figure 2.1.3. Distribution of surface salinity, August–September 2011.

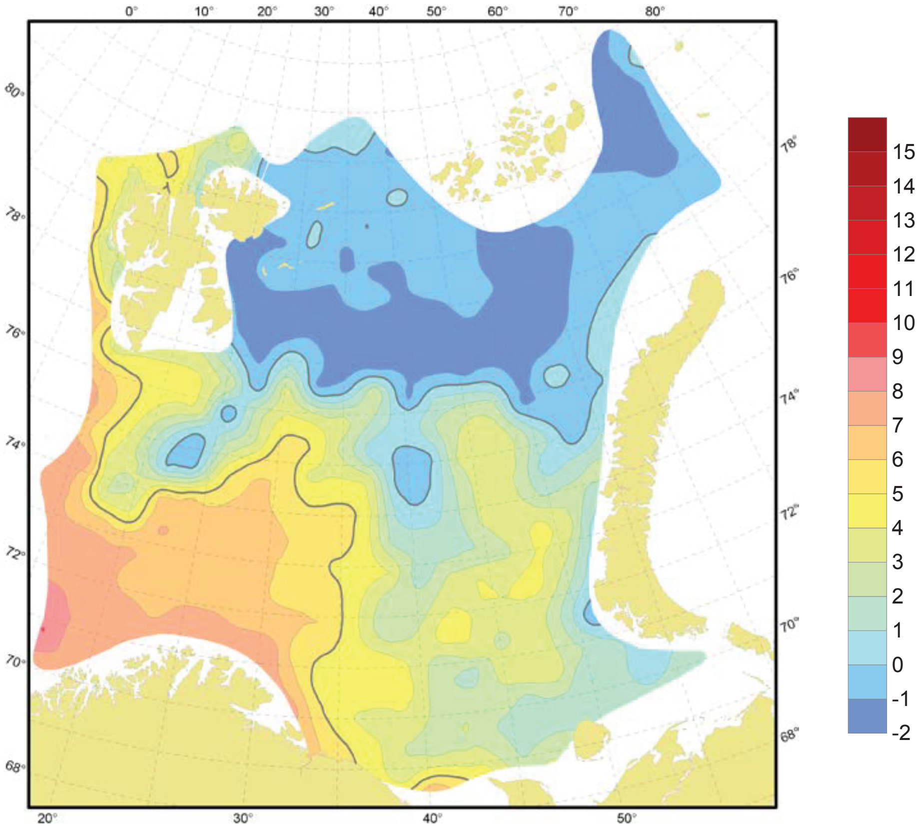


Figure 2.1.4. Distribution of temperature (°C) at the 50 m depth, August–September 2011.

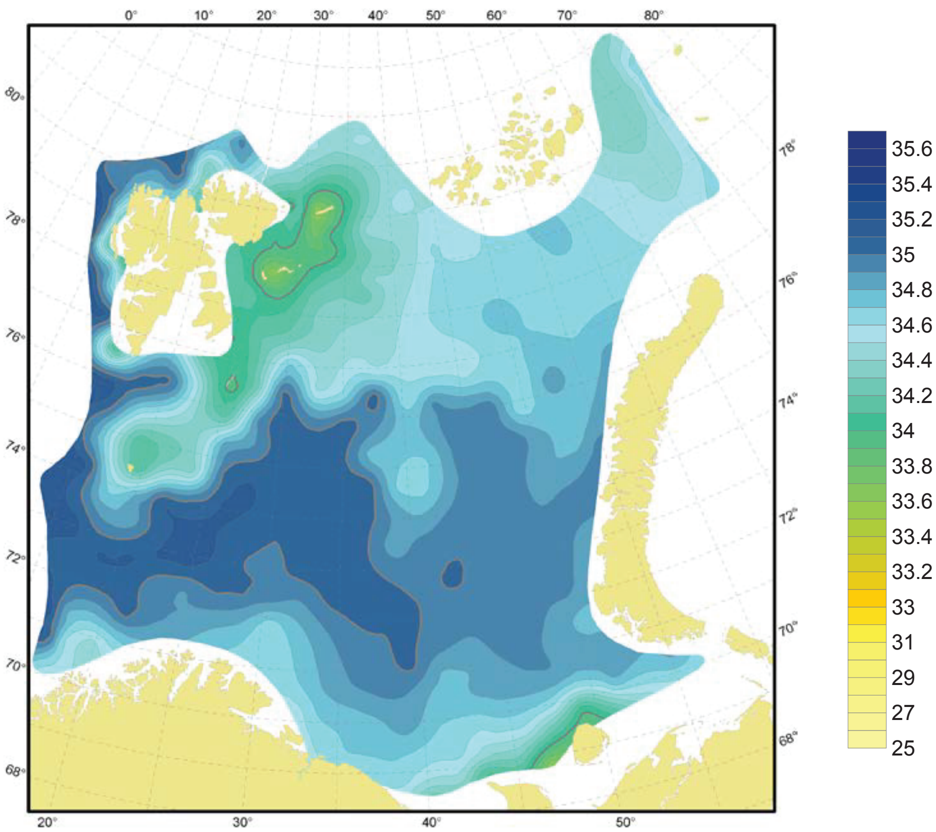


Figure 2.1.5. Distribution of salinity at the 50 m depth, August–September 2011.

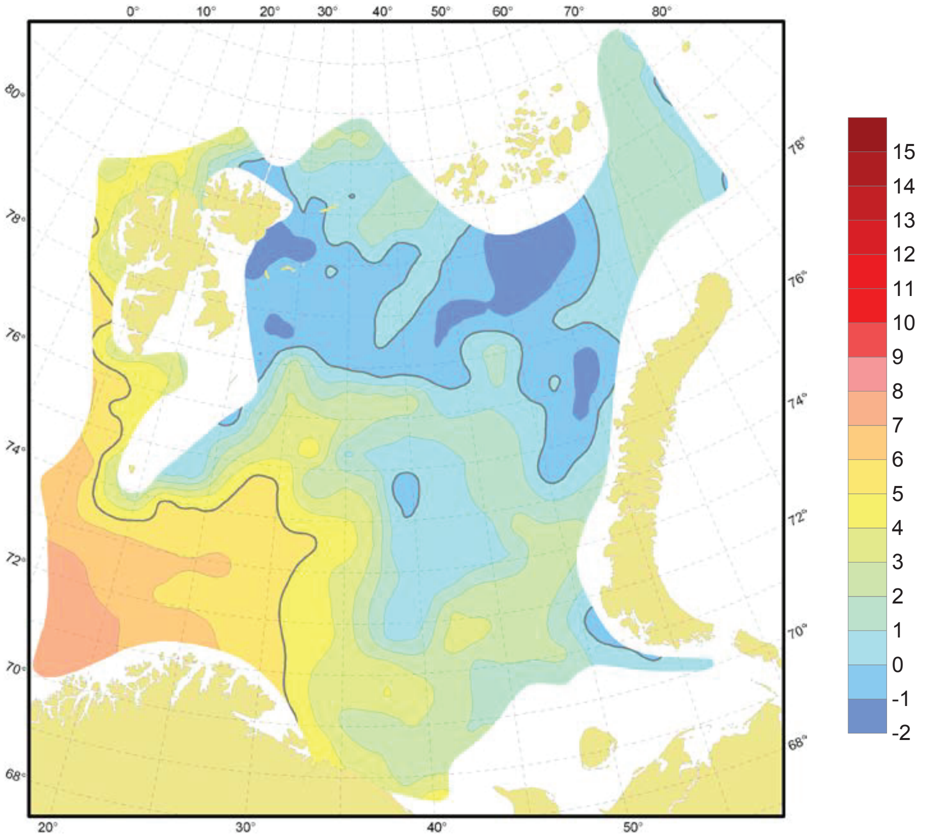


Figure 2.1.6. Distribution of temperature (°C) at the 100 m depth, August–September 2011.

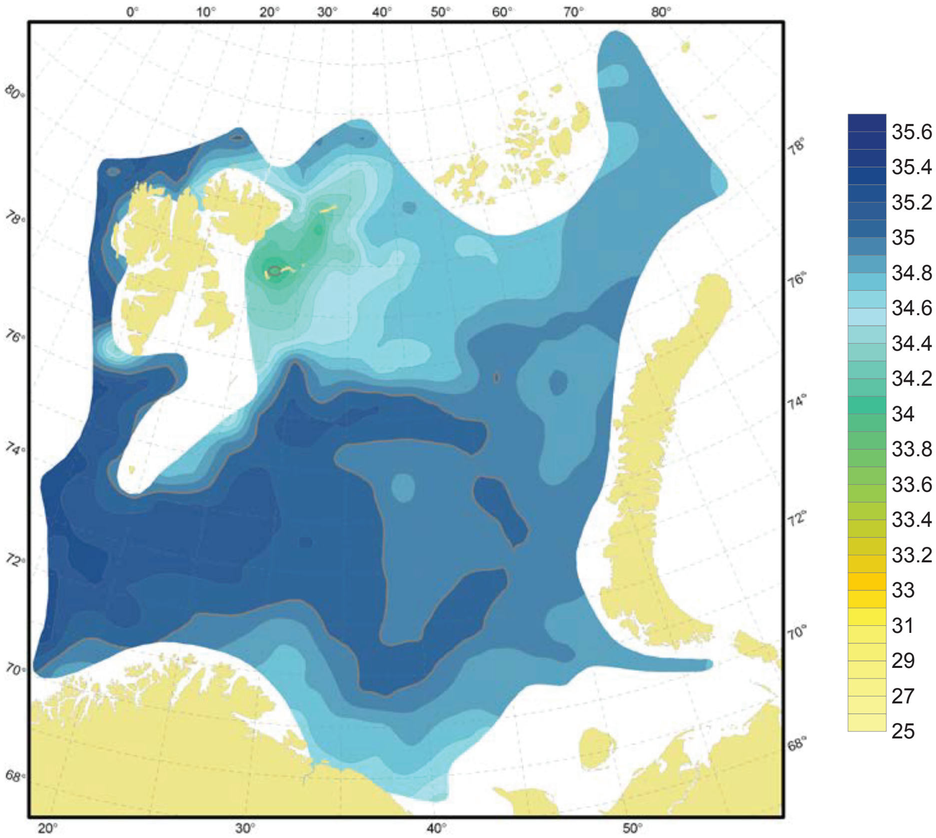


Figure 2.1.7. Distribution of salinity at the 100 m depth, August–September 2011.

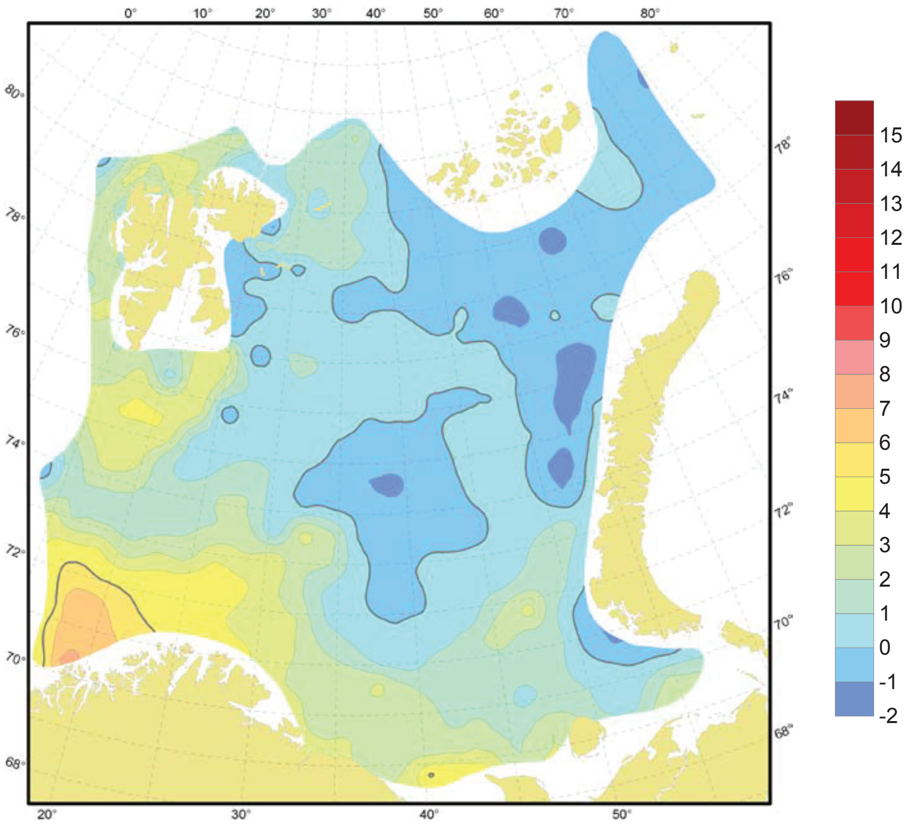


Figure 2.1.8. Distribution of temperature (°C) at the bottom, August–September 2011.

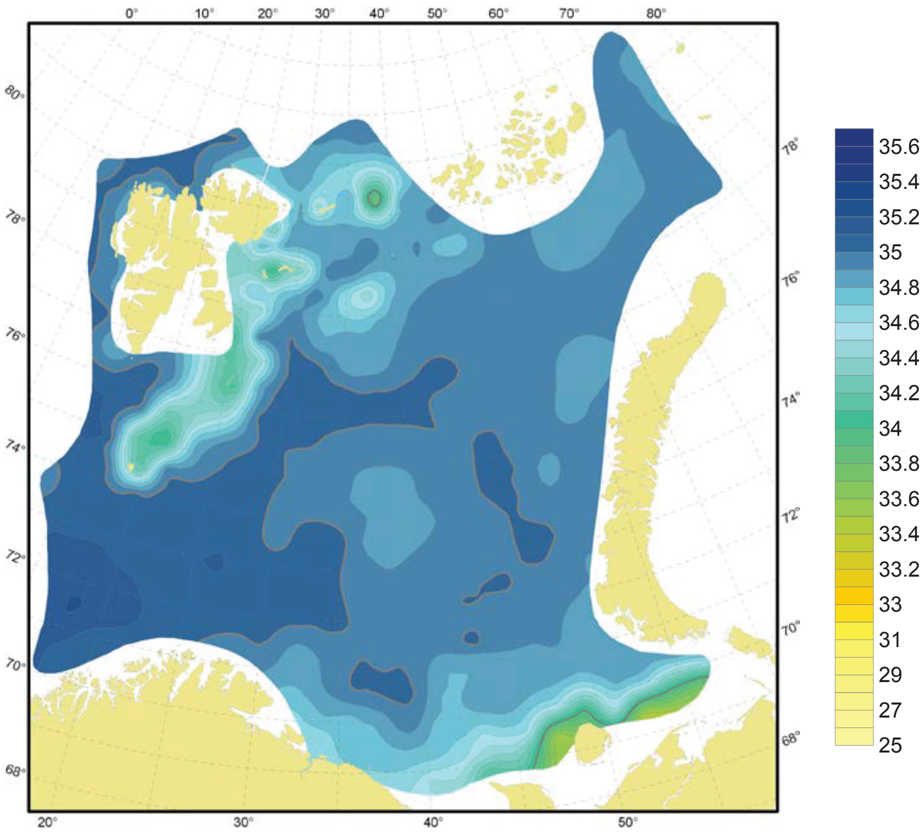


Figure 2.1.9. Distribution of salinity at the bottom, August–September 2011.

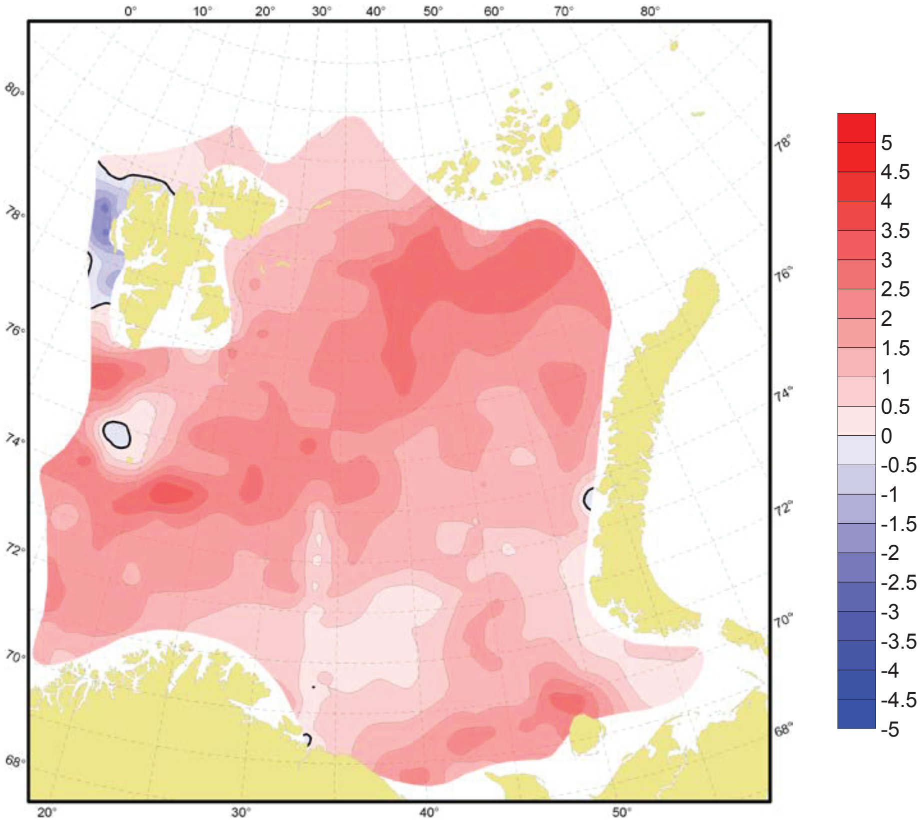


Figure 2.1.10. Surface temperature anomalies (°C), August–September 2011.

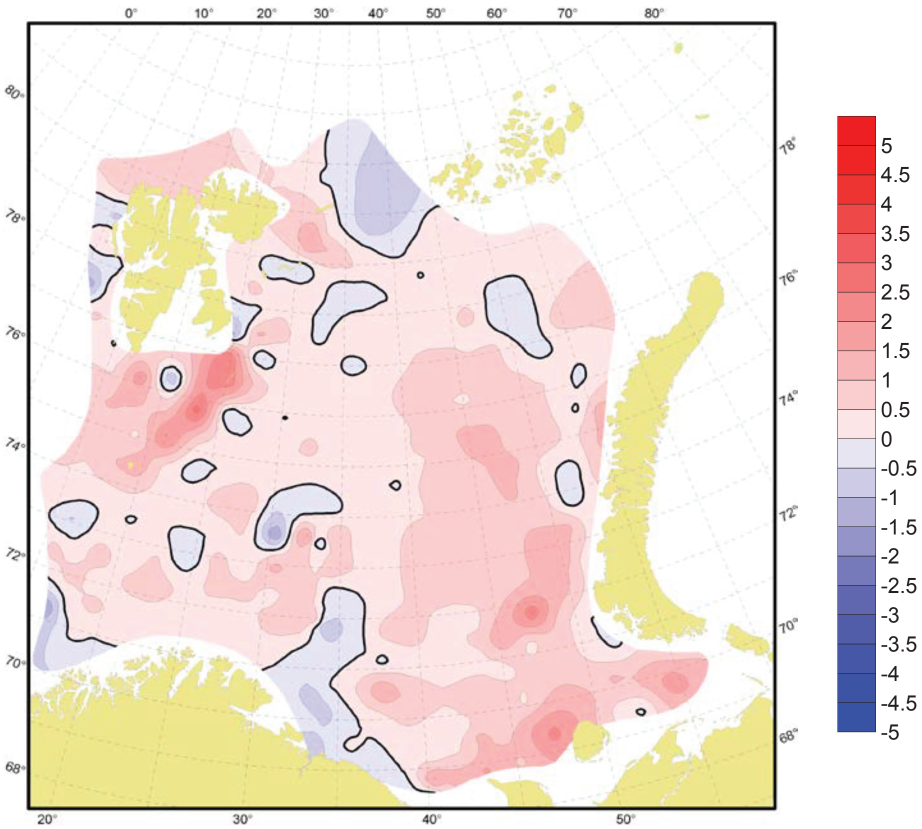


Figure 2.1.11. Temperature anomalies (°C) at the bottom, August–September 2011.

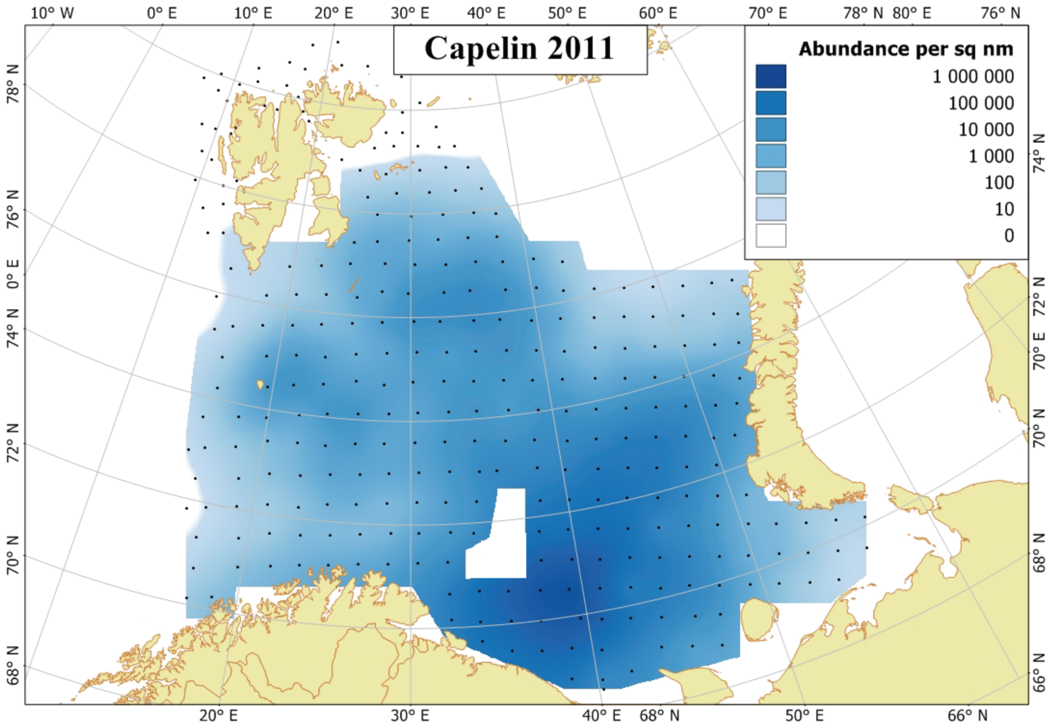


Figure 2.2.1. Distribution of 0-group capelin, August-October 2011.

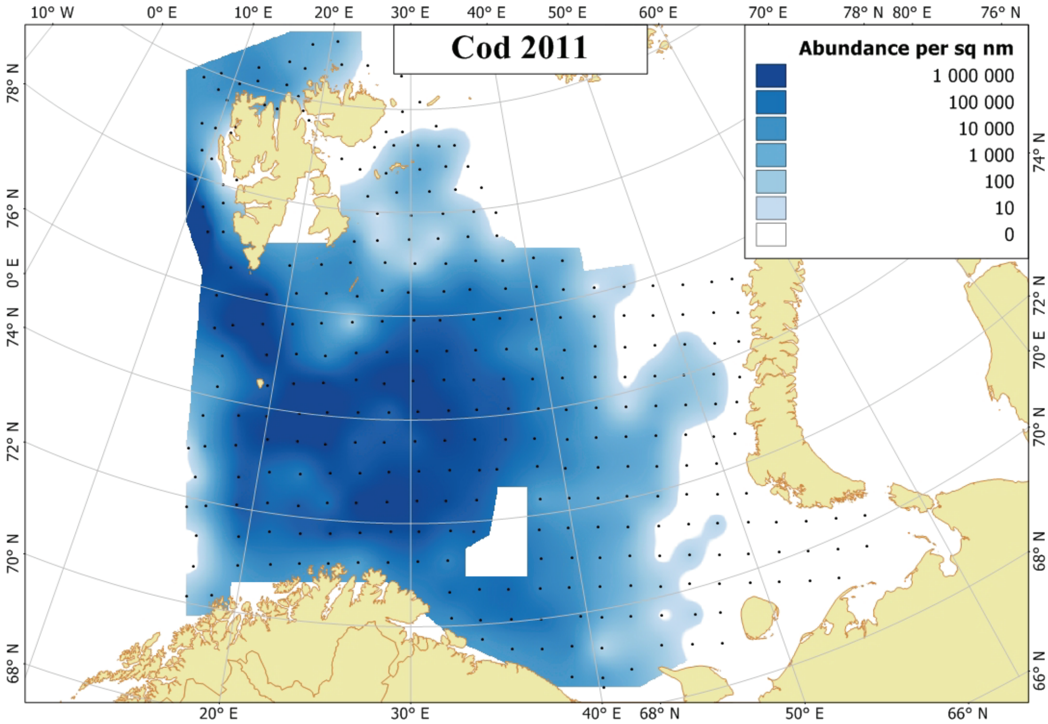


Figure 2.2.2. Distribution of 0-group cod, August-October 2011.

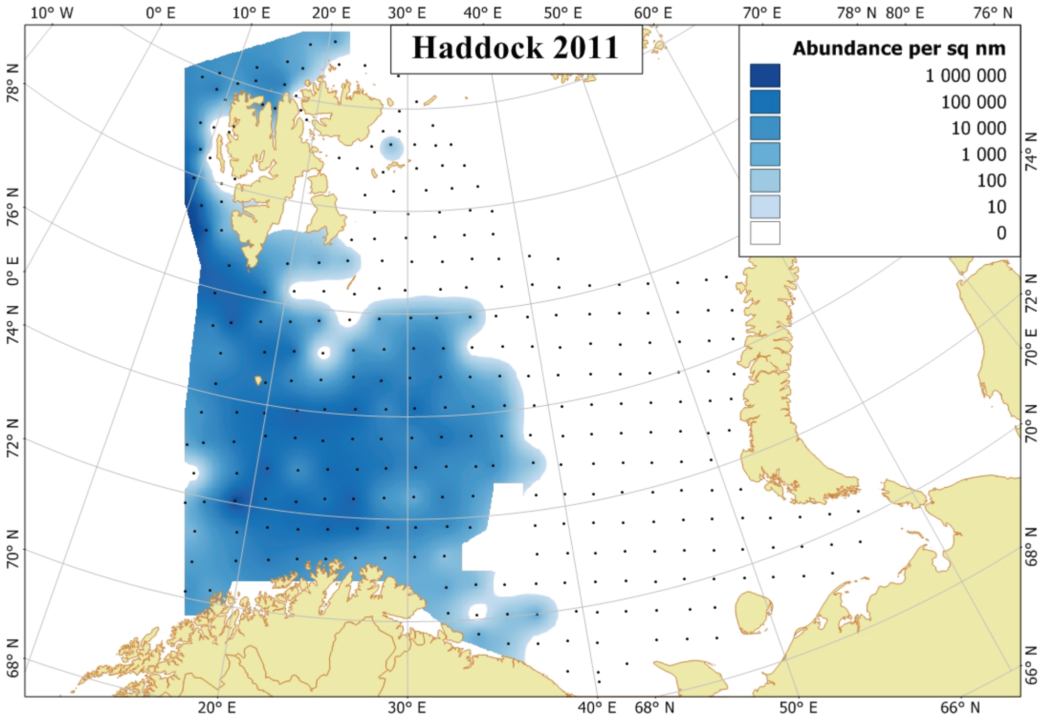


Figure 2.2.3. Distribution of 0-group haddock, August-October 2011.

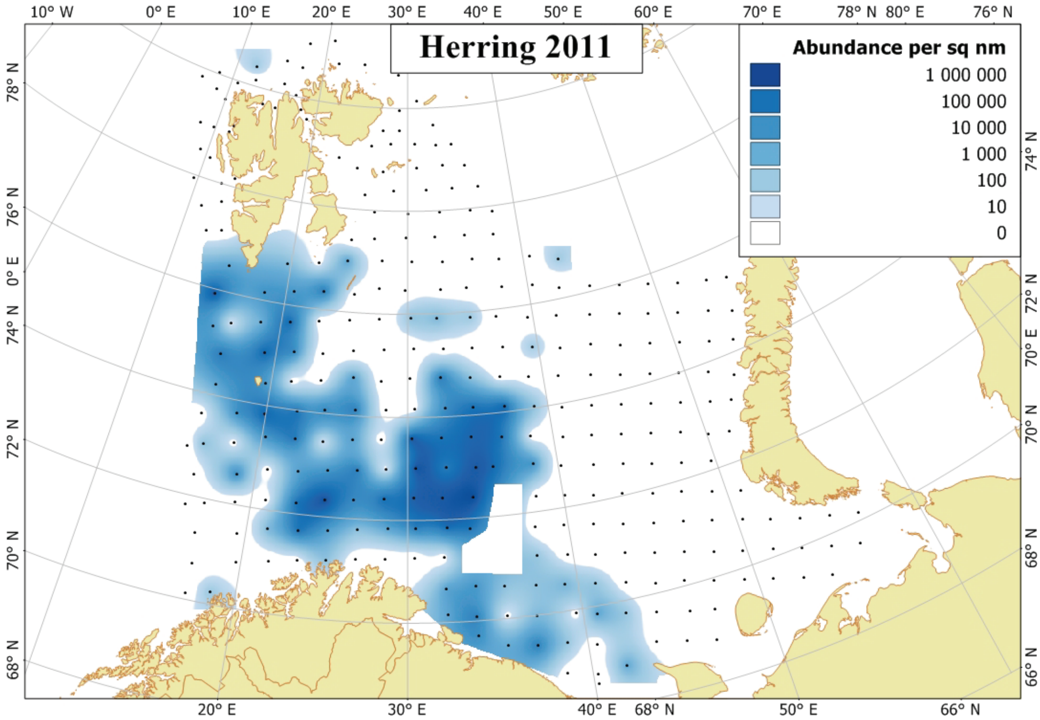


Figure 2.2.4. Distribution of 0-group herring, August-October 2011.

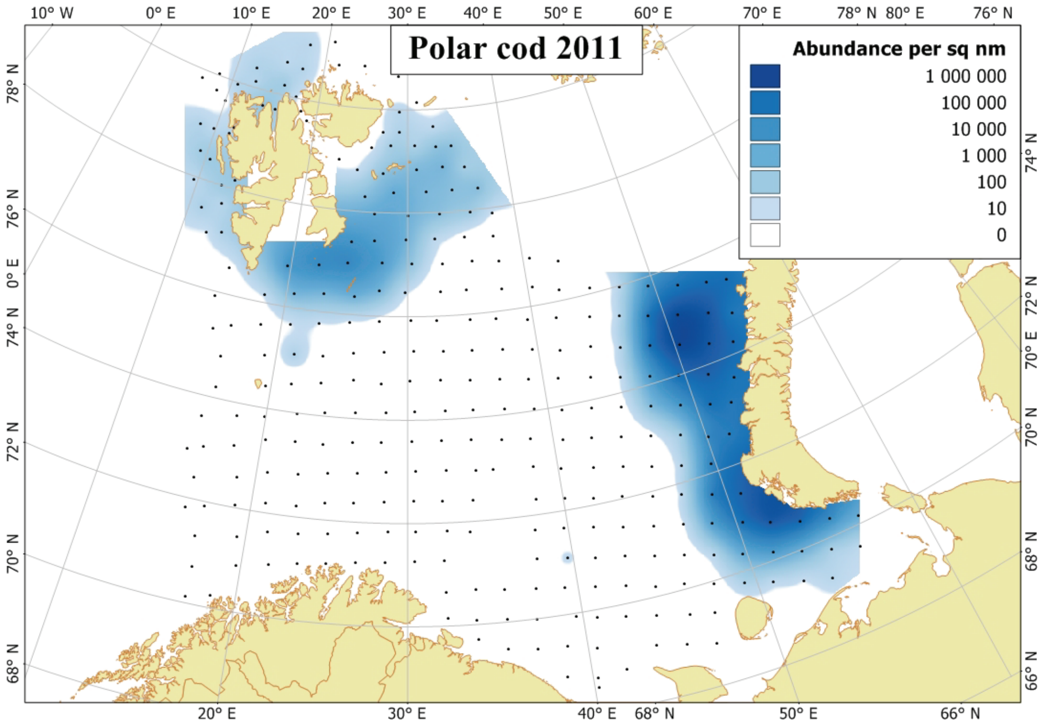


Figure 2.2.5. Distribution of 0-group polar cod, August-October 2011.

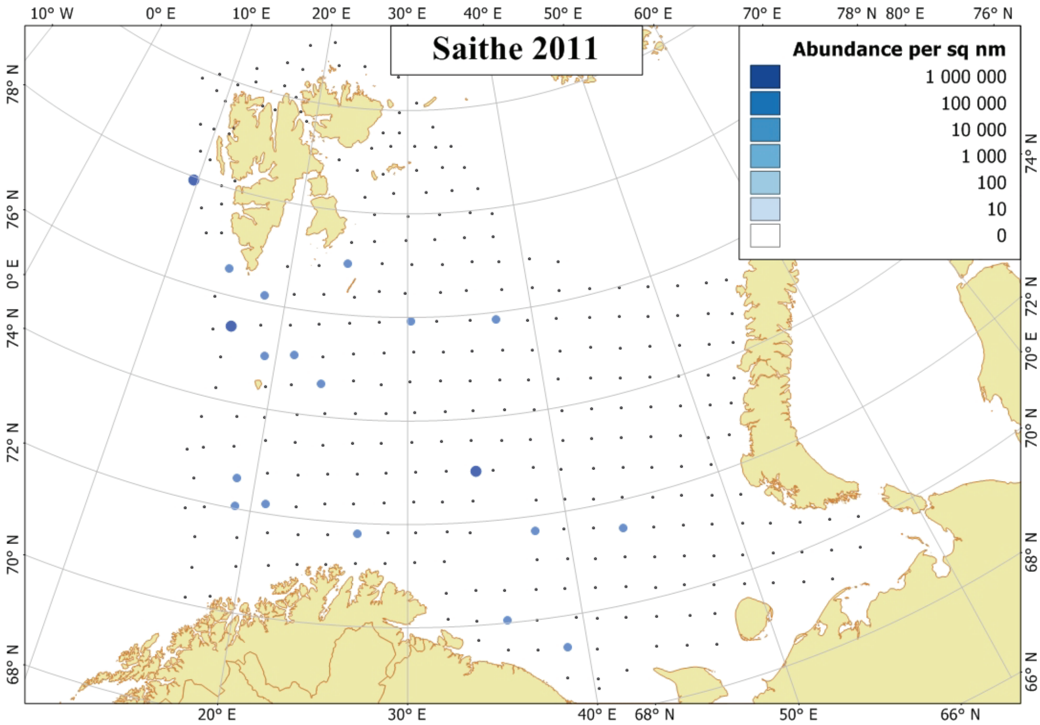


Figure 2.2.6. Distribution of 0-group saithe, August-October 2011.

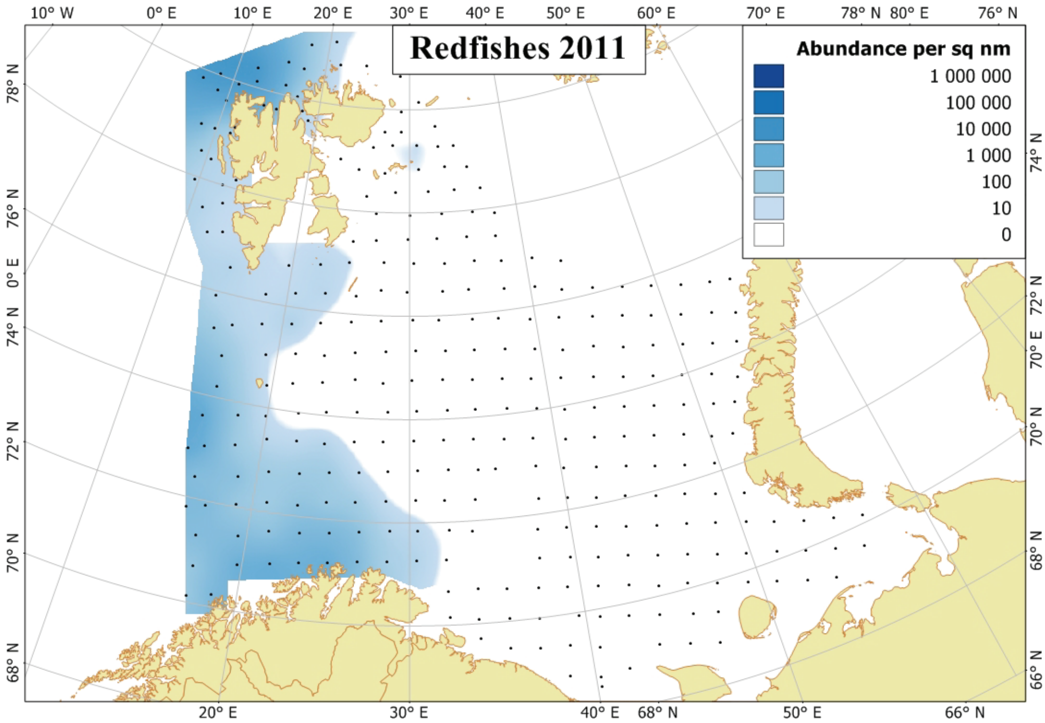


Figure 2.2.7. Distribution of 0-group redfish, August-October 2011.

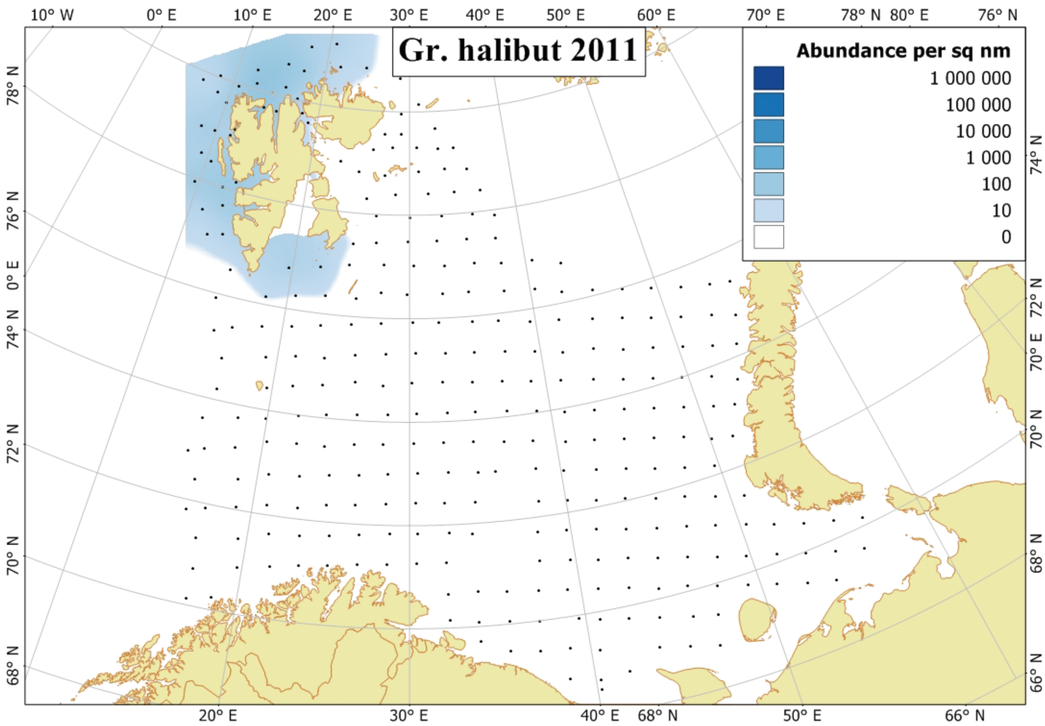


Figure 2.2.8. Distribution of 0-group Greenland halibut, August-October 2011.

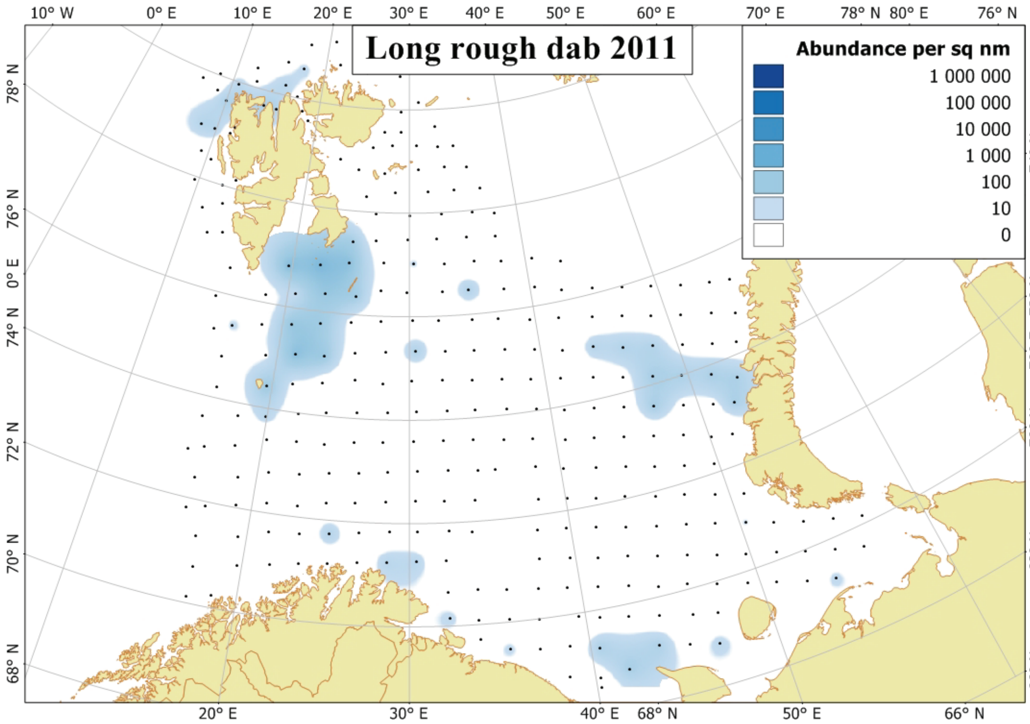


Figure 2.2.9. Distribution of 0-group long rough dab, August-October 2011.

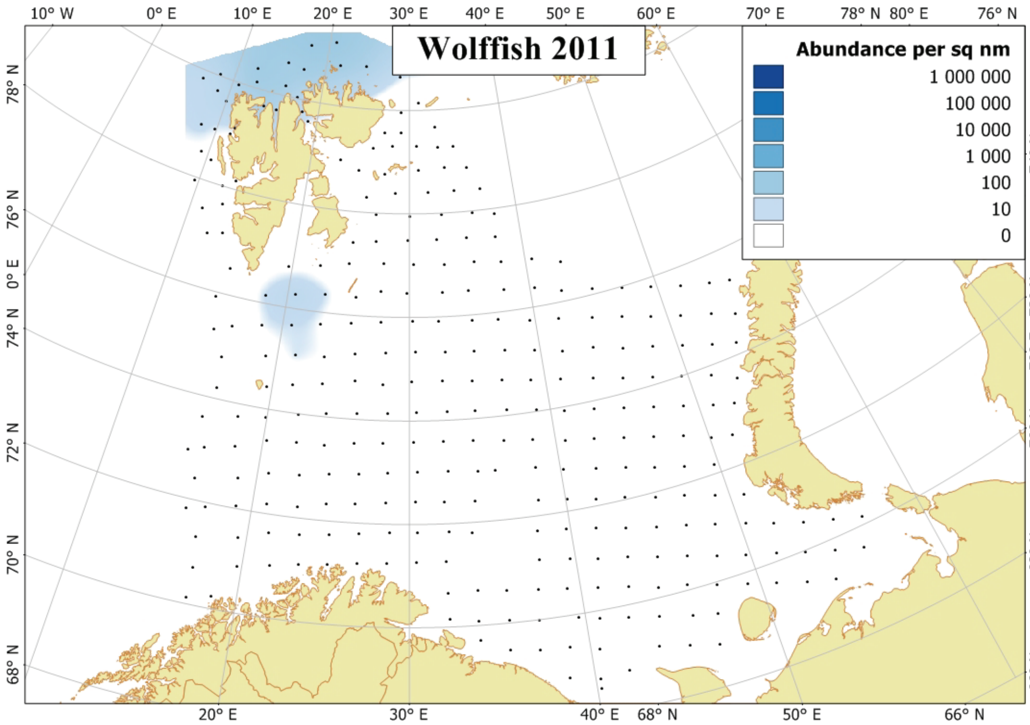


Figure 2.2.10. Distribution of 0-group wolffish, August-October 2011.

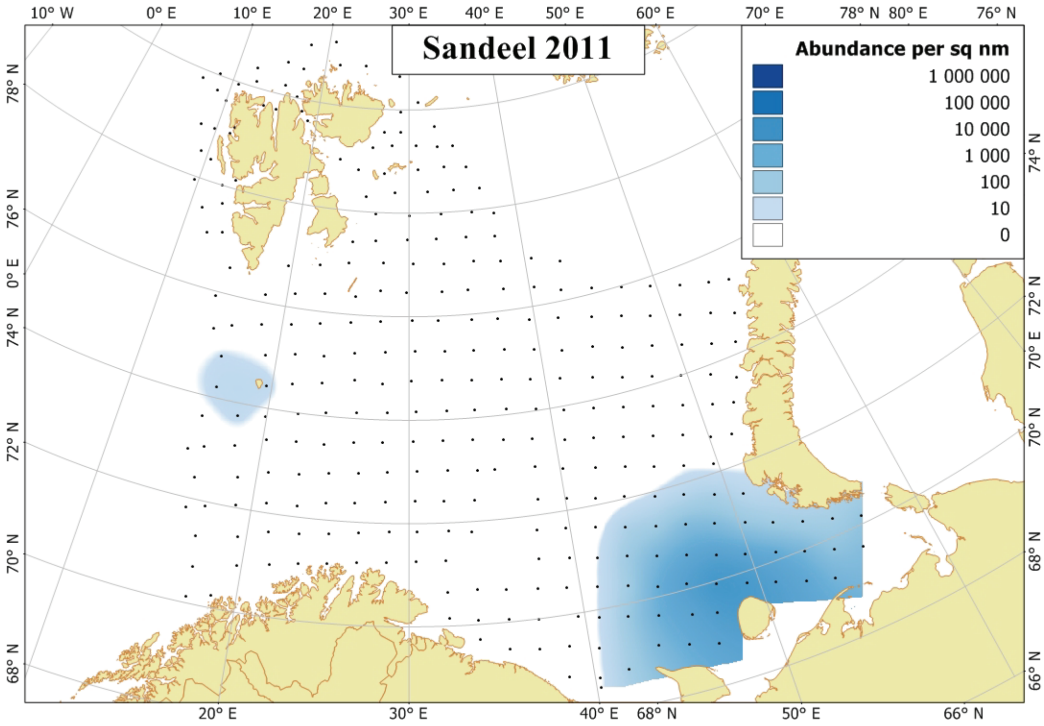


Figure 2.2.11. Distribution of 0-group sandeel, August-October 2011.

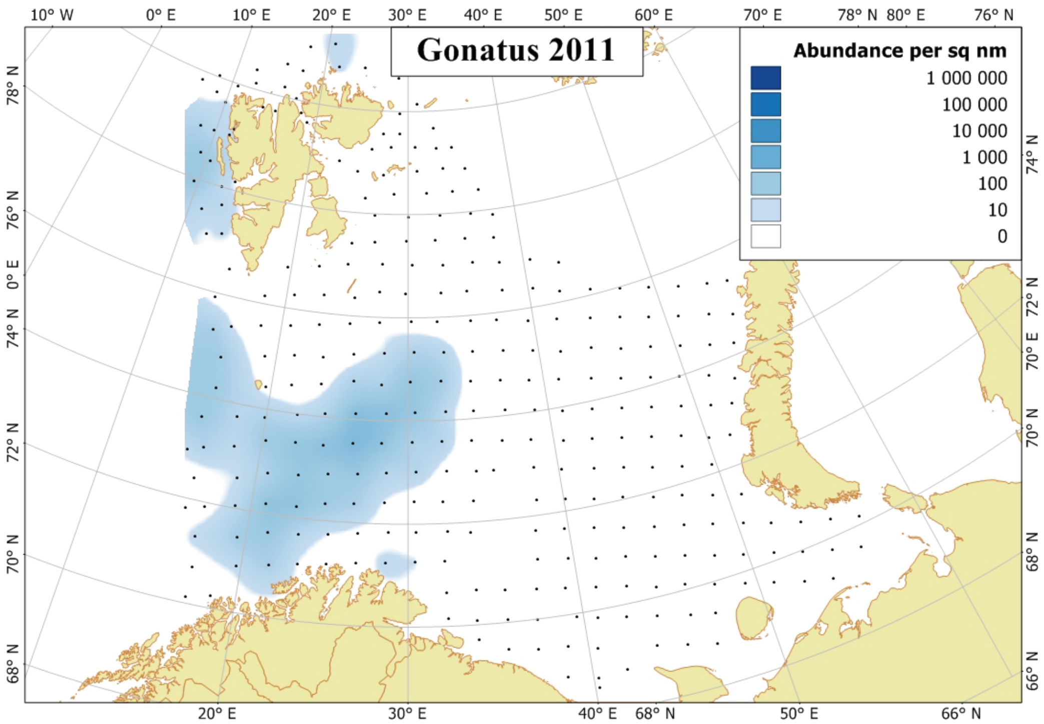


Figure 2.2.12. Distribution of 0-group gonatus (*Gonatus fabricii*), August-October 2011.

Figure 2.3.1. Estimated density distribution of one-year-old capelin (t/nautical mile^2), August-October 2011.

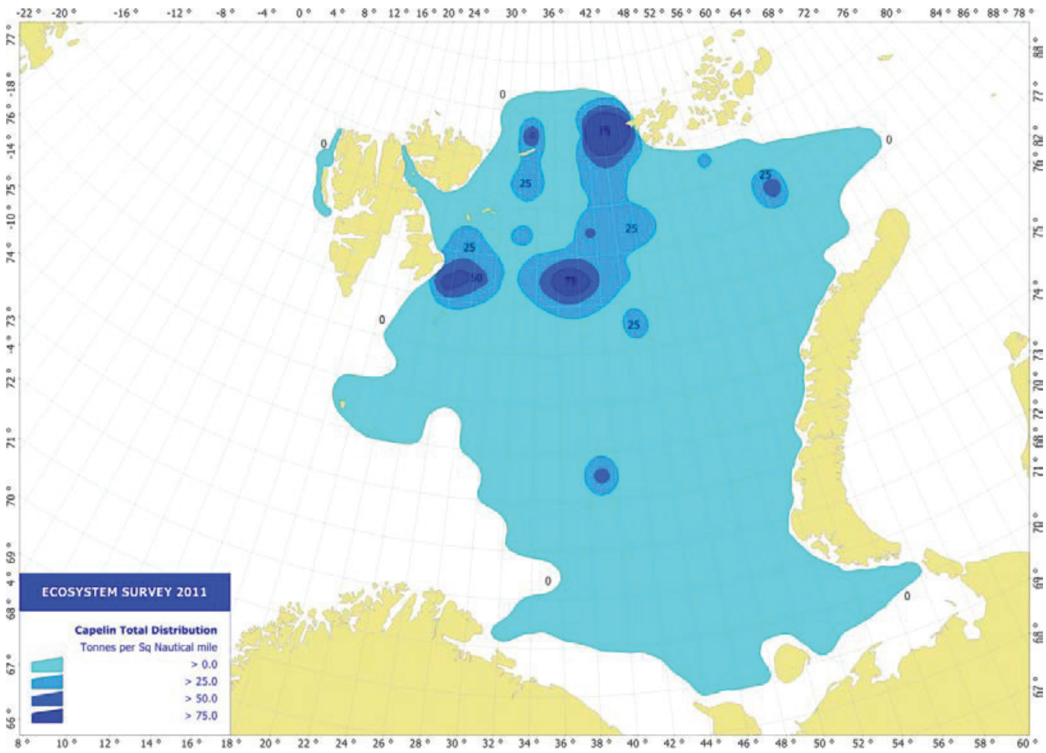


Figure 2.3.2. Estimated total density distribution of capelin (t/nautical mile^2), August-October 2011.

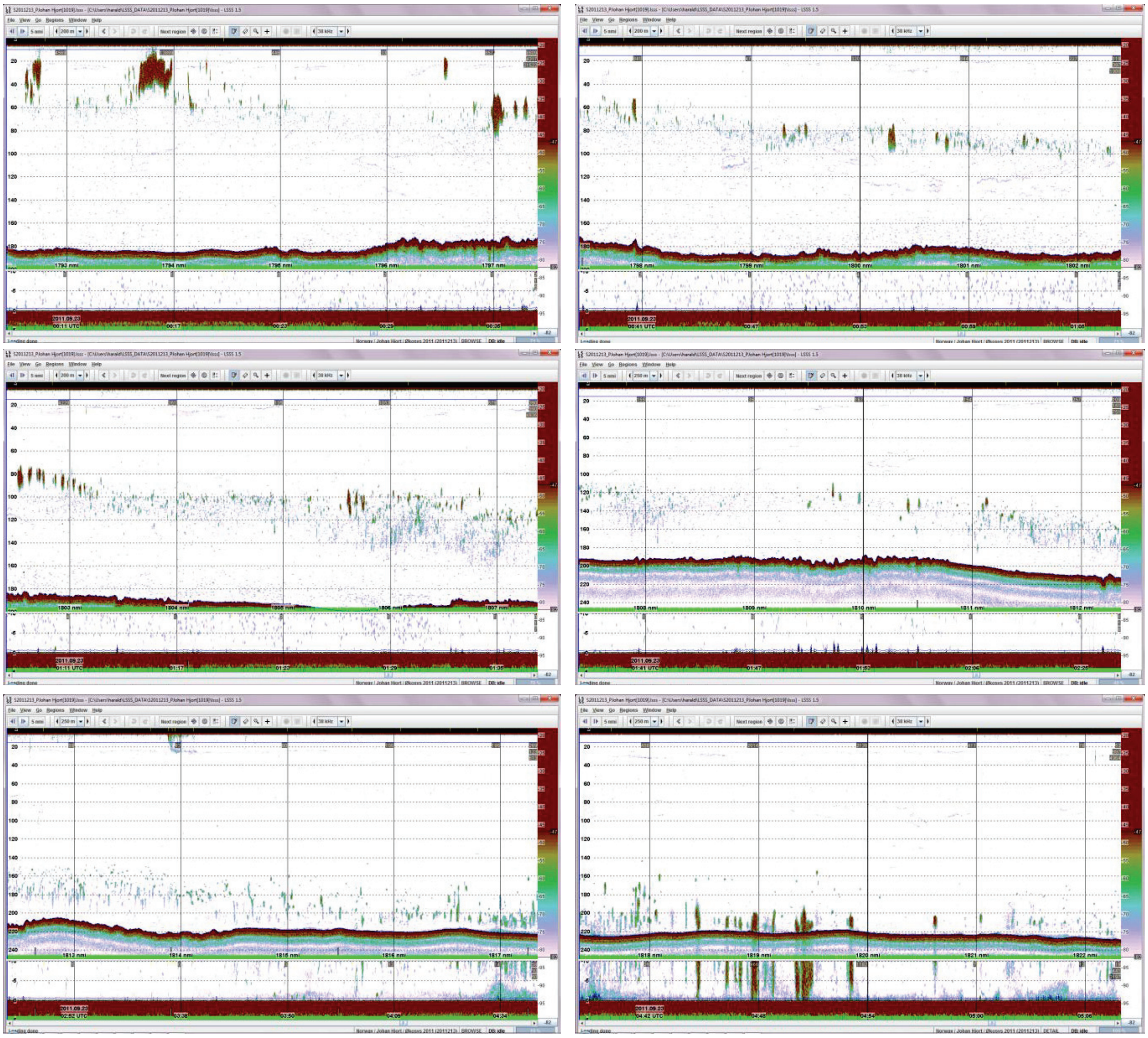


Figure 2.3.3. Echograms of capelin in the area near King Karl's Land on 23 September 2011, from 00:11 UTC to 05.06 UTC. The collage shows how capelin descend from the upper layer when it is dark, through midwater at dawn, eventually to settle at the sea bed. Echo recordings from "Johan Hjort".

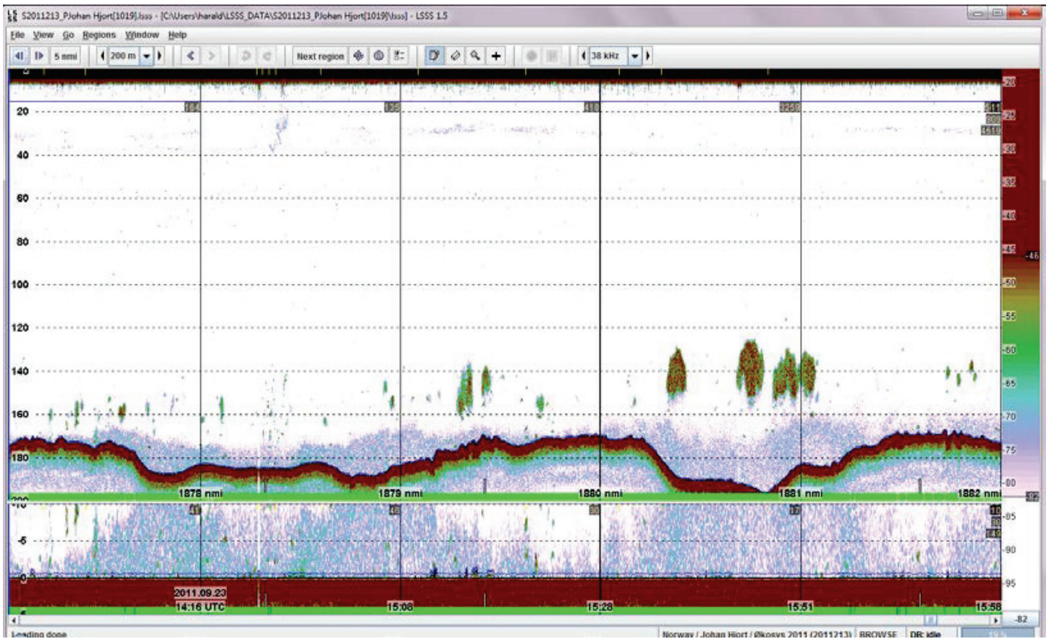


Figure 2.3.4. Echogram showing capelin (schools) and polar cod (layer), 23.09.2011 in daylight conditions. Echo recordings from “Johan Hjort”.

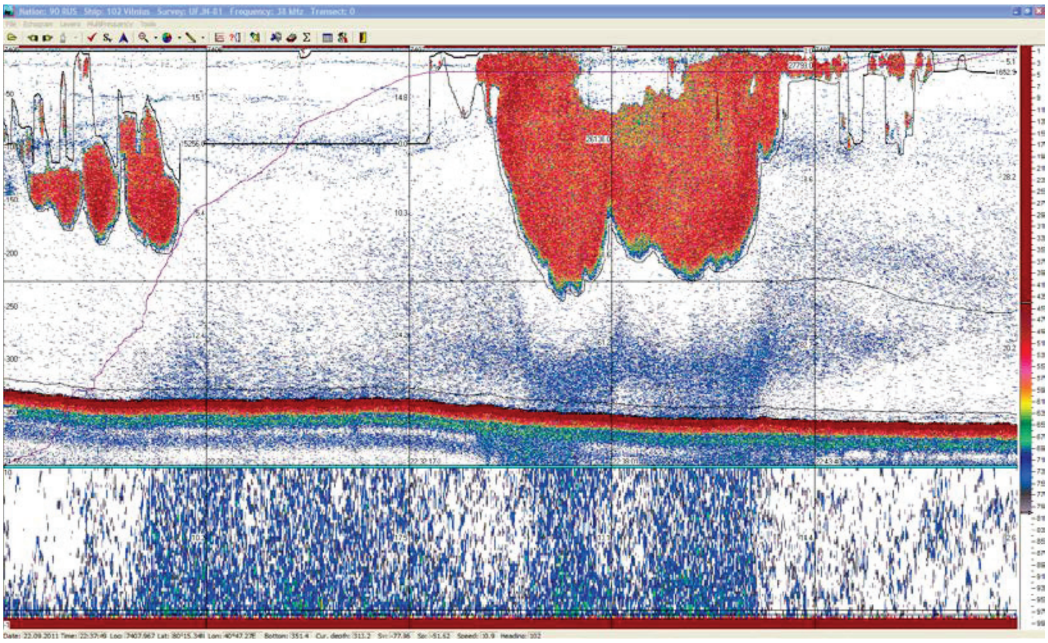


Figure 2.3.5. Echogram of capelin to the south-west of Franz Josef Land (80º15′ N, 40º47′ E), 22.09.2011. Echo recordings from “Vilnyus”.

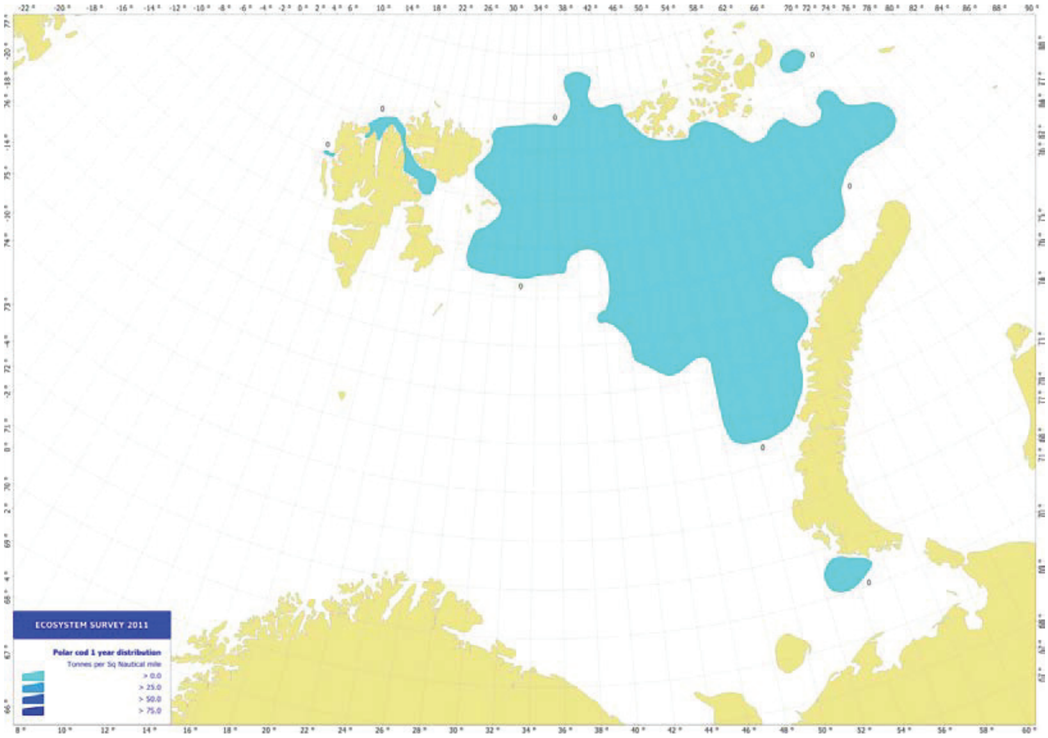


Figure 2.3.6. Estimated density distribution of one year old polar cod (t/nautical mile^2), August-October 2011.

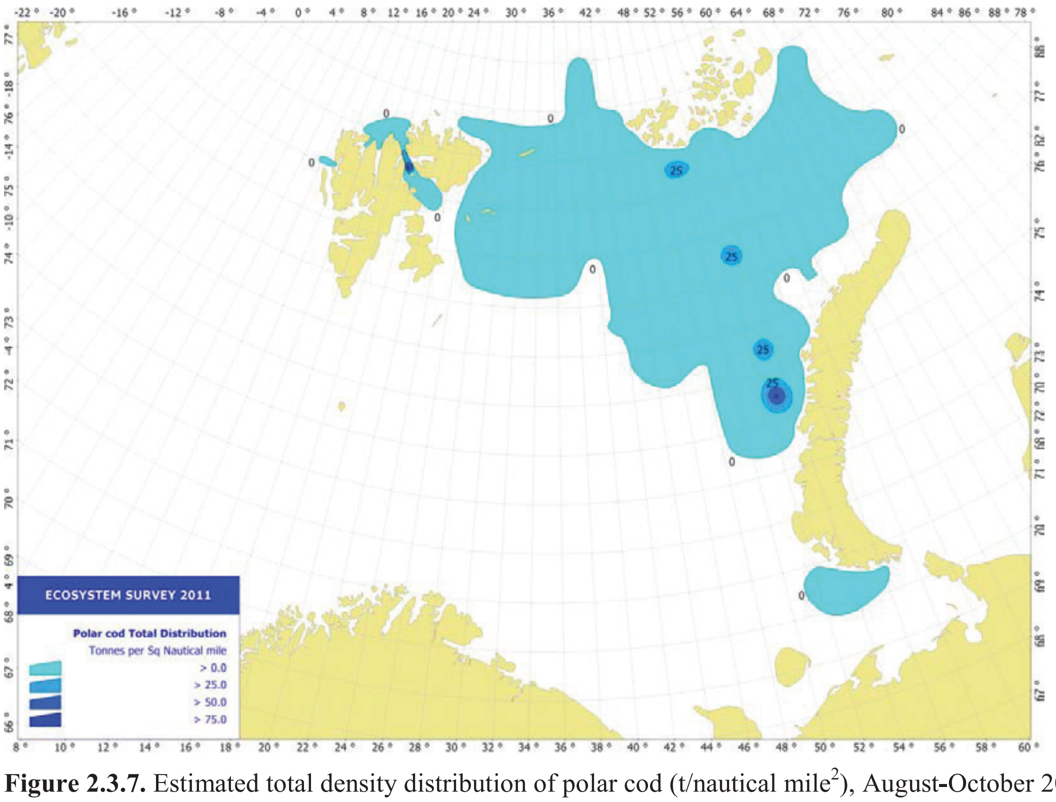


Figure 2.3.7. Estimated total density distribution of polar cod (t/nautical mile^2), August-October 2011.

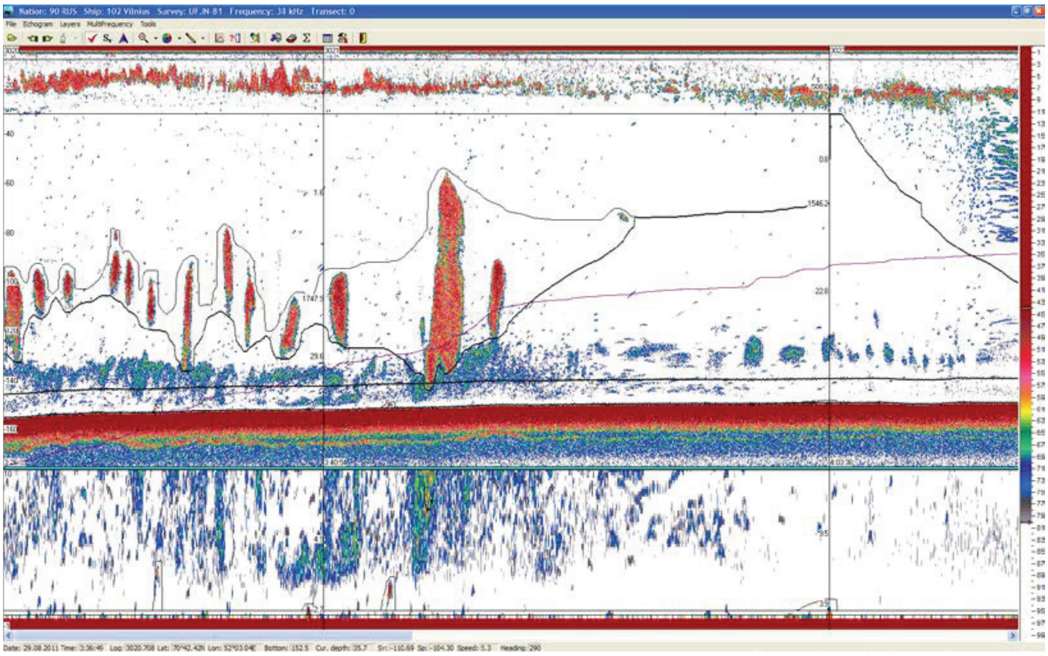


Figure 2.3.8. Echogram of polar cod to the south of Novaja Zemlja (70º42´ N, 52º03´ E), 29.08.2011. Echo recordings from “Vilnyus”.

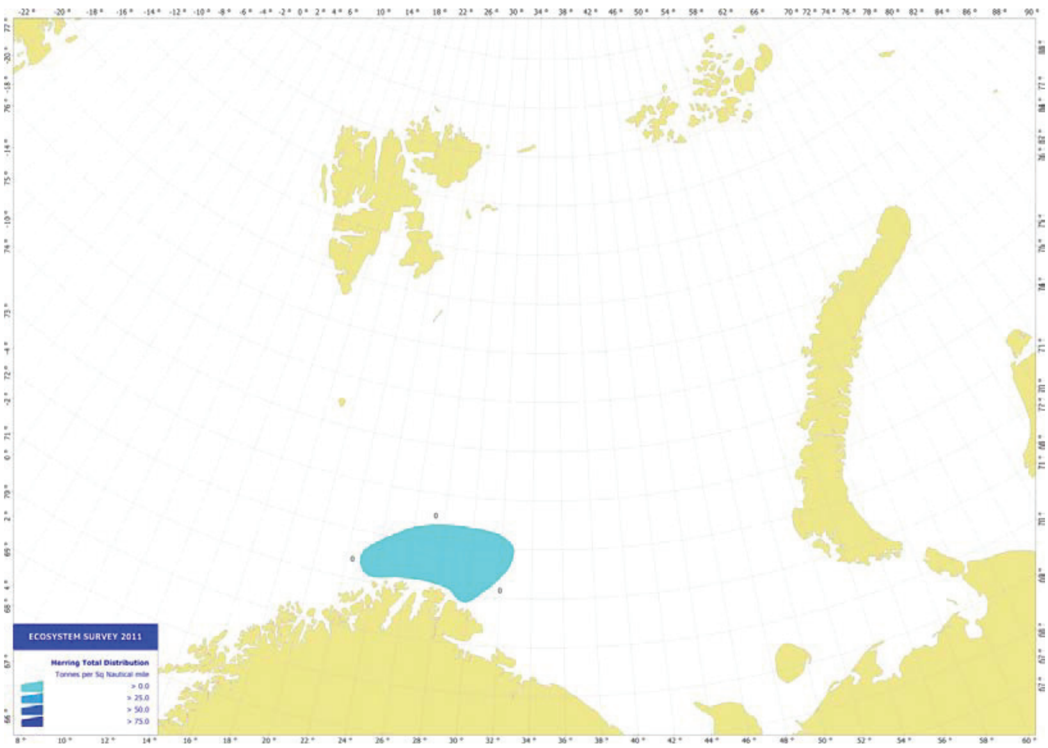


Figure 2.3.9. Estimated total density distribution of herring (t/nautical mile^2), August-October 2011.

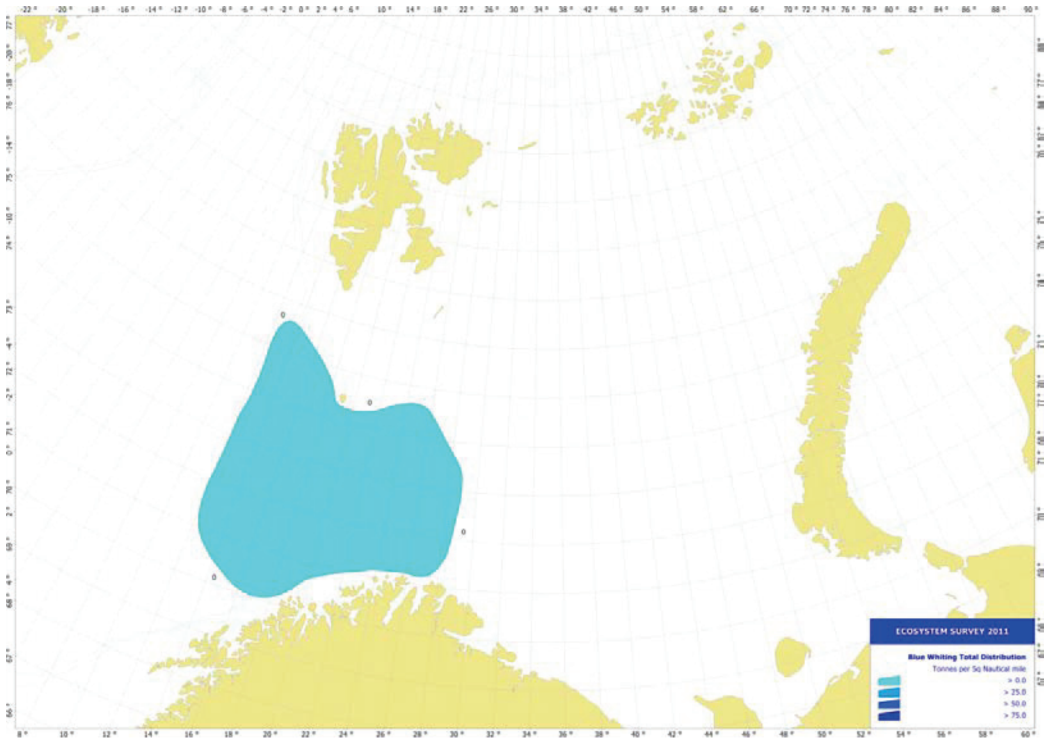


Figure 2.3.10. Estimated total density distribution of blue whiting (t/nautical mile^2), August-October 2011.

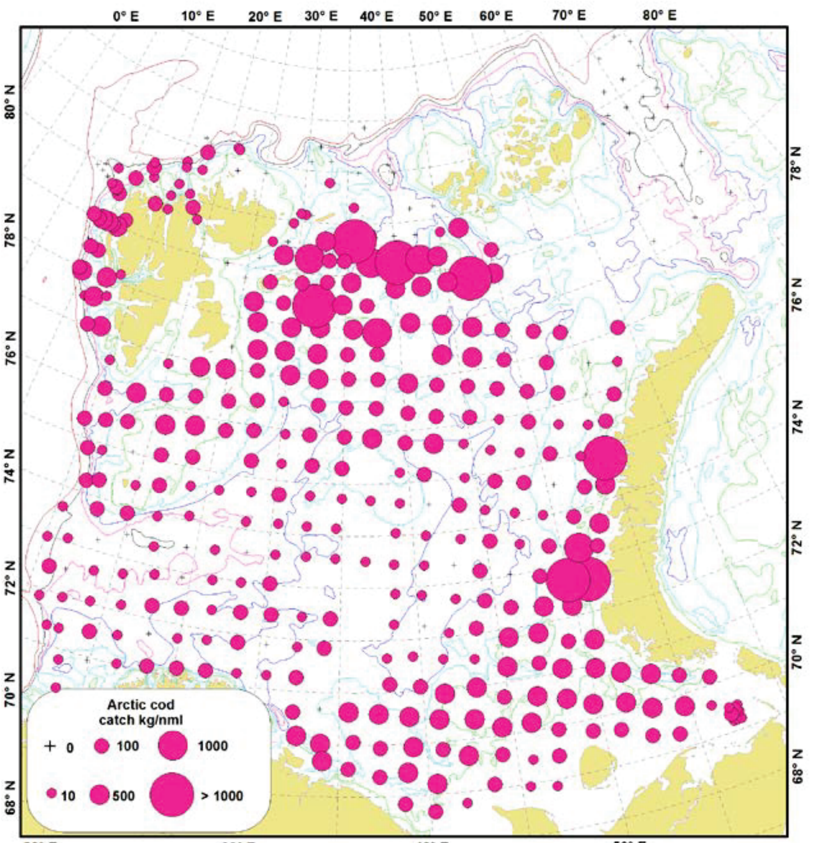
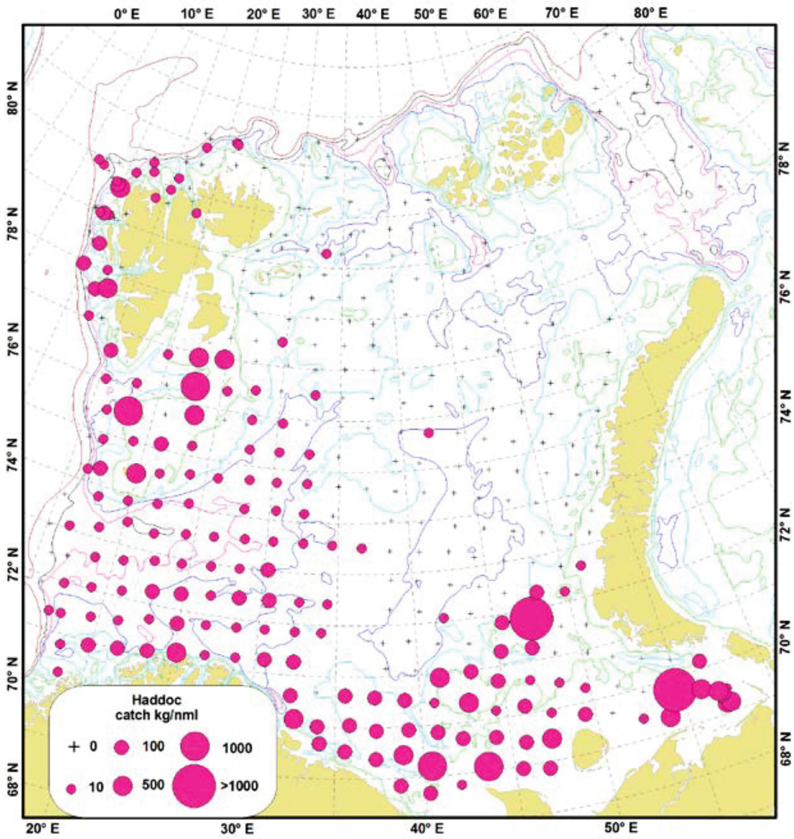


Figure 2.4.1. Distribution of cod *(Gadus morhua morhua)*, August-October 2011.



F**igure 2.4.2**. Distribution of haddock *(Melanogrammus aeglefinus)*, August-October 2011.

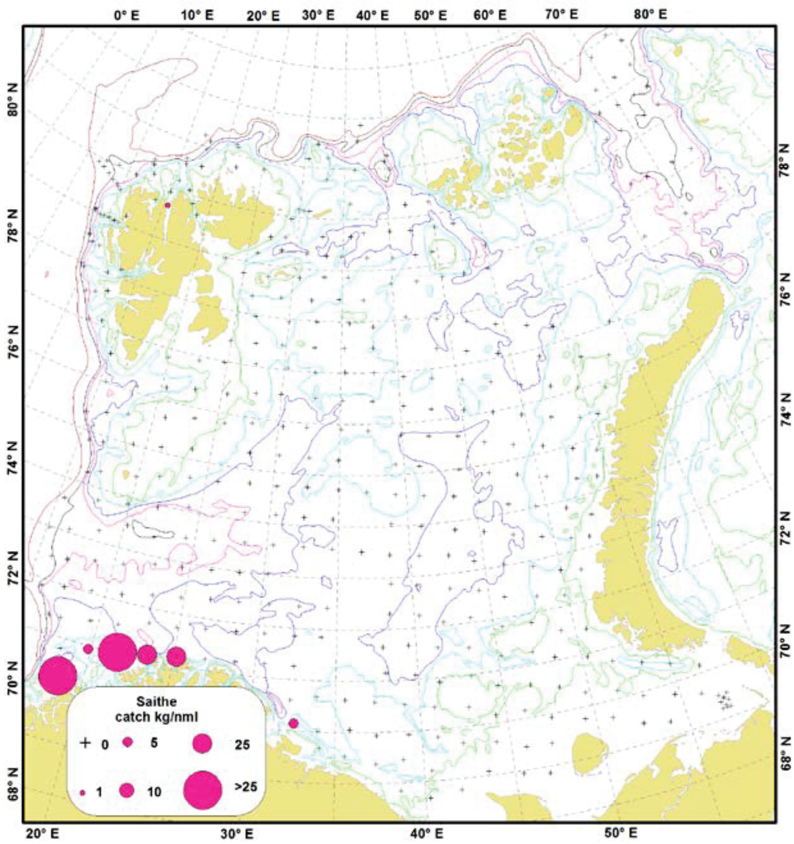


Figure 2.4.3. Distribution of saithe *(Pollachius virens)*, August-October 2011.

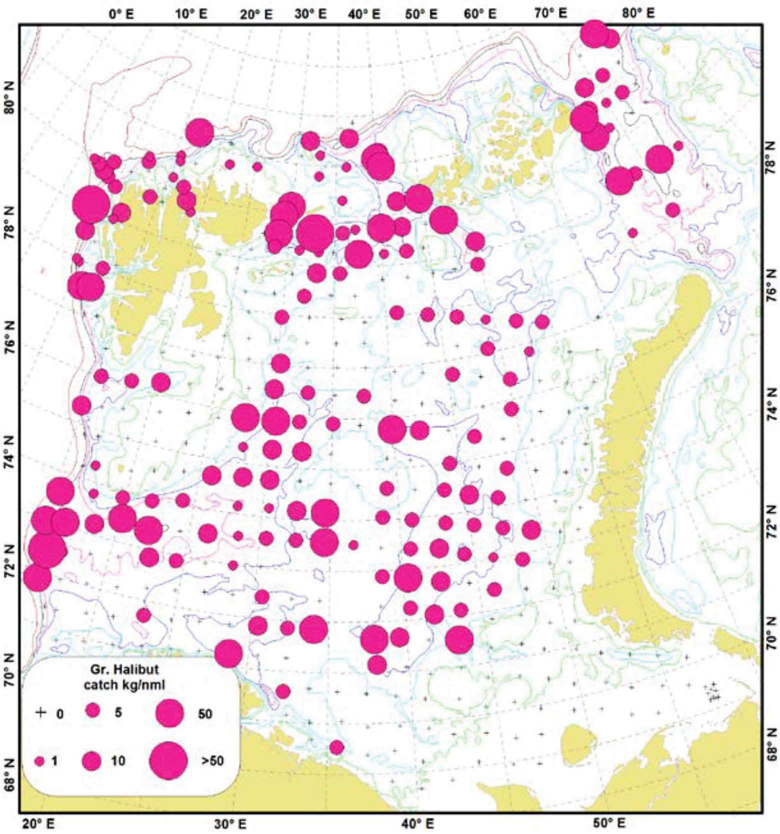


Figure 2.4.4. Distribution of Greenland halibut *(Reinhardtius hippoglossoides)* (WCPUE, based on weight of fish), August-October 2011.

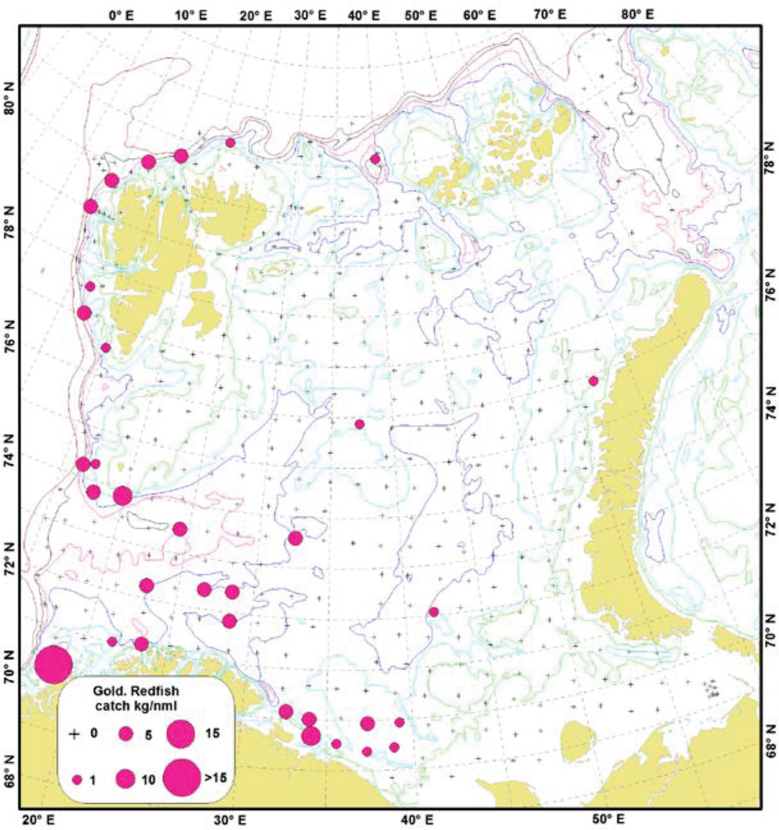


Figure 2.4.5 . Distribution of golden redfish (*Sebastes marinus)*, August-October 2011.

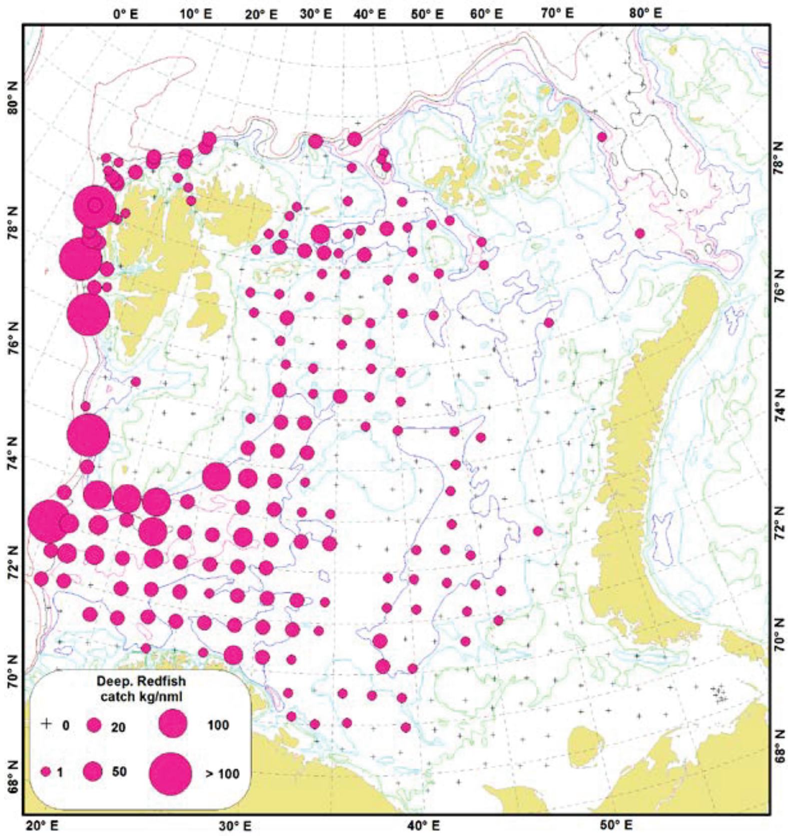


Figure 2.4.6. Distribution of deep-water redfish *(Sebastes mentella)*, August-October 2011.

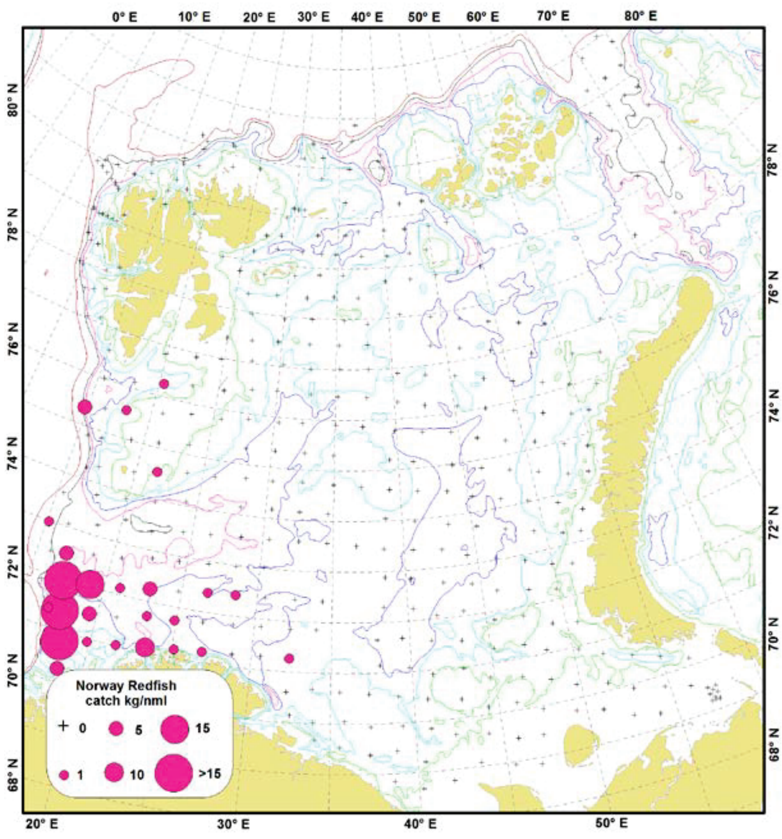


Figure 2.4.7. Distribution of Norway redfish *(Sebastes viviparus)*, August-October 2011.

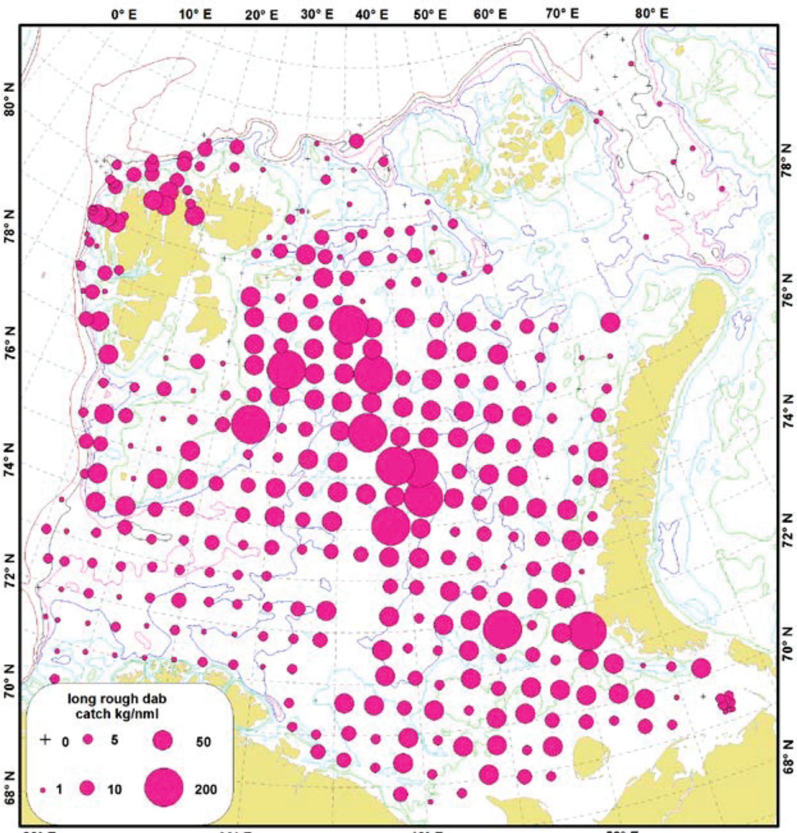


Figure 2.4.8. Distribution of long rough dab *(Hippoglossoides platessoides)*, August-October 2011.

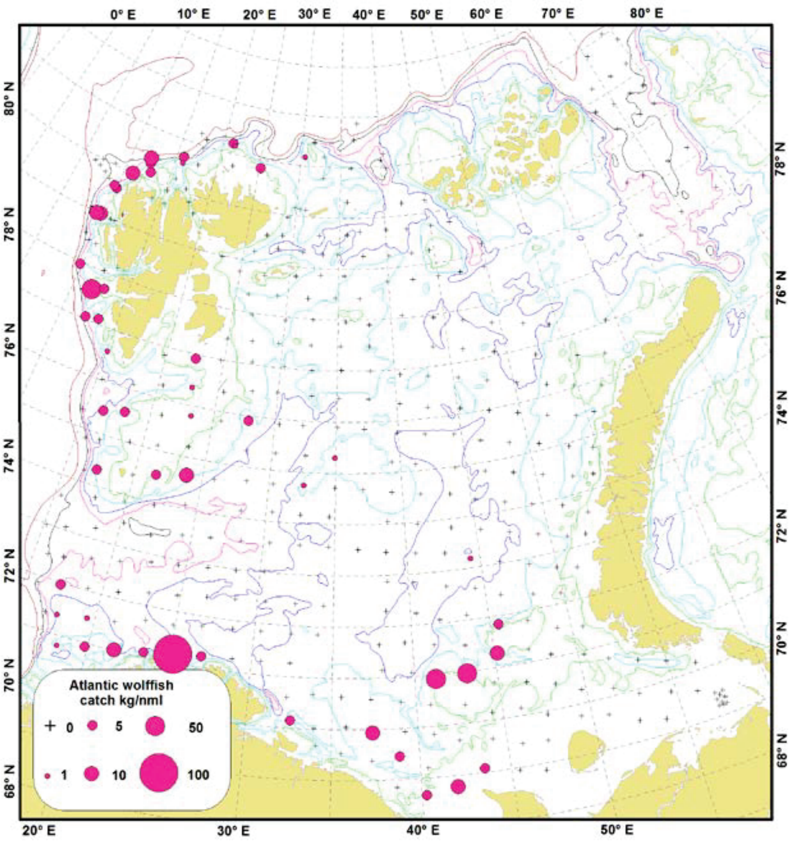


Figure 2.4.9. Distribution of Atlantic wolffish (*Anarhichas lupus*), August-October 2011.

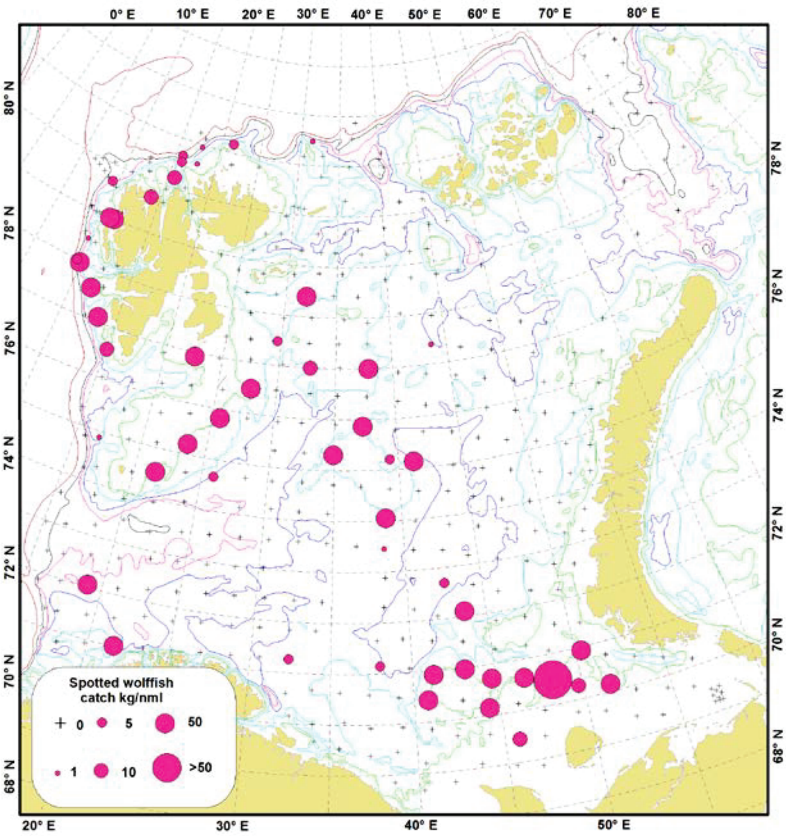


Figure 2.4.10. Distribution of spotted wolffish (*Anarhichas minor*), August-October 2011.

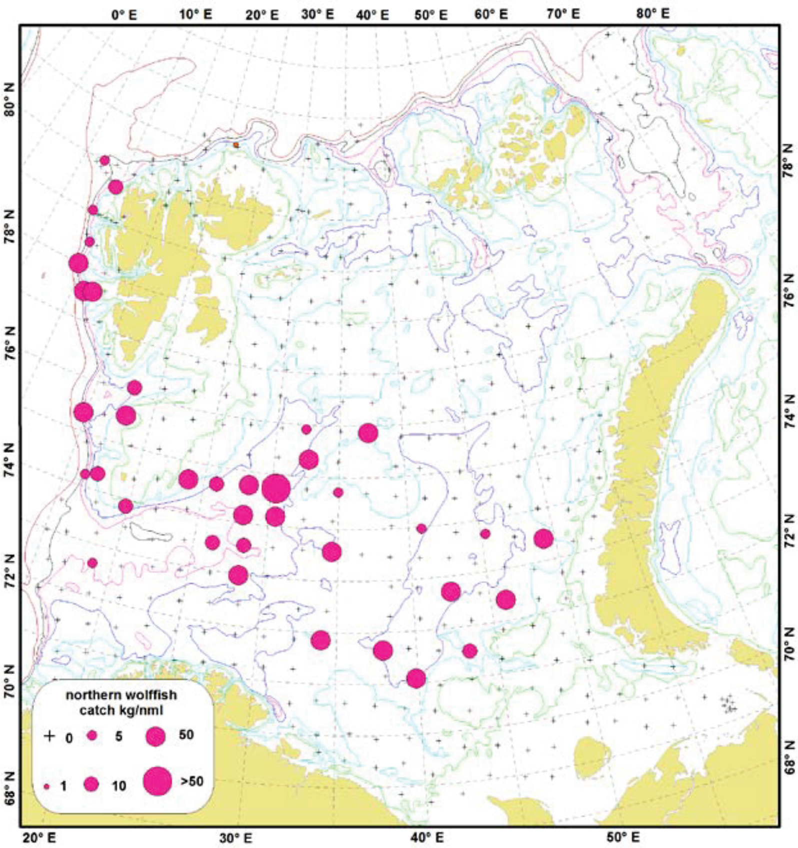


Figure 2.4.11. Distribution of northern wolffish (*Anarhichas denticulatus*), August-October 2011.

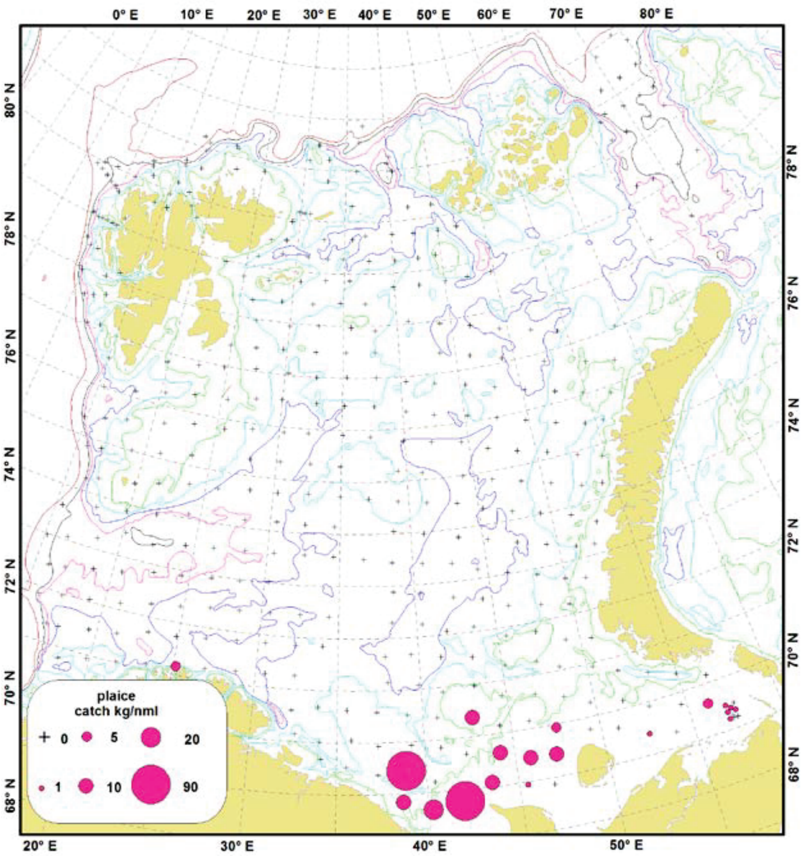


Figure 2.4.12. Distribution of plaice (*Pleuronectes platessa*), August-October 2011.

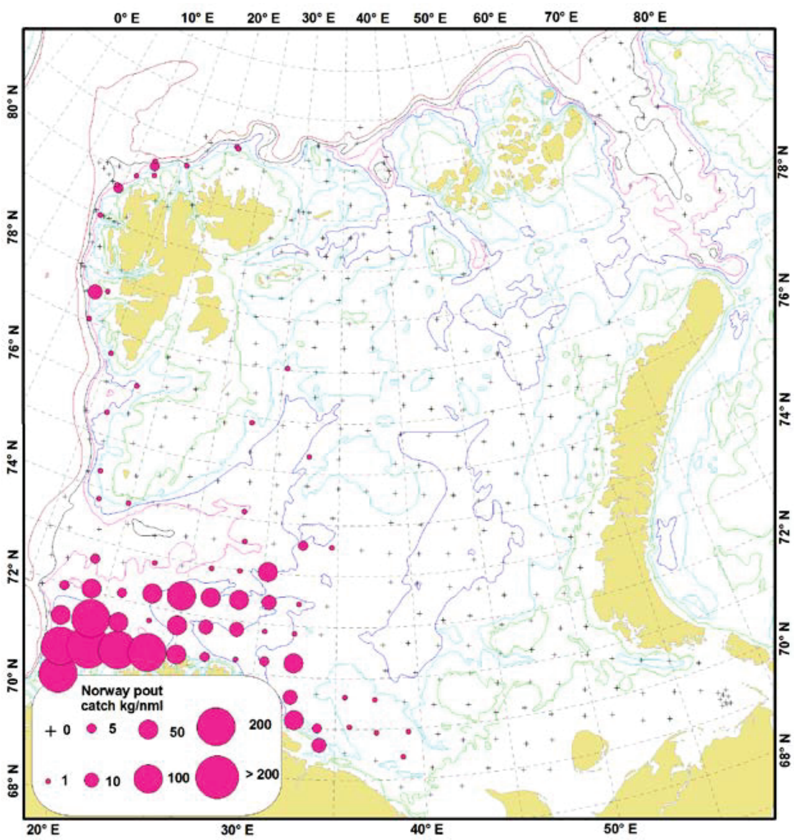


Figure 2.4.13. Distribution of Norway pout *(Trisopterus Esmarkii)*, August-October 2011.

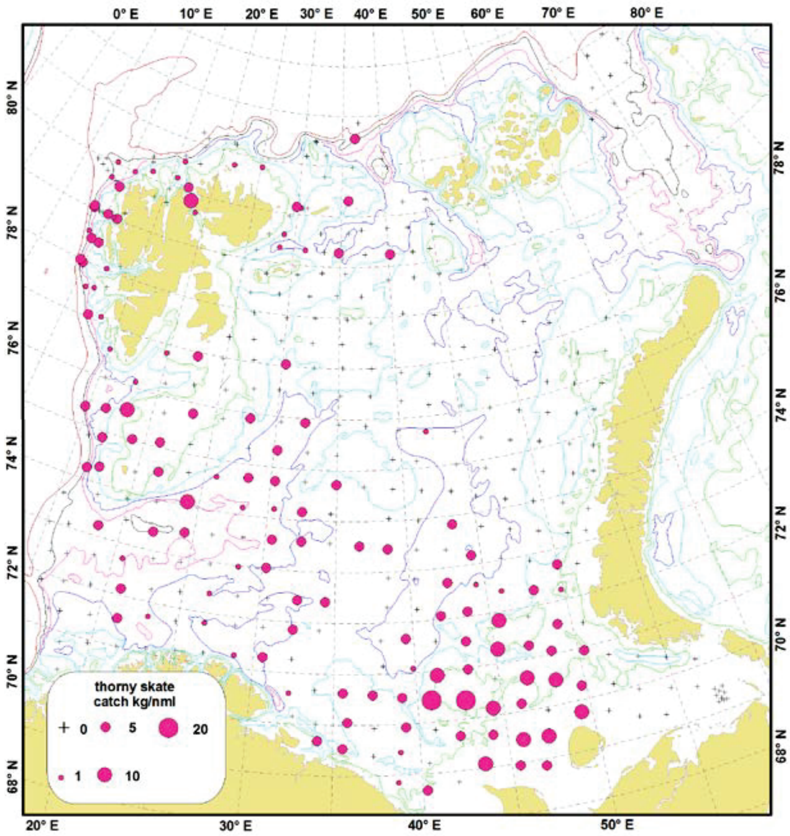


Figure 2.4.14. Distribution of thorny skate (*Amblyraja radiata*), August-October 2011.

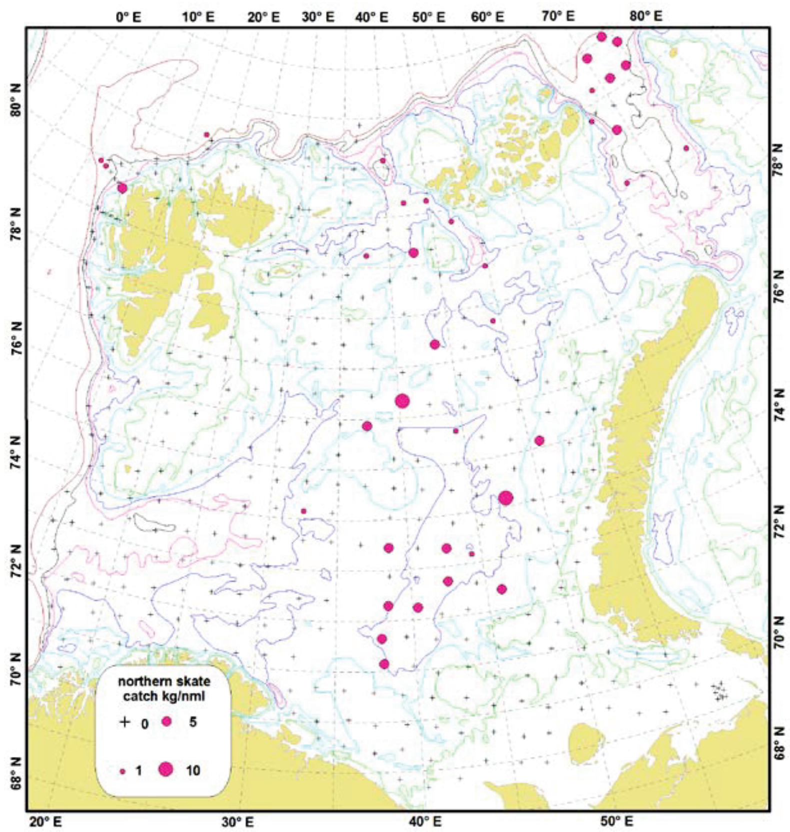


Figure 2.4.15. Distribution of northern skate (*Amblyraja hyperborea*), August-October 2011.

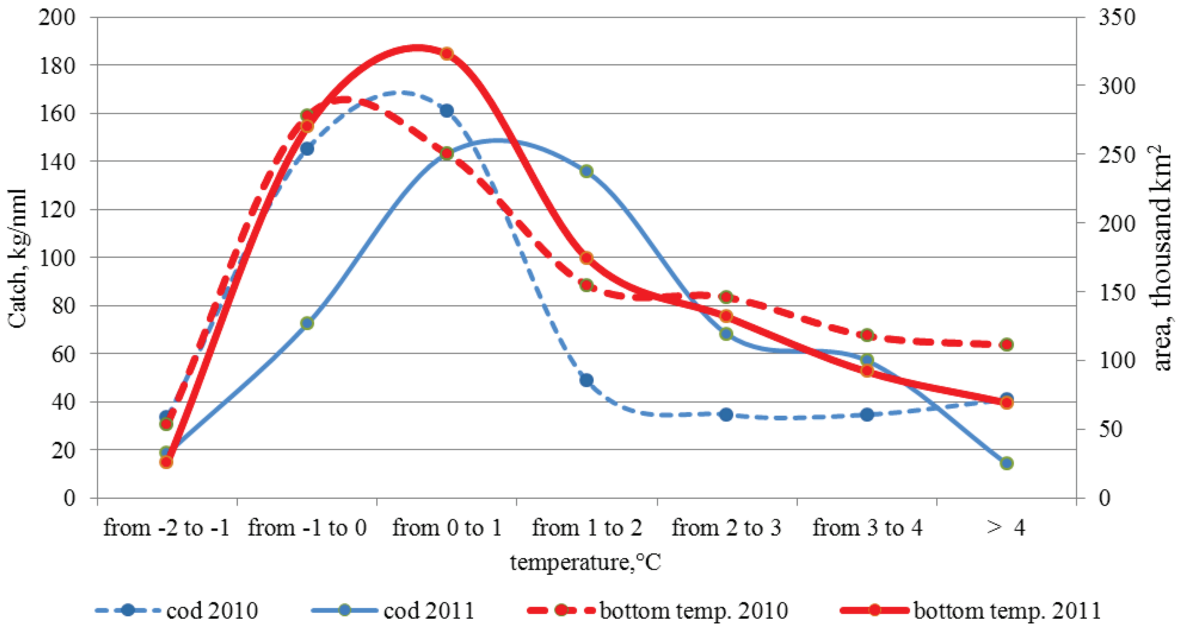


Figure 2.5.1. Area with temperature and mean catches of cod within different temperature ranges.

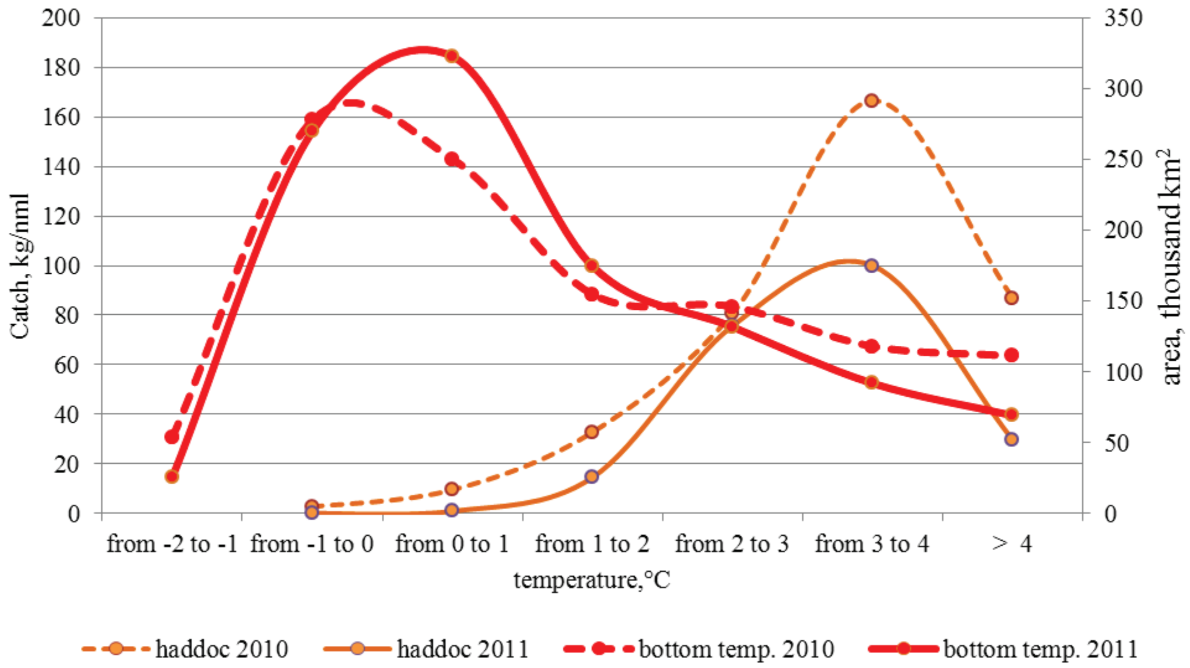


Figure 2.5.2. Area with temperature and mean haddock catches within different temperature ranges.

Figure 2.5.3 Mean length and hepatosomatic index of cod.

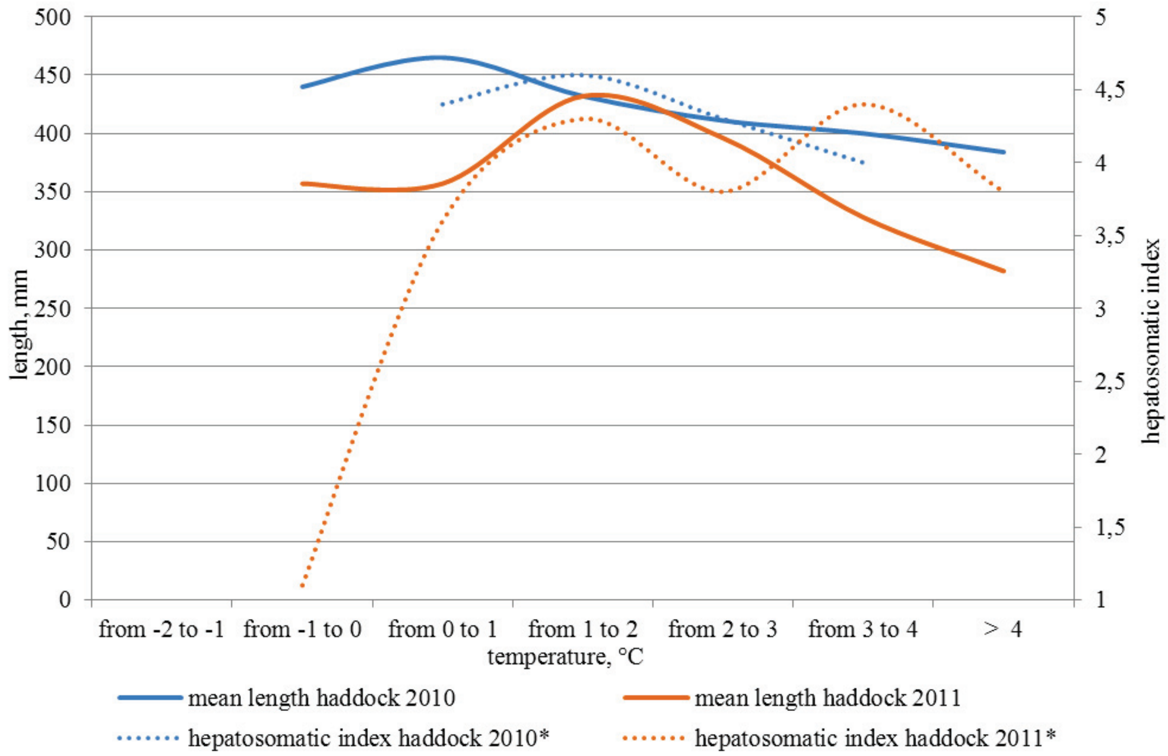


Figure 2.5.4. Mean length and hepatosomatic index of haddock.

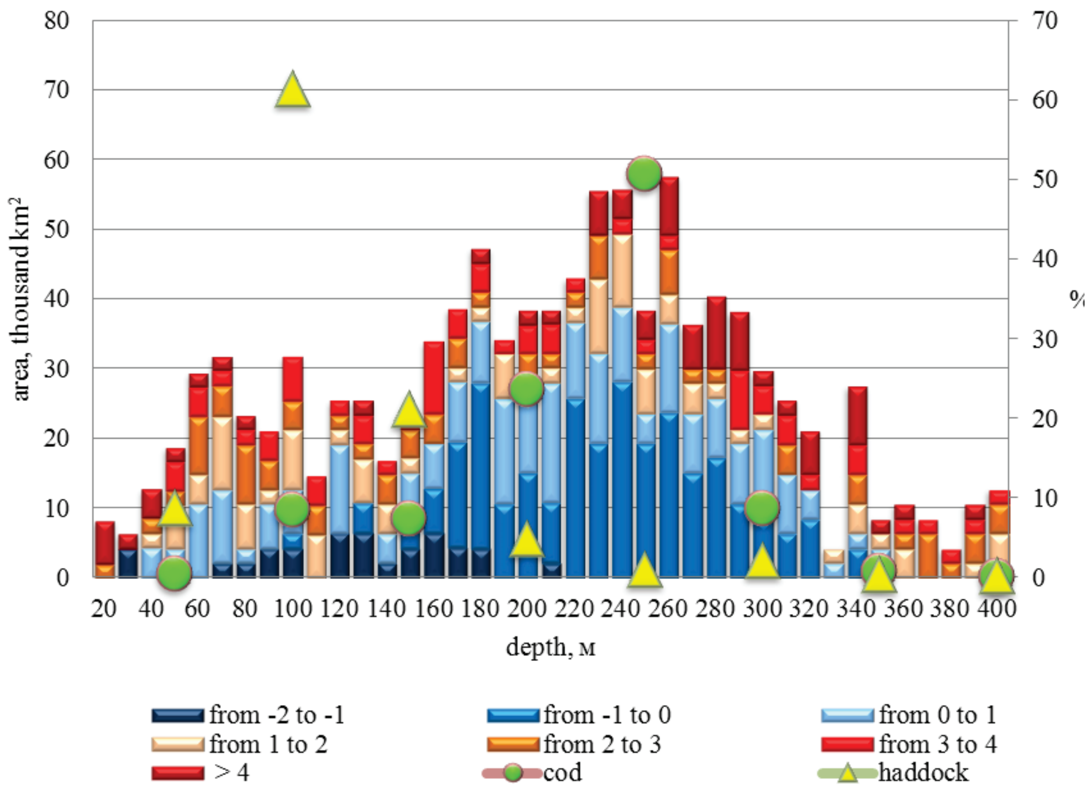


Figure 2.5.5. Depth area depending on temperature and catches by depth in 2010.

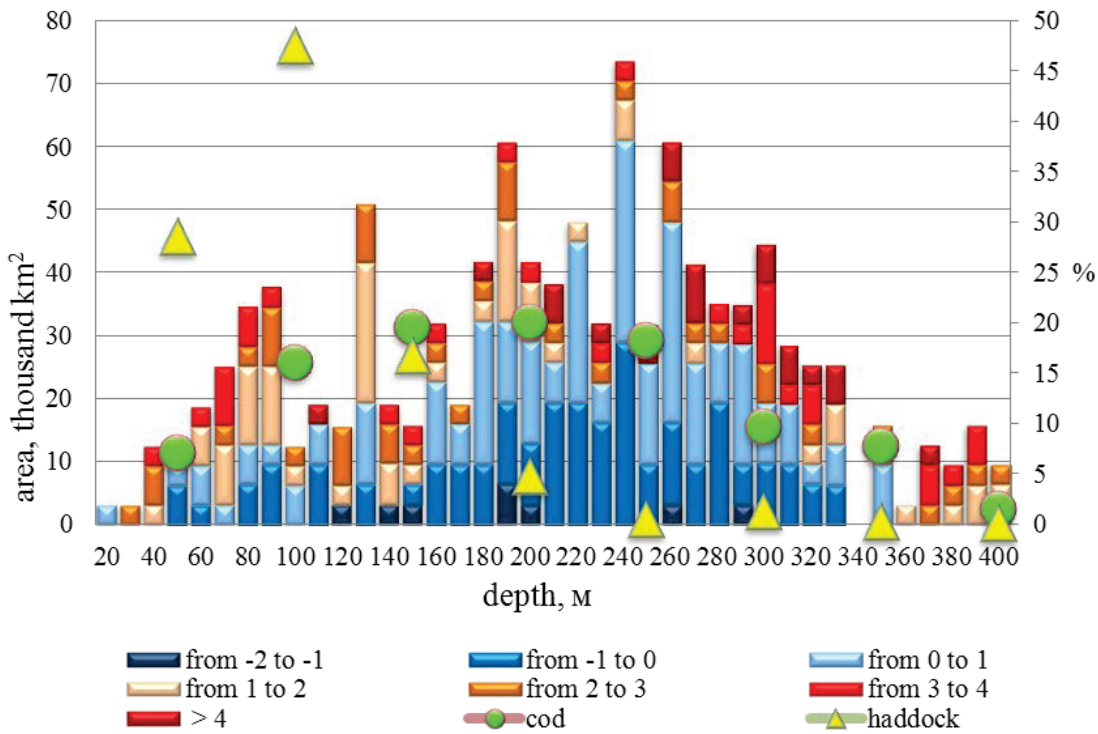


Figure 2.5.6. Depth area depending on temperature and catches by depth in 2011.

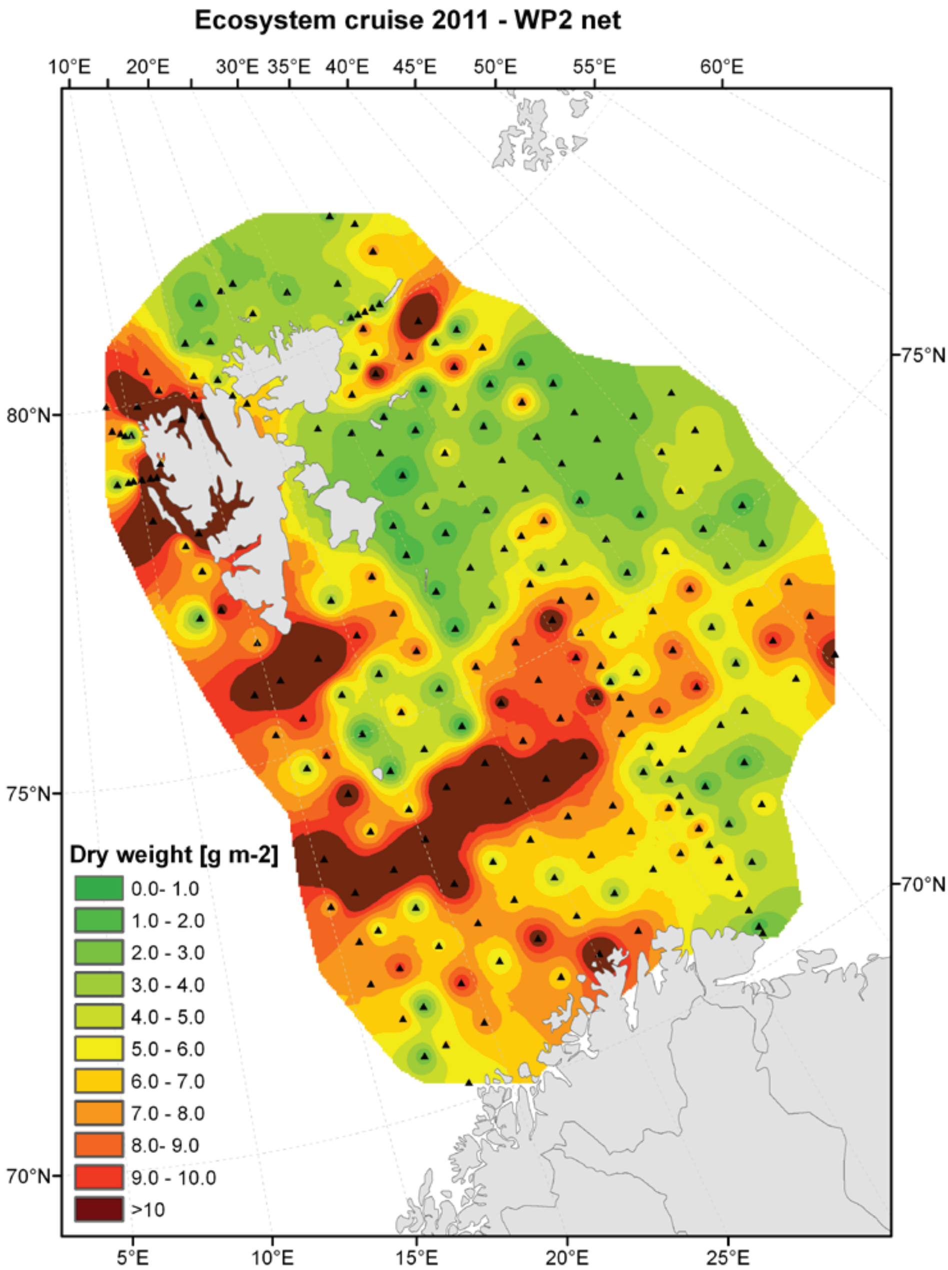


Figure 2.6.1. Zooplankton biomass during the Barents Sea Ecosystem cruise in August-September 2011. Norwegian data from vertically operated 180 µm meshed WP2 net (bottom-0 m).

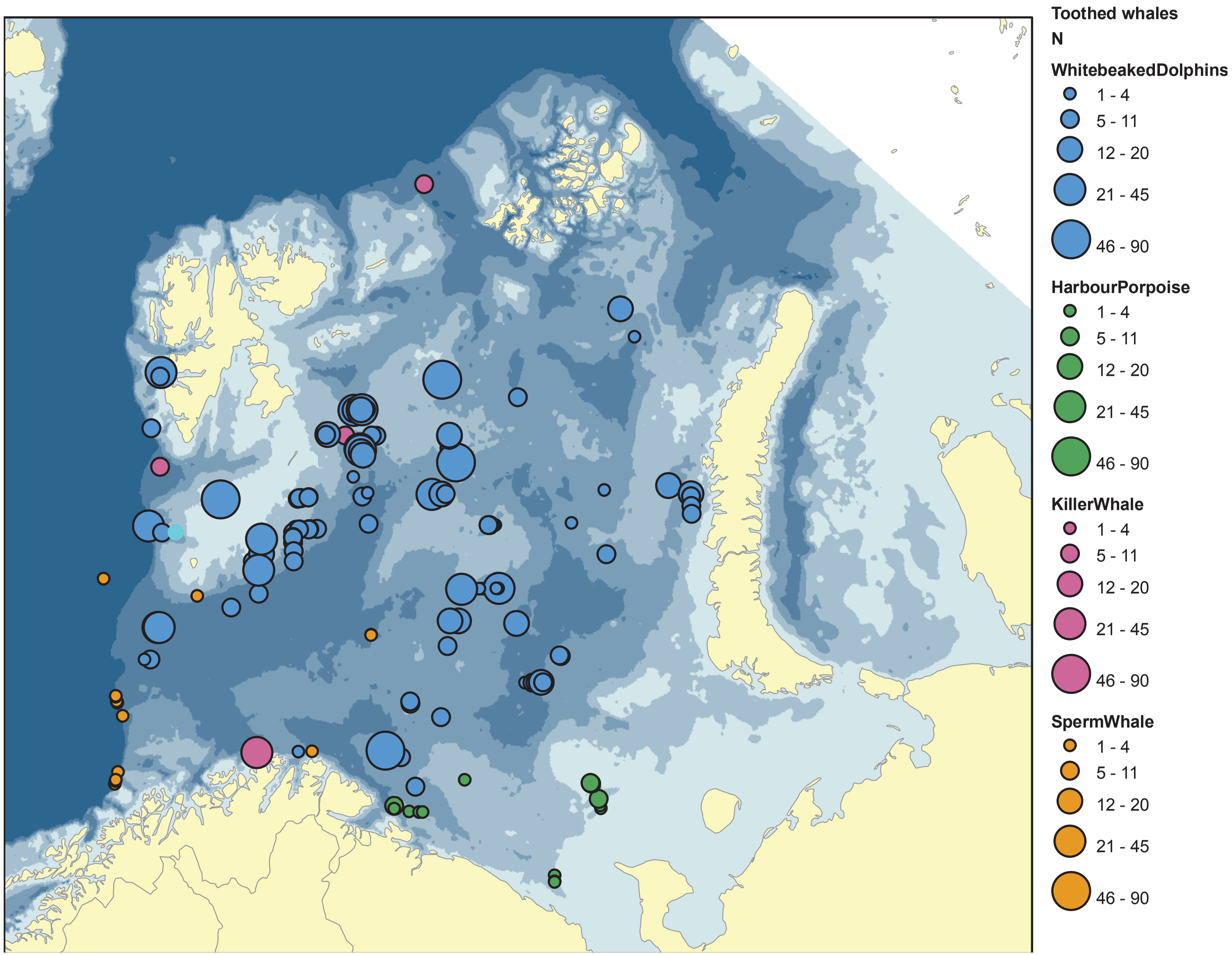


Figure 2.7.1. Distribution of toothed whales observed in August-September 2011.

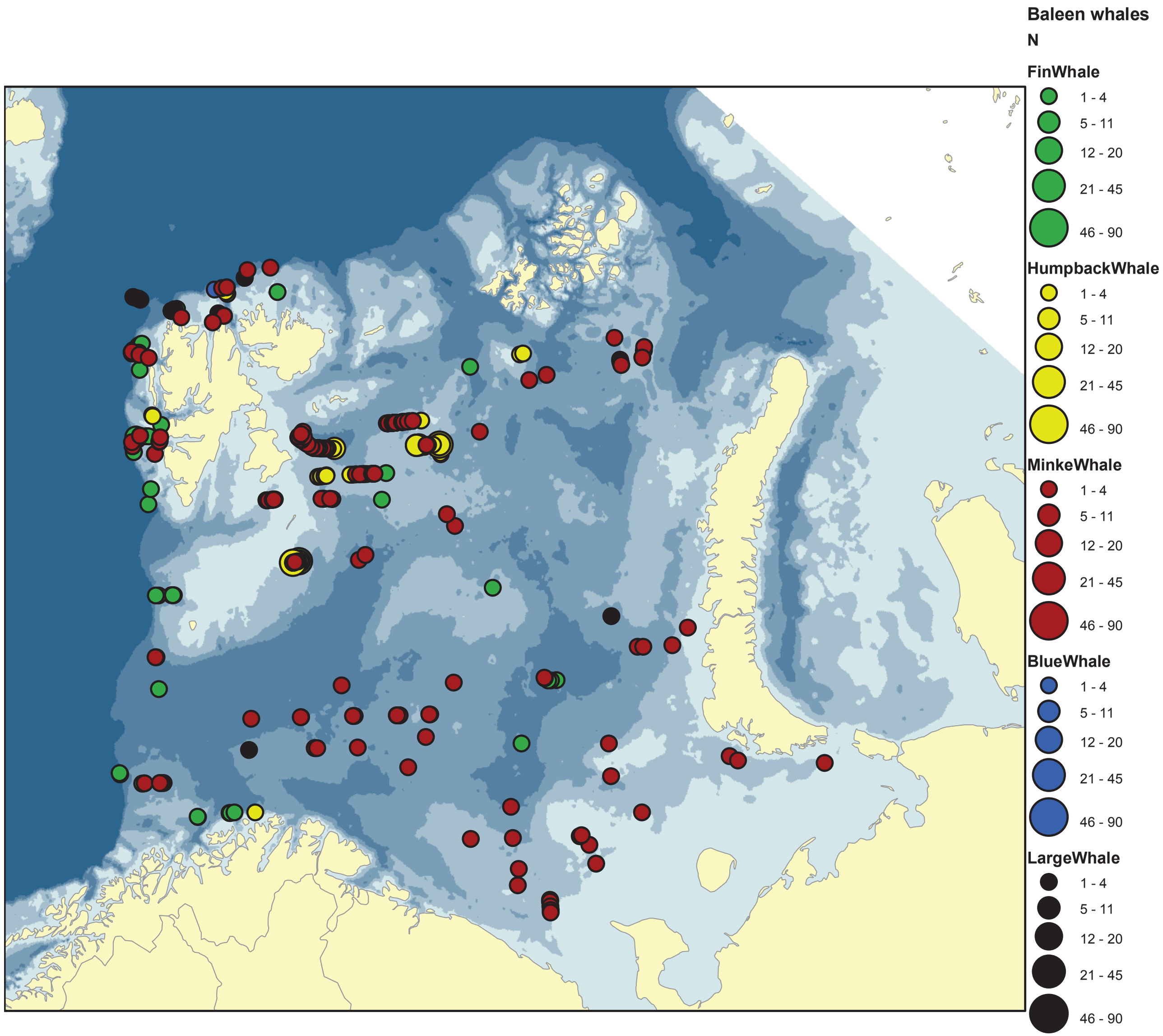


Figure 2.7.2. Distribution of baleen whales as observed in August-September 2011-

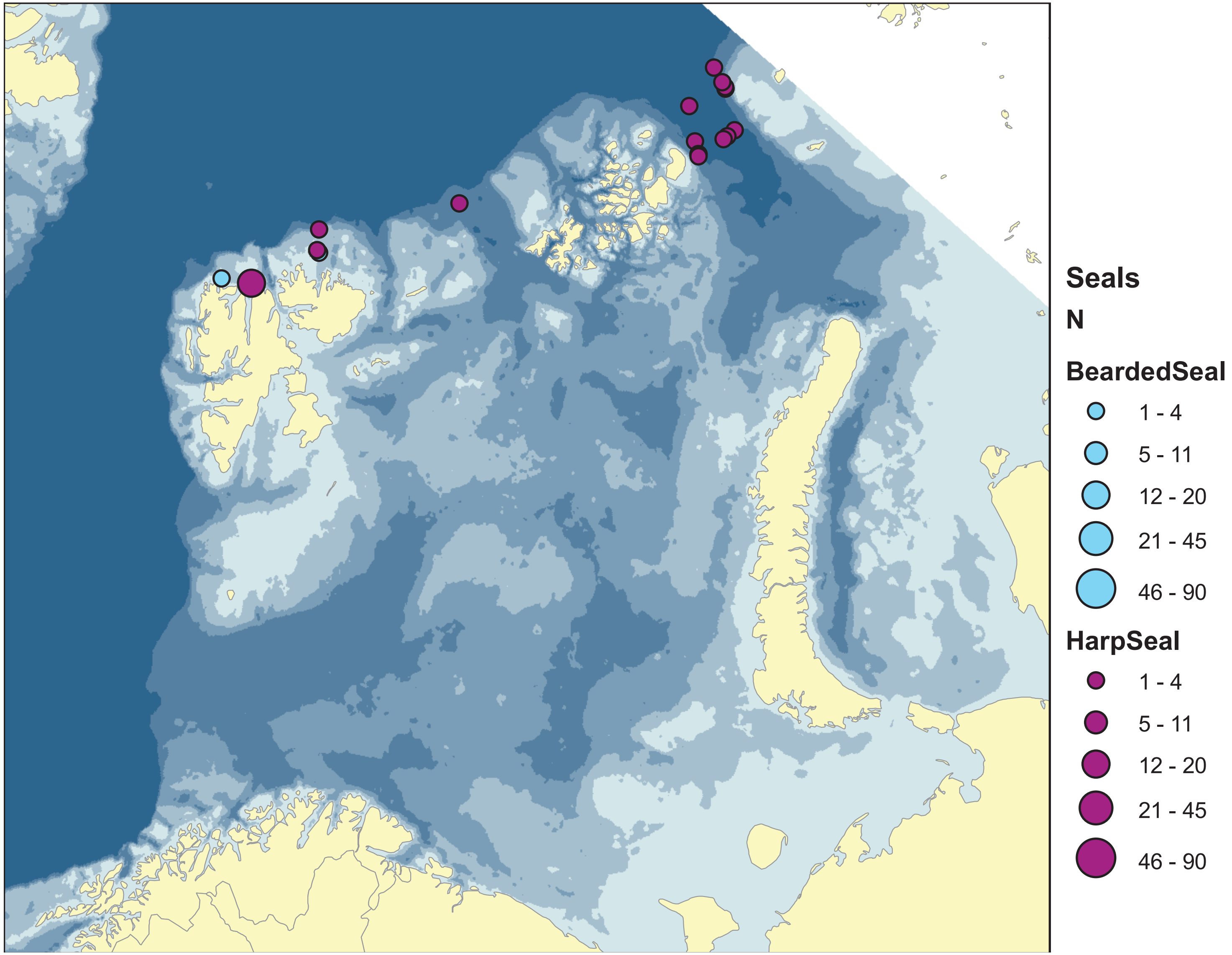


Figure 2.7.3. Distribution of seals as observed in August-September 2011.

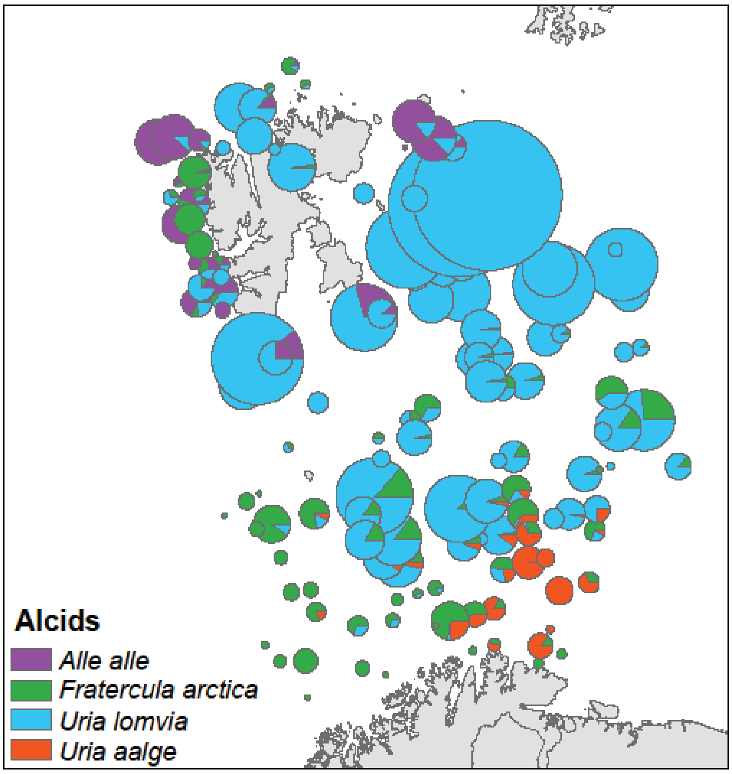


Figure 2.7.4. Distribution of alcid seabirds observed during the Norwegian part of the Joint Norwegian/Russian Ecosystem Survey 2011.

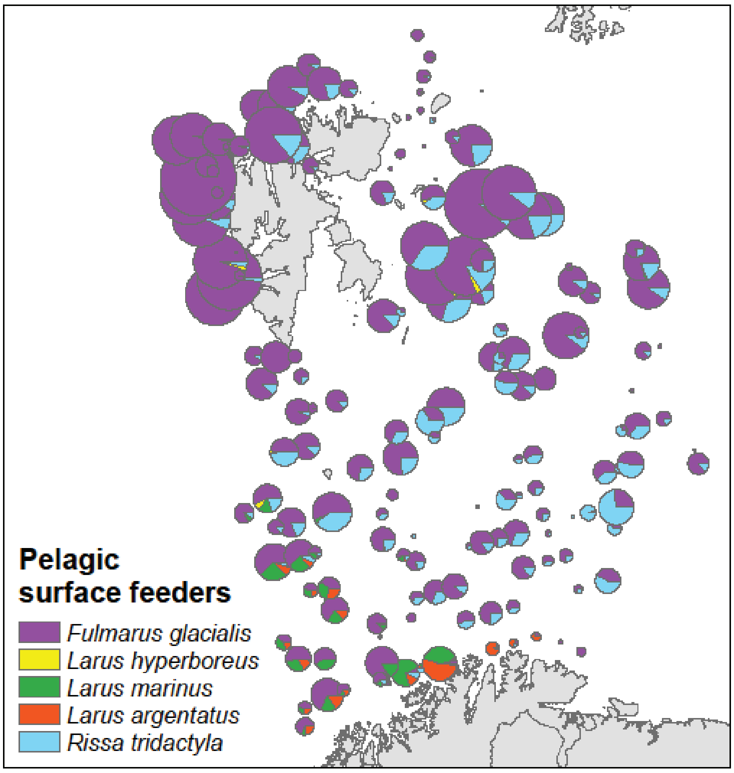


Figure 2.7.5. Distribution of pelagic birds observed during the Norwegian part of the Joint Norwegian/Russian Ecosystem Survey 2011.

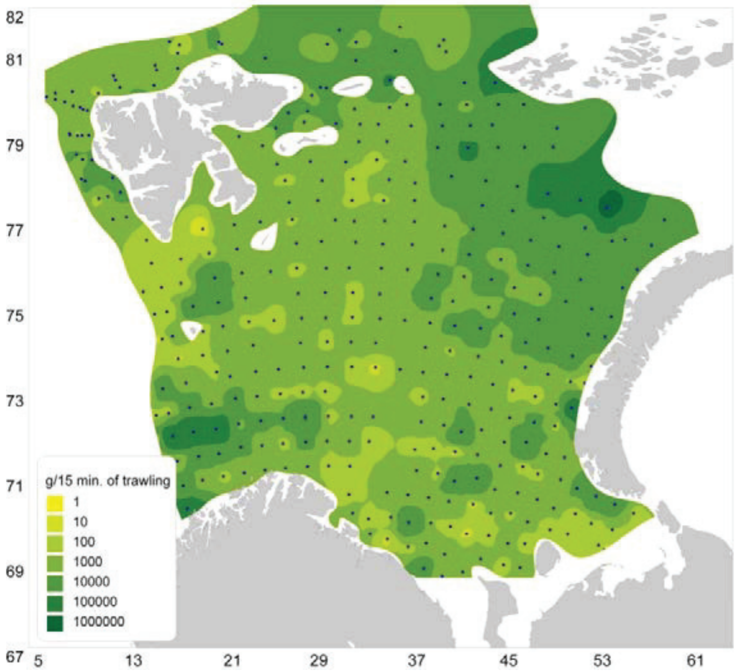


Figure 2.8.1. The recorded biomass (extrapolated) of all registered bottom living evertebrate (except Nothern shrimp *(Pandalus borealis*) taken by Campelen bottom trawl in the Ecosystem Survey in August-October 2011

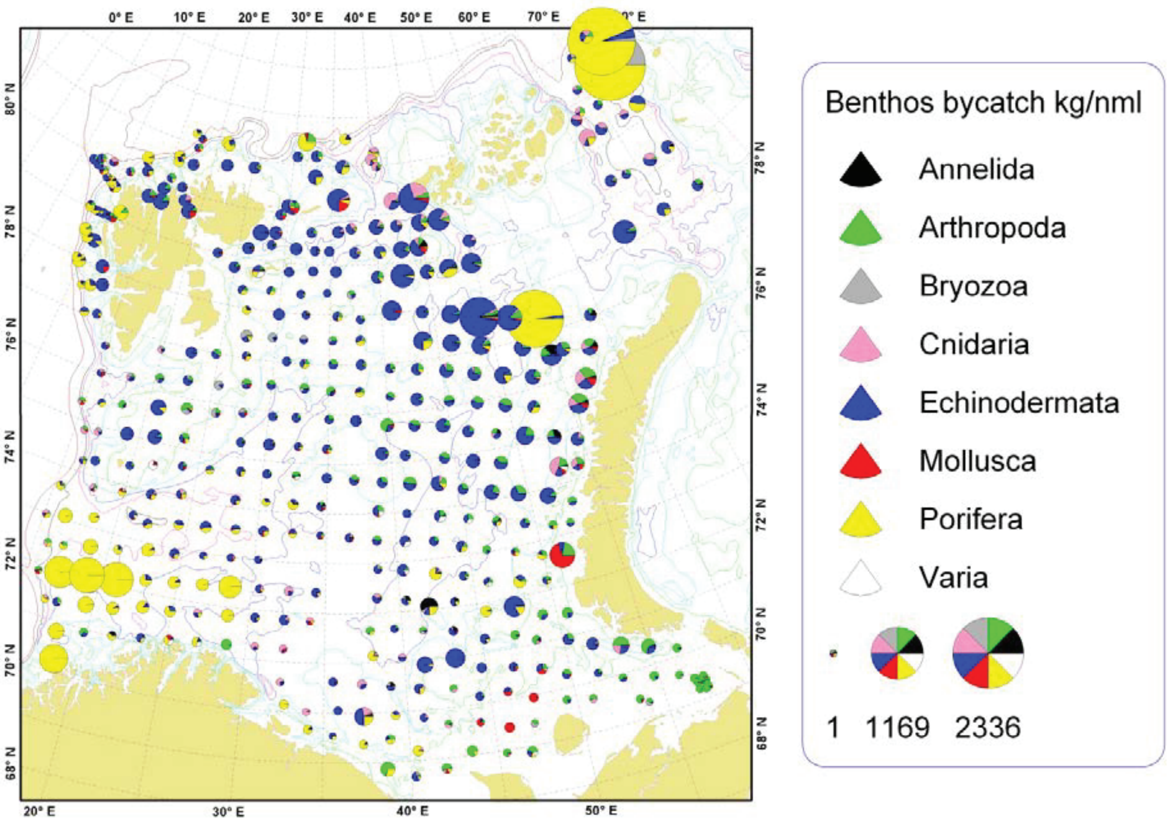


Figure 2.8.2. The relative distribution of main benthic animal groups presented as quantitative circles at each sampled station with Campelen trawl in August-October 2011.

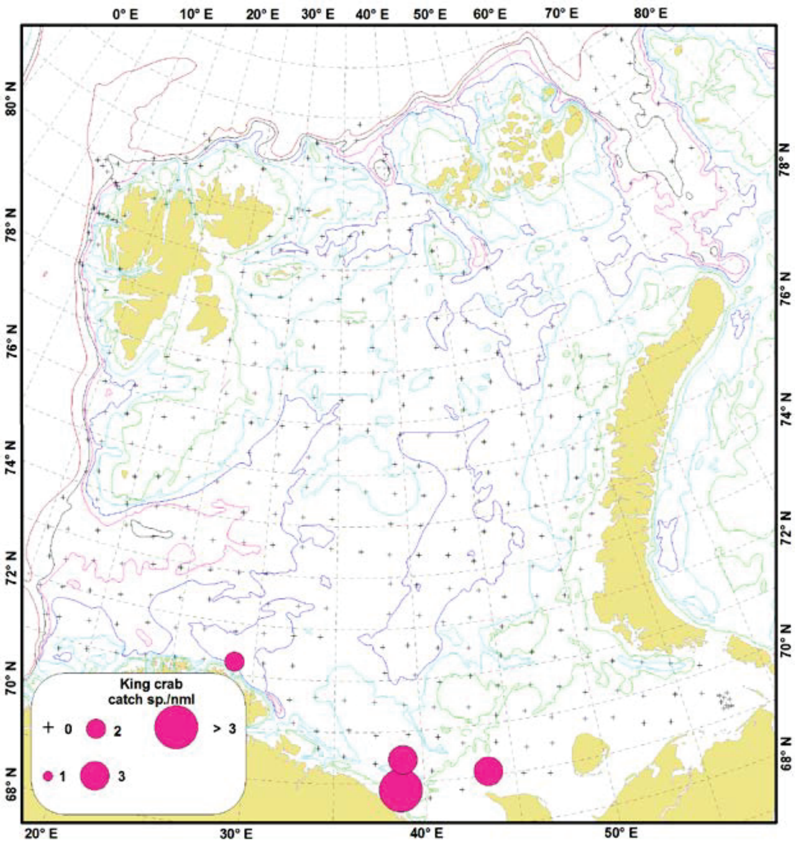


Figure 2.8.3. Distribution of the king crab (*Paralithodes camtschaticus*) as recorded by Campelen bottom trawl. Standardized to numbers/1 nm, August-October 2011.

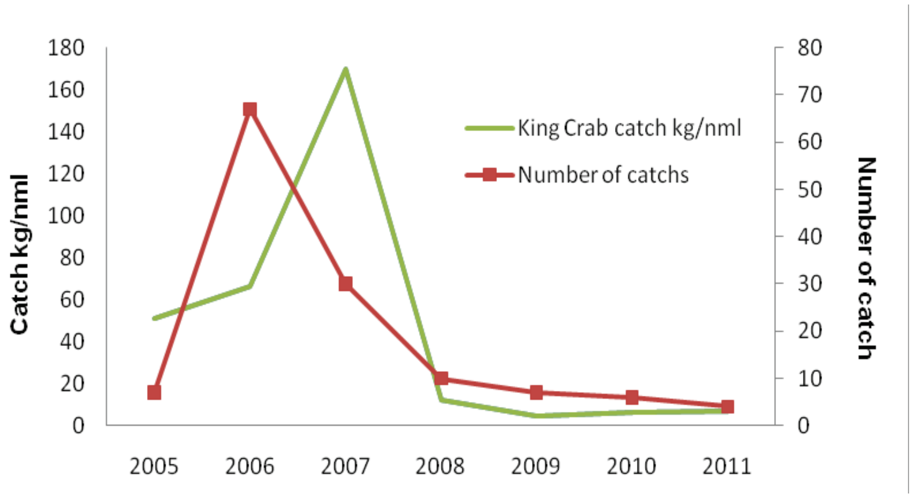


Figure 2.8.4. Catch statistics of the king crab (*Paralithodes camtschaticus*) recorded by the joint annual Ecosystem surveys 2005-2011.

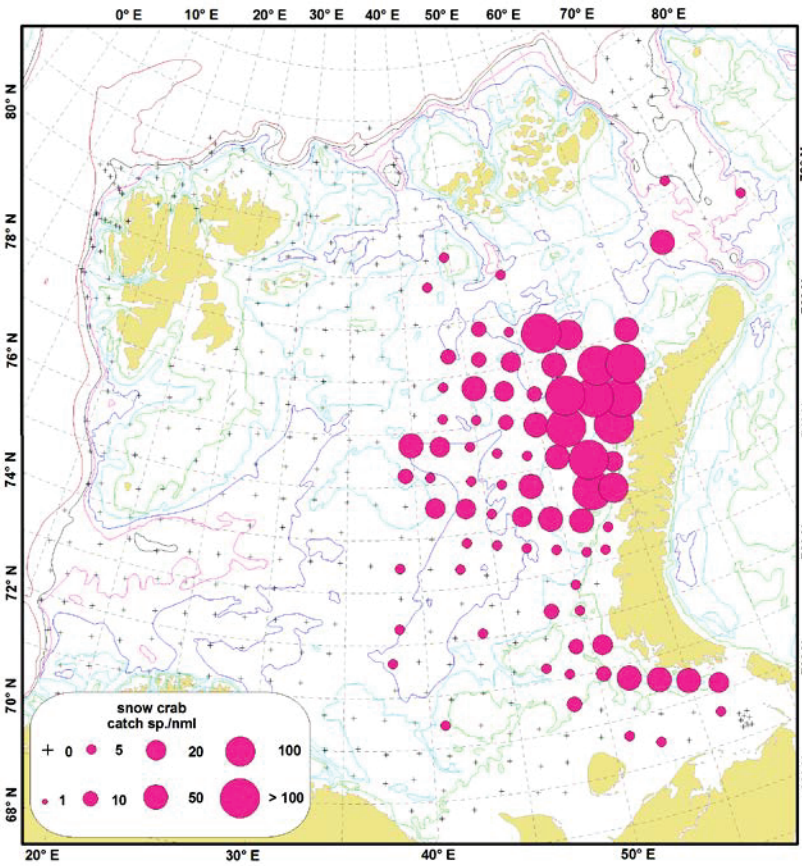


Figure 2.8.5. The distribution of the Snow crab (*Chionoecetes opilio*) as recorded by the Campelen bottom trawl. Standardized to numbers/1 nm, on the Ecosystem Survey in August-October 2011.

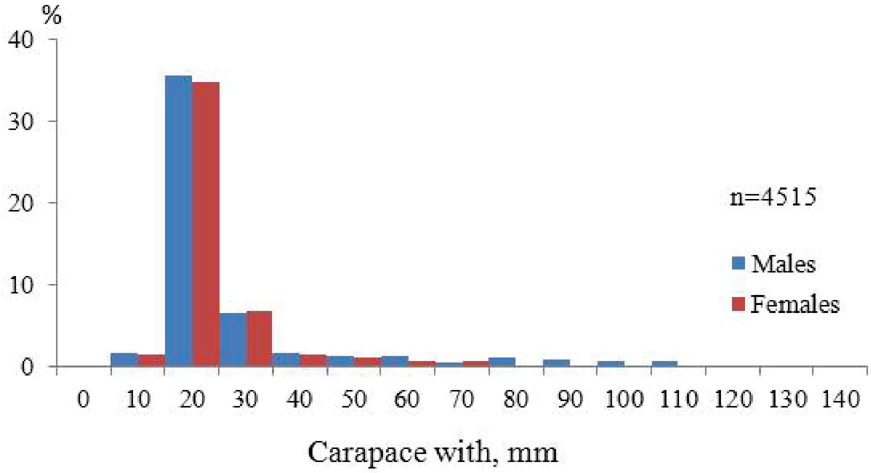


Figure 2.8.6. The size composition of the Snow crab (*Chionoecetes opilio*) population recorded by the Ecosystem Survey in August-October 2011.

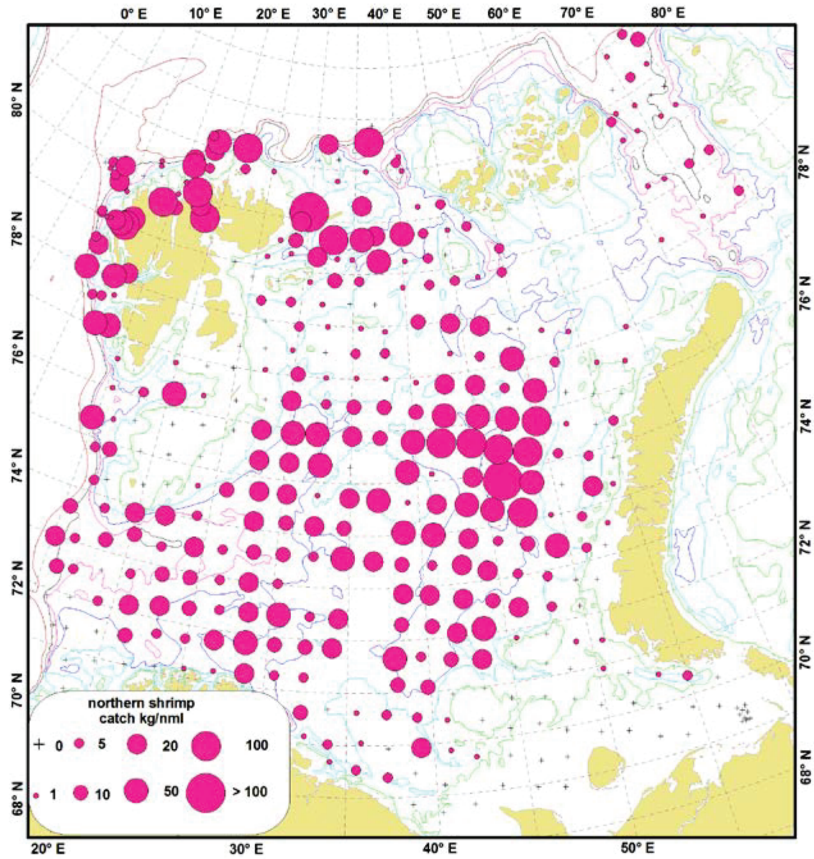


Figure 2.8.7. Distribution of northern shrimp (*Pandalus borealis*) as recorded by the Campelen bottom trawl on the Ecosystem Survey in August-October 2011.

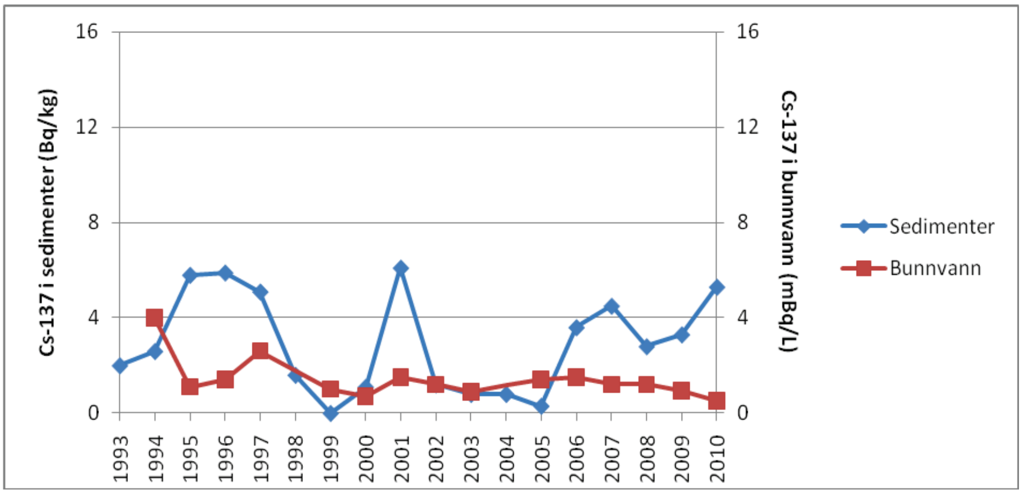


Figure 2.9.1. Levels of Cs-137 in sediments (left Y-axis, blue line) and bottom water (right Y-axis, red line) in the vicinity of the sunken Russian submarine "Komsomolets". The submarine rests at a depth of about 1700 m southwest of the Bear Island.

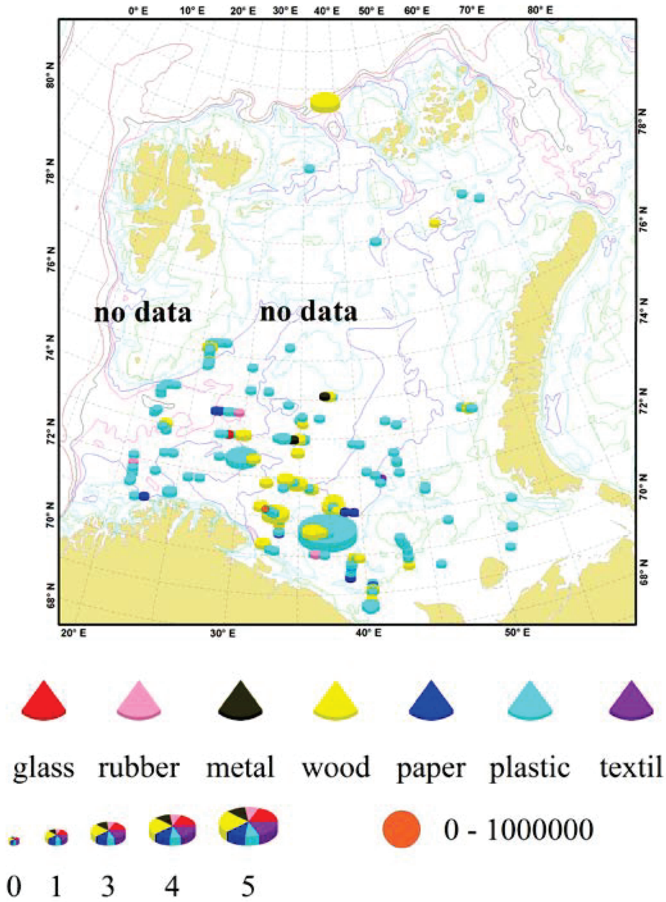


Figure 2.9.2. Type of garbage visible at surface (m^3, oil – 12 m^2).

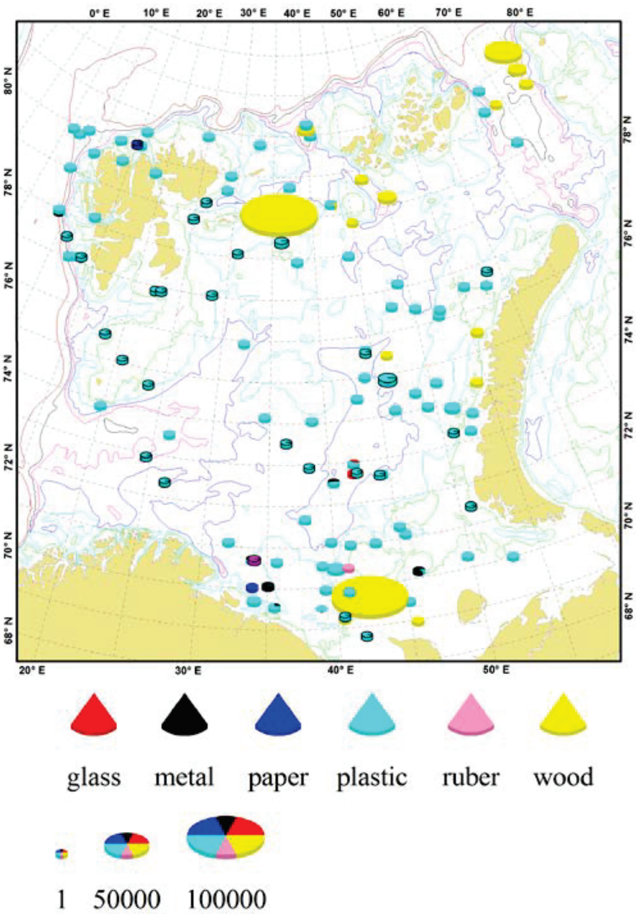


Figure 2.9.3. Type of garbage collected in pelagic and bottom trawl (g) (symbols with contour – in pelagic trawl, symbols without contour – in bottom trawl)

Figure 2.9.4. Some types of garbage collected in survey area in the 2011.

6 Appendices

Appendix 1 Ecosystem survey 2011

Research vessel	Participants
"Vilnyus" (11.08-02.10)	A.V. Amelkin, A.N. Benzik, D.V. Zakharov M.Y., Kalashnikova, S.A. Kharlin, P.V. Krivosheya, N.N. Lukin, P.A. I.V. Malkov, P.A. Murashko, M.A. Nosov, D.V. Prozorkevich (cruise leader), A.V. Semenov, A.G. Trofimov
"Christina E" (27.08-17.09)	J. Røttingen (cruise leader), I. M. Beck, A. Storaker, F. Midtøy, R. Wienerroither, H. Senneset, Y. Hunt, S. Wennerqvist, T. Haugland, J. Kristiansen, H. Gill, B. Skjold, B. Ellertsen, K. Gjertsen, O. Zimina, S. Murray, S. Sørensen
"Johan Hjort" (31.08-05.10)	Part 1 (31.08-14.09): J. Alvarez (cruise leader), E. Holm, J. Vedholm, H.Ø. Hansen, G. Bakke, J.E. Nygård, T. Hovland, E. Hermansen, B.V. Svendsen, J. Erices, A. Rey, T. A. Prokhorova, E. Grønningsæter, O. Ljubina, J. Wallenschus, T. Sivertsen, G. McCallum
	Part 2 (15.09-05.10): H. Gjøsæter (cruise leader), J. Alvarez, E. Holm, S. Kleven, T.H. Thangstad, M. Kvalsund, B. Kvinge, L. Drivenes, R. Pedersen, A.L. Johnsen, M. Martinussen, T. Jåvold, G. McCallum, T. A. Prokhorova, B. Røttingen, E. Grønningsæter, O. Ljubina, T. Sivertsen, G. McCallum
"Helmer Hanssen" (former "Jan Mayen") (09.08-24.08)	T. de L. Wenneck (cruise leader), M. Kvalsund, G. Langhelle, J. Skadal, H. Mjanger, S. Seim, T. Johansen, M. Mjanger, A.-K. Abrahamsen, J. Alvarez, I. Henriksen, J. Erices, O. Zimina, M. Buchholz-Sørensen, E. Grønningsæter, P. V. Dahlen, A. Kraft

Appendix 2. Sampling of fish in ecosystem survey 2011

Family	Latin name/ English name	Norwegian vessels	Russian vessels	Sum
Agonidae	*Leptagonus decagonus*/ Atlantic poacher			
	No of stations with samples	129	110	239
	Nos. length measured	528	980	1508
	Nos. aged	-	46	46
Agonidae	*Ulcina olrikii/* Arctic alligatorfish			
	No of stations with samples	-	32	32
	Nos. length measured	-	478	478
	Nos. aged	-	-	-
Ammodytidae	*Ammodytes marinus*/ Lesser sandeel			
	No of stations with samples	27	42	69
	Nos. length measured	72	545	617
	Nos. aged	-	-	-
Ammodytidae	*Ammodytes* sp./ Sandeels			
	No of stations with samples	1	-	1
	Nos. length measured	1	-	1
	Nos. aged	-	-	-
Ammodytidae	A*mmodytes tobianus*/ Small sandeel			
	No of stations with samples	-	2	2
	Nos. length measured	-	3	3
	Nos. aged	-	-	-
Anarhichadidae	*Anarhichas* sp./ Catfishes			
	No of stations with samples	2	5	7
	Nos. length measured	2	10	12
	Nos. aged	-	-	-
Anarhichadidae	*Anarhichas denticulatus*/ Northern wolffish			
	No of stations with samples	42	7	49
	Nos. length measured	62	8	70
	Nos. aged	-	-	-
Anarhichadidae	*Anarhichas lupus*/ Atlantic wolffish			
	No of stations with samples	56	11	67
	Nos. length measured	314	25	339
	Nos. aged	-	-	-
Anarhichadidae	*Anarhichas minor*/ Spotted wolffish			
	No of stations with samples	44	15	59
	Nos. length measured	98	36	134
	Nos. aged	-	-	-
Argentinidae	*Argentina silus*/ Greater argentine			
	No of stations with samples	31	-	31
	Nos. length measured	292	-	292
	Nos. aged	-	-	-
Carangidae	*Trachurus trachurus*/ Horse mackerel			
	No of stations with samples	1	-	1
	Nos. length measured	1	-	1
	Nos. aged	-	-	-
Chimaeridae	*Chimaera monstrosa*/ Rabbitfish			
	No of stations with samples	2	-	2
	Nos. length measured	2	-	2
	Nos. aged	-	-	-
Clupeidae	*Clupea harengus*/ Atlantic herring			
	No of stations with samples	86	19	105
	Nos. length measured	3628	221	3849
	Nos. aged	72	-	72

Family	Latin name/ English name	Norwegian vessels	Russian vessels	Sum
Clupeidae	*Clupea harengus*/ Kanin herring			
	No of stations with samples	-	12	12
	Nos. length measured	-	884	884
	Nos. aged	-	104	104
Cottidae	*Artediellus atlanticus*/ Atlantic hookear sculpin			
	No of stations with samples	170	93	263
	Nos. length measured	1755	1284	3039
	Nos. aged	-	-	-
Cottidae	*Artediellus scaber*/ Rough hamecon			
	No of stations with samples	-	5	5
	Nos. length measured	-	77	77
	Nos. aged	-	-	-
Cottidae	*Cottidae* g.sp./ Bullheads and Sculpins			
	No of stations with samples	3	22	25
	Nos. length measured	3	64	67
	Nos. aged	-	-	-
Cottidae	*Gymnocanthus tricuspis*/ Arctic staghorn sculpin			
	No of stations with samples	2	24	26
	Nos. length measured	7	251	258
	Nos. aged	-	63	63
Cottidae	*Icelus bicornis*/ Twohorn sculpin			
	No of stations with samples	31	3	34
	Nos. length measured	125	3	128
	Nos. aged	-	-	-
Cottidae	*Icelus spatula*/ Twohorn sculpin			
	No of stations with samples	-	30	30
	Nos. length measured	-	285	285
	Nos. aged	-	-	-
Cottidae	*Myoxocephalus aenaeus*/ Grubby			
	No of stations with samples	-	1	1
	Nos. length measured	-	1	1
	Nos. aged	-	1	1
Cottidae	*Myoxocephalus scorpius*/ Shorthhorn sculpin			
	No of stations with samples	6	-	6
	Nos. length measured	45	-	45
	Nos. aged	-	-	-
Cottidae	*Triglops murrayi*/ Moustache sculpin			
	No of stations with samples	47	15	62
	Nos. length measured	379	46	425
	Nos. aged	-	3	3
Cottidae	*Triglops nybelini*/ Bigeye sculpin			
	No of stations with samples	63	63	126
	Nos. length measured	760	440	1200
	Nos. aged	-	7	7
Cottidae	*Triglops pingelii/* Ribbed sculpin			
	No of stations with samples	7	20	27
	Nos. length measured	31	188	219
	Nos. aged	-	-	-
Cottidae	*Triglops* sp./			
	No of stations with samples	1	7	8
	Nos. length measured	1	7	8
	Nos. aged	-	-	-

Family	Latin name/ English name	Norwegian vessels	Russian vessels	Sum
Cyclopteridae	*Cyclopterus lumpus*/ Lumpsucker			
	No of stations with samples	97	35	132
	Nos. length measured	254	60	314
	Nos. aged	-	-	-
Cyclopteridae	*Eumicrotremus derjugini*/ Leatherfin lumpsucker			
	No of stations with samples	3	2	5
	Nos. length measured	3	4	7
	Nos. aged	-	-	-
Cyclopteridae	*Eumicrotremus spinosus*/ Atlantic spiny lumpsucker			
	No of stations with samples	20	2	22
	Nos. length measured	75	15	90
	Nos. aged	-	-	-
Gadidae	*Arctogadus glacialis*/ Arctic cod			
	No of stations with samples	10	5	15
	Nos. length measured	22	5	27
	Nos. aged	-	4	4
Gadidae	*Boreogadus saida*/ Polar cod			
	No of stations with samples	179	163	342
	Nos. length measured	6114	17760	23874
	Nos. aged	1394	425	1819
Gadidae	*Eleginus nawaga/* Atlantic navaga			
	No of stations with samples	-	10	10
	Nos. length measured	-	902	902
	Nos. aged	-	95	95
Gadidae	*Enchelyopus cimbrius*/ Fourbeard rockling			
	No of stations with samples	12	-	12
	Nos. length measured	41	-	41
	Nos. aged	-	-	-
Gadidae	*Gadiculus argenteus*/ Silvery pout			
	No of stations with samples	13	-	13
	Nos. length measured	115	-	115
	Nos. aged	-	-	-
Gadidae	*Gaidropsarus argentatus*/ Arctic threebearded rockling			
	No of stations with samples	4	-	4
	Nos. length measured	6	-	6
	Nos. aged	-	-	-
Gadidae	*Gadus morhua*/ Atlantic cod			
	No of stations with samples	390	209	599
	Nos. length measured	21872	11893	33765
	Nos. aged	1201	1357	2558
Gadidae	M*elanogrammus aeglefinus*/ Haddock			
	No of stations with samples	250	79	329
	Nos. length measured	8911	5399	14310
	Nos. aged	475	503	978
Gadidae	*Merlangius merlangius/* Whiting			
	No of stations with samples	4	1	5
	Nos. length measured	11	2	13
	Nos. aged	-	-	-
Gadidae	*Micromesistius poutassou/* Blue whiting			
	No of stations with samples	57	-	57
	Nos. length measured	762	-	762
	Nos. aged	76	-	76

Family	Latin name/ English name	Norwegian vessels	Russian vessels	Sum
Gadidae	*Molva molva*/ Ling			
	No of stations with samples	3	-	3
	Nos. length measured	4	-	4
	Nos. aged	-	-	-
Gadidae	*Pollachius virens*/ Saithe			
	No of stations with samples	21	5	26
	Nos. length measured	142	7	149
	Nos. aged	-	3	3
Gadidae	*Trisopterus esmarkii*/ Norway pout			
	No of stations with samples	63	10	73
	Nos. length measured	1710	630	2340
	Nos. aged	-	-	-
Gasterosteidae	*Gasterosteus aculeatus*/ Three-spined stickleback			
	No of stations with samples	-	11	11
	Nos. length measured	-	178	178
	Nos. aged	-	-	-
Liparidae	*Careproctus* sp./			
	No of stations with samples	38	-	38
	Nos. length measured	94	-	94
	Nos. aged	-	-	-
Liparidae	*Careproctus micropus*/			
	No of stations with samples	-	17	17
	Nos. length measured	-	27	27
	Nos. aged	-	-	-
Liparidae	*Careproctus reinhardii*/ Sea tadpole			
	No of stations with samples	-	25	25
	Nos. length measured	-	49	49
	Nos. aged	-	8	8
Liparidae	*Liparis fabricii*/ Gelatinous snailfish			
	No of stations with samples	62	57	119
	Nos. length measured	618	1924	2542
	Nos. aged	-	5	5
Liparidae	*Liparis gibbus*/ Variagated snailfish			
	No of stations with samples	11	14	25
	Nos. length measured	72	44	116
	Nos. aged	-	3	3
Liparidae	*Liparis montague*/ Montagu's sea snail			
	No of stations with samples	-	1	1
	Nos. length measured	-	3	3
	Nos. aged	-	-	-
Liparidae	*Liparis* sp./ Sea snails			
	No of stations with samples	7	22	29
	Nos. length measured	83	157	240
	Nos. aged	-	-	-
Lophiidae	*Lophius piscatorius*/ Anglerfish			
	No of stations with samples	1	-	1
	Nos. length measured	1	-	1
	Nos. aged	-	-	-
Lotidae	*Brosme brosme*/ Cusk			
	No of stations with samples	15	1	16
	Nos. length measured	39	1	40
	Nos. aged	-	-	-

Family	Latin name/ English name	Norwegian vessels	Russian vessels	Sum
Macrouridae	*Macrourus berglax*/ Rough rattail			
	No of stations with samples	8	-	8
	Nos. length measured	17	-	17
	Nos. aged	-	-	-
Myctophidae	*Benthosema glaciale*/ Glacier lanternfish			
	No of stations with samples	27	15	42
	Nos. length measured	104	28	132
	Nos. aged	-	-	-
Myctophidae	*Lampanyctus* sp./			
	No of stations with samples	-	2	2
	Nos. length measured	-	2	2
	Nos. aged	-	-	-
Myctophidae	*Lampanyctus macdonaldi*/ Rakery beaconlamp			
	No of stations with samples	1	-	1
	Nos. length measured	1	-	1
	Nos. aged	-	-	-
Myctophidae	*Notoscopelus* sp./			
	No of stations with samples	5	-	5
	Nos. length measured	25	-	25
	Nos. aged	-	-	-
Osmeridae	*Mallotus villosus*/ Capelin			
	No of stations with samples	300	221	521
	Nos. length measured	17043	18099	35142
	Nos. aged	3508	905	4413
Osmeridae	*Osmerus eperlanus*/ European smelt			
	No of stations with samples	-	8	8
	Nos. length measured	-	66	66
	Nos. aged	-	66	66
Paralepididae	*Arctozenus risso*/ White barracudina			
	No of stations with samples	14	3	17
	Nos. length measured	39	3	42
	Nos. aged	-	-	-
Petromyzontidae	*Lethenteron japonicum*/			
	No of stations with samples	-	2	2
	Nos. length measured	-	2	2
	Nos. aged	-	-	-
Pleuronectidae	*Hippoglossoides platessoides*/ Long rough dab			
	No of stations with samples	247	176	423
	Nos. length measured	4538	10624	15162
	Nos. aged	-	168	168
Pleuronectidae	*Hippoglossus hippoglossus*/ Atlantic halibut			
	No of stations with samples	1	-	1
	Nos. length measured	3	-	3
	Nos. aged	-	-	-
Pleuronectidae	*Limanda limanda*/ Dab			
	No of stations with samples	-	5	5
	Nos. length measured	-	14	14
	Nos. aged	-	1	1
Pleuronectidae	*Microstomus kitt*/ Lemon sole			
	No of stations with samples	4	-	4
	Nos. length measured	11	-	11
	Nos. aged	-	-	-

Family	Latin name/ English name	Norwegian vessels	Russian vessels	Sum
Pleuronectidae	*Pleuronectes glacialis*/ Arctic flounder			
	No of stations with samples	-	8	8
	Nos. length measured	-	106	106
	Nos. aged	-	76	76
Pleuronectidae	*Pleuronectes platessa*/ European plaice			
	No of stations with samples	1	18	19
	Nos. length measured	1	226	227
	Nos. aged	-	86	86
Pleuronectidae	*Reinhardtius hippoglossoides*/ Greenland halibut			
	No of stations with samples	127	70	197
	Nos. length measured	2541	1098	3639
	Nos. aged	415	459	874
Psychrolutidae	*Cottunculus microps/* Polar sculpin			
	No of stations with samples	16	15	31
	Nos. length measured	35	88	123
	Nos. aged	-	-	-
Psychrolutidae	*Cottunculus sadko*/ Sadko sculpin			
	No of stations with samples	-	11	11
	Nos. length measured	-	18	18
	Nos. aged	-	-	-
Rajidae	*Amblyraja hyperborean*/ Arctic skate			
	No of stations with samples	8	30	38
	Nos. length measured	15	42	57
	Nos. aged	-	-	-
Rajidae	*Amblyraja radiate*/ Thorny skate			
	No of stations with samples	80	50	130
	Nos. length measured	153	184	337
	Nos. aged	-	-	-
Rajidae	*Bathyraja spinicauda/* Spinetail ray			
	No of stations with samples	2	-	2
	Nos. length measured	2	-	2
	Nos. aged	-	-	-
Rajidae	*Dipturus linteus/* Sailray			
	No of stations with samples	1	-	1
	Nos. length measured	1	-	1
	Nos. aged	-	-	-
Rajidae	*Rajella fyllae*/ Round ray			
	No of stations with samples	20	-	20
	Nos. length measured	23	-	23
	Nos. aged	-	-	-
Salmonidae	*Salmo salar/* Atlantic salmon			
	No of stations with samples	1	-	1
	Nos. length measured	1	-	1
	Nos. aged	-	-	-
Scombridae	*Scomber scombrus*/ Mackerel			
	No of stations with samples	1	-	1
	Nos. length measured	1	-	1
	Nos. aged	-	-	-
Scorpaenidae	*Sebastes marinus*/ Golden redfish			
	No of stations with samples	22	11	33
	Nos. length measured	76	124	200
	Nos. aged	27	6	33

Family	Latin name/ English name	Norwegian vessels	Russian vessels	Sum
Scorpaenidae	*Sebastes mentella/* Deepwater redfish			
	No of stations with samples	146	53	199
	Nos. length measured	5752	661	6413
	Nos. aged	518	16	534
Scorpaenidae	*Sebastes* sp./ Redfishes			
	No of stations with samples	110	7	117
	Nos. length measured	2871	31	2902
	Nos. aged	-	-	-
Scorpaenidae	*Sebastes viviparus* / Norway redfish			
	No of stations with samples	25	-	25
	Nos. length measured	325	-	325
	Nos. aged	-	-	-
Squalidae	*Somniosus microcephalus*/ Greenland shark			
	No of stations with samples	-	1	1
	Nos. length measured	-	1	1
	Nos. aged	-	-	-
Sternoptychidae	*Maurolicus muelleri*/ Pearlside			
	No of stations with samples	28	2	30
	Nos. length measured	130	2	132
	Nos. aged	-	-	-
Stichaeidae	*Anisarchus medius*/ Stout eelblenny			
	No of stations with samples	13	4	17
	Nos. length measured	42	19	61
	Nos. aged	-	-	-
Stichaeidae	L*eptoclinus* sp., *Lumpenu*s sp./			
	No of stations with samples	-	1	1
	Nos. length measured	-	3	3
	Nos. aged	-	-	-
Stichaeidae	*Leptoclinus maculates*/ Daubed shanny			
	No of stations with samples	156	114	270
	Nos. length measured	1700	971	2671
	Nos. aged	-	-	-
Stichaeidae	*Lumpenus lampretaeformis*/Snake blenny			
	No of stations with samples	56	22	78
	Nos. length measured	385	119	504
	Nos. aged	-	-	-
Triglidae	*Eutrigla gurnardus*/ Grey gurnard			
	No of stations with samples	3	-	3
	Nos. length measured	3	-	3
	Nos. aged	-	-	-
Zoarcidae	*Gymnelus retrodorsalis*/ Aurora unernak			
	No of stations with samples	4	-	4
	Nos. length measured	6	-	6
	Nos. aged	-	-	-
Zoarcidae	*Gymnelus viridis*/ Fish doctor			
	No of stations with samples	1	3	4
	Nos. length measured	4	3	7
	Nos. aged	-	-	-
Zoarcidae	*Lycodes esmarkii*/ Esmark's eelpout			
	No of stations with samples	16	-	16
	Nos. length measured	86	-	86
	Nos. aged	-	-	-

Family	Latin name/ English name	Norwegian vessels	Russian vessels	Sum
Zoarcidae	*Lycodes eudipleurostictus*/ Double line eelpout			
	No of stations with samples	21	5	26
	Nos. length measured	79	17	96
	Nos. aged	-	-	-
Zoarcidae	Lycodes gracilis/ Vahl's eelpout			
	No of stations with samples	63	6	69
	Nos. length measured	272	13	285
	Nos. aged	-	-	-
Zoarcidae	Lycodes luetkenii/ Lutken's eelpout			
	No of stations with samples	-	2	2
	Nos. length measured	-	7	7
	Nos. aged	-	-	-
Zoarcidae	Lycodes pallidus/ Pale eelpout			
	No of stations with samples	34	40	74
	Nos. length measured	102	245	347
	Nos. aged	-	-	-
Zoarcidae	Lycodes polaris/ Canadian eelpout			
	No of stations with samples	1	9	10
	Nos. length measured	1	32	33
	Nos. aged	-	-	-
Zoarcidae	Lycodes reticulates/ Arctic eelpout			
	No of stations with samples	32	18	50
	Nos. length measured	57	105	162
	Nos. aged	-	15	15
Zoarcidae	Lycodes rossi/ Threespot eelpout			
	No of stations with samples	20	31	51
	Nos. length measured	50	86	136
	Nos. aged	-	-	-
Zoarcidae	Lycodes seminudus/ Longear eelpout			
	No of stations with samples	14	32	46
	Nos. length measured	41	180	221
	Nos. aged	-	1	1
Zoarcidae	Lycodes squamiventer/ Scalebelly eelpout			
	No of stations with samples	1	2	3
	Nos. length measured	1	6	7
	Nos. aged	-	-	-
Zoarcidae	Lycodonus flagellicauda/			
	No of stations with samples	2	-	2
	Nos. length measured	8	-	8
	Nos. aged	-	-	-
Zoarcidae	Lycenchelys kolthoffi/ Checkered wolf eel			
	No of stations with samples	3	3	6
	Nos. length measured	5	12	17
	Nos. aged	-	-	-
Zoarcidae	Lychenchelus muraena/ Moray wolf eel			
	No of stations with samples	2	-	2
	Nos. length measured	2	-	2
	Nos. aged	-	-	-

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

Appendix 3. List of identified invertebrate taxa and their observed frequency in the Campelen trawl per research vessel in the Barents sea ecosystem survey 2011.

CE – Christina E, HH – Helmer Hanssen, JH – Johan Hjort, VI – Vilnyus.

Phylum	Class	Taxa	CE	HH	JH	VI
Porifera		*Porifera* g. sp.	29	45	55	6
	Calcarea	*Sycon* sp.			1	
	Demospongiae	*Asbestopluma* sp.			1	
		Chondrocladia gigantea		3	1	
		Forcepia sp.			1	
		Geodia barretti	7	6	6	
		Geodia macandrewii	8	1	7	
		Geodia sp.	1	4	5	2
		Haliclona sp.		2	4	
		Haliclona ventilabrum				1
		Mycale lingua			8	
		Mycale sp.			5	
		Myxilla incrustans			1	
		Myxilla sp.		4		
		Phakellia sp.		5	10	2
		Polymastia sp.	2	5	6	23
		Polymastia thielei		2		
		Polymastia uberrima	2	10	8	
		Radiella grimaldi	20	11	24	22
		Radiella hemisphaericum	13	1	7	
		Radiella sarsi				1
		Sphaerotylus borealis	2			
		Stylocordyla borealis	2	3		
		Stylocordyla sp.				1
		Suberites ficus		1	5	
		Suberites sp.	1		1	5
		Tentorium semisuberites	4	15	16	
		Tethya aurantium			5	
		Tethya norvegica	3	13		
		Tetilla cranium	6	6	4	
		Tetilla polyura	19	4	5	
		Tetilla sp.	1			
		Thenea muricata	21	9	10	
Cnidaria	Anthozoa	*Actiniaria* g. sp.	5	7	19	102
		Actinostola sp.			1	
		Anthozoa g. sp.	2	1	3	3
		Caryophyllia smithii	3			
		Cerianthus lloydi			1	
		Drifa glomerata	6	28	21	47
		Duva florida		11	32	
		Epizoanthus incrustatus	1		10	
		Epizoanthus sp.	2	3	6	1
		Gersemia fruticosa	1		15	
		Gersemia rubiformis	21	15	11	2
		Gersemia sp.			1	77
		Hormathia digitata	45	53	53	31
		Hormathia sp.	1			
		Metridium sp.			1	
		Umbellula encrinus		4		13

Phylum	Class	Taxa	CE	HH	JH	VI
Cnidaria cont.	Anthozoa cont.	*Urticina felina*	18	3		
	Hydrozoa	*Abietinaria abietina*			23	
		Campanularia sp.			5	
		Halecium muricatum	1	3	11	
		Halecium sp.			8	
		Hydrallmania falcata			14	
		Hydroidea g. sp.	2	18	12	
		Hydrozoa g. sp.			5	1
		Ptychogena lactea			1	
		Sertularella sp.			2	
		Sertularia mirabilis			8	
		Sertulariidae g. sp.				
		Symplectoscyphus tricuspidatus			13	
		Thuiaria carica			1	
		Thuiaria lonchitis			3	
		Thuiaria sp.			3	
		Thuiaria thuja	1			
		Tubularia sp.	1			
	Scyphozoa	*Cyanea capillata*			1	
		Scyphozoa g. sp.			9	
Plathelminthes		*Plathelmintes* g. sp.		1	3	
	Turbellaria	*Turbellaria* g. sp.			5	3
Nemertini	Nemertini	*Nemertini* g. sp.	6	2	13	13
Annelida	Polychaeta	*Ampharetidae* g. sp.			3	
		Aphrodita sp.		6		
		Aphroditidae g. sp.			3	
		Brada granulata	2	11		1
		Brada granulosa	14		14	1
		Brada inhabilis	30	22	34	35
		Brada sp.			2	
		Brada villosa			5	1
		Eunice norvegica			1	
		Eunice sp.	2			
		Eunicidae g. sp.			2	
		Euphrosine borealis				1
		Euphrosine sp.	1		5	
		Glycera sp.			2	
		Harmothoe sp.	23	37	11	50
		Laetmonice filicornis	5			
		Lumbrineris sp.	2	2	2	
		Maldane sp.		2	2	
		Maldanidae g. sp.	1	1	4	
		Nephtyidae g. sp.		1	2	
		Nephtys sp.		6	10	8
		Nereis sp.	2			
		Nothria hyperborea			6	
		Pectinaria hyperborea	4	6	16	3
		Phyllodocidae g. sp.			1	
		Polychaeta g. sp.	5	7	14	26
		Polynoidae g. sp.			48	
		Polyphisia sp.		1	1	
		Sabellidae g. sp.	8	2	2	

Phylum	Class	Taxa	CE	HH	JH	VI
Annelida cont.	Polychaeta cont.	*Serpulidae* g. sp.				
		Spiochaetopterus typicus		1		
		Terebellidae g. sp.	7		23	
Cephalorhyncha	Priapulida	*Priapulidae* g. sp.			1	
		Priapulopsis bicaudatus			2	7
		Priapulus caudatus	1	1	3	
Echiura	Echiurida	*Echiurus echiurus echiurus*				3
		Hamingia arctica	9		4	3
Sipuncula	Sipunculidea	*Golfingia* sp.	2	4	2	
		Golfingia vulgaris vulgaris		1	1	
		Nephasoma sp.		1		
		Phascolion strombus strombus	14	6	1	
		Sipunculidea g. sp.	1		5	15
Arthropoda		Crustacea g. sp.				1
	Cirripedia	*Balanus balanus*	1	9	8	
		Balanus crenatus			2	
		Balanus sp.			5	9
		Scalpellum sp.			3	
		Semibalanus balanoides				1
	Malacostraca	*Acanthostepheia malmgreni*	4	2	10	
		Aega psora			7	
		Aega sp.			1	
		Amathillopsis spinigera				1
		Ampelisca eschrichti	1		3	
		Amphipoda g. sp.			2	11
		Anonyx nugax	15	1	31	
		Anonyx sp.				15
		Arrhis phyllonyx			3	
		Atylus smitti	1		1	
		Boreomysis arctica		3		
		Bythocaris biruli				11
		Bythocaris payeri		4		
		Bythocaris sp.				2
		Calathura brachiata			1	
		Chionoecetes opilio	8		4	65
		Cleippides quadricuspis		1		9
		Diastylis goodsiri			2	
		Diastylis sp.			2	
		Epimeria loricata	17	15	29	6
		Eualus gaimardi			11	11
		Eualus sp.				1
		Eurythenes gryllus		2		
		Eusirus cuspidatus		1		
		Eusirus holmi		5		3
		Gammaridae g. sp.				3
		Gammarus wilkitzkii		3	7	
		Haploops setosa			1	
		Hyas araneus	4	22	18	53
		Hyas coarctatus	17	8	5	4
		Hymenodora glacialis		3		
		Isopoda g. sp.			1	2
		Lebbeus polaris	13	20	39	49
		Lepidepecreum umbo			1	

Phylum	Class	Taxa	CE	HH	JH	VI
Arthropoda cont.	Malacostraca cont.	*Lithodes maja*			2	1
		Meganyctiphanes norvegica			25	
		Munida bamffica	9		12	
		Munnopsis sp.			1	
		Onisimus sp.		6		
		Pagurus bernhardus			2	2
		Pagurus pubescens	13	27	24	29
		Pandalus borealis	59	53	66	126
		Pandalus montagui	3	7	5	
		Paralithodes camtschaticus	1			3
		Paramphithoe hystrix	4	7	16	5
		Pardalisca abyssi			1	
		Paroediceros lynceus			1	
		Pasiphaea multidentata	1	6	1	10
		Pasiphaea sivado				5
		Pasiphaea sp.		3		1
		Pasiphaea tarda		5		
		Pontophilus norvegicus	29	14	15	
		Rhachotropis aculeata	3	8	16	
		Rhachotropis helleri			1	
		Sabinea sarsi	4	18	11	
		Sabinea septemcarinata	27	36	65	132
		Sabinea sp.		1		
		Saduria sabini	14		11	40
		Saduria sabini sabini				1
		Saduria sibirica				1
		Sargestes arcticus		1		3
		Sclerocrangon boreas		12	11	11
		Sclerocrangon ferox	12	21	32	53
		Socarnes bidenticulatus			2	
		Spirontocaris lilljeborgii	4			
		Spirontocaris spinus	8	9	24	11
		Stegocephalus inflatus	10	12	25	23
		Themisto libellula		9	12	
		Thysanoessa inermis			5	
		Tmetonyx cicada	1		7	
		Unciola leucopis			1	
	Pycnogonida	*Ascorhynchus abyssi*		1		
		Boreonymphon robustum	16	18	27	
		Colossendeis angusta	1	4		
		Colossendeis proboscidea	5	6	1	
		Colossendeis sp.				36
		Cordylochele brevicolis	3		1	
		Cordylochele malleolata		3	5	
		Nymphon elegans			3	
		Nymphon grossipes			1	
		Nymphon hirtipes			37	
		Nymphon hirtum			7	
		Nymphon serratum	1		1	
		Nymphon sp.	1	27	1	
		Nymphon spinosum	16			
		Nymphon stroemi stroemi	20	35	21	
		Pycnogonida g. sp.		1	2	56

Phylum	Class	Taxa	CE	HH	JH	VI
Arthropoda cont.	Pycnogonida cont.	*Pycnogonum litorale*			1	
Mollusca	Bivalvia	*Anomia* sp.				1
		Arctinula greenlandica	12	2	12	14
		Astarte arctica			1	
		Astarte borealis				9
		Astarte crenata		1	35	34
		Astarte elliptica			1	
		Astarte sp.	25	28		
		Bathyarca glacialis	25	8	11	23
		Bathyarca pectunculoides		4		
		Bivalvia g. sp.		1	4	
		Chlamys islandica	12	19	20	49
		Chlamys sp.	1			
		Chlamys sulcata			4	
		Clinocardium ciliatum	10	10	14	22
		Cuspidaria arctica	3	4	7	6
		Cuspidaria sp.	1			
		Delectopecten vitreus	1	1	1	
		Hiatella arctica	8	4	16	12
		Hiatella rugosa			1	
		Leionucula tenuis			1	
		Macoma calcarea			2	
		Macoma sp.				1
		Modiolus modiolus	2			10
		Musculus discors		1		
		Musculus laevigatus			4	
		Musculus niger			2	
		Mya sp.	2			
		Mya truncata			2	3
		Nucula sp.				1
		Nuculana pernula			1	
		Pseudamussium septemradiatum	12	13		
		Serripes groenlandicus				3
		Yoldia hyperborea	1	2	2	
		Yoldiella intermedia			1	
		Yoldiella lenticula				1
		Yoldiella sp.				5
		Yoldiidae g. sp.				1
	Cephalopoda	*Bathypolypus arcticus*	4	23	2	6
		Benthoctopus sp.		2	2	14
		Cirroteuthis muelleri		1		
		Gonatus fabricii	11	17	9	3
		Rossia moelleri		4		1
		Rossia palpebrosa	1	11	12	32
		Rossia sp.		2	2	
	Gastropoda	*Admete* sp.	1			
		Aldisia zetlandica			1	
		Beringius ossiani	6	5	3	5
		Boreotrophon clathratus			1	
		Boreotrophon sp.				2
		Boreotrophon truncatus			1	
		Buccinidae g. sp.			1	
		Buccinum angulosum				5

Phylum	Class	Taxa	CE	HH	JH	VI
Mollusca cont.	Gastropoda cont.	*Buccinum belcheri*			2	1
		Buccinum ciliatum ciliatum			1	1
		Buccinum ciliatum sericatum		3	1	
		Buccinum cyaneum			1	
		Buccinum elatior		4	3	16
		Buccinum finmarchianum	4	5	10	1
		Buccinum fragile	5	5	5	15
		Buccinum glaciale		1	3	5
		Buccinum hydrophanum	8	23	22	41
		Buccinum maltzani				1
		Buccinum micropoma		1	2	
		Buccinum nivale			1	
		Buccinum polare			1	
		Buccinum sp.		3	1	4
		Buccinum undatum		2	1	4
		Bulbus smithi	10		3	
		Cadlina laevis			1	
		Capulacmaea radiata			6	3
		Clione limacina			17	
		Colus altus		2	1	7
		Colus glaber			1	
		Colus holboelli	9			
		Colus islandicus	6	4	2	11
		Colus kroyeri			2	
		Colus pubescens		1	2	
		Colus sabini	22	17	26	83
		Colus sp.		1		
		Colus turgidulus			4	1
		Cryptonatica affinis	4	15	16	10
		Cylichna alba			1	
		Dendronotus frondosus			4	
		Dendronotus sp.	1	1	8	
		Eggs *Buccinidae* g. sp.	1			13
		Eggs *Gastropoda* g. sp.			3	1
		Eggs *Naticidae* g. sp.				2
		Gastropoda g. sp.		2	3	
		Iphinoe kroyery				1
		Limneria undata	2		4	7
		Lunatia pallida	2		12	6
		Margarites costalis	1		4	2
		Margarites groenlandicus groenlandicus		1	9	4
		Margarites sp.	3		1	
		Mohnia mohni	1			
		Naticidae g. sp.		1	1	
		Neptunea communis				1
		Neptunea denselirata		1	5	6
		Neptunea despecta	11	12	2	4
		Neptunea sp.			1	
		Neptunea ventricosa				1
		Nudibranchia g. sp.	10	13	9	10
		Oenopota harpa				1

Phylum	Class	Taxa	CE	HH	JH	VI
Mollusca cont.	Gastropoda cont.	*Onchidiopsis glacialis*	4		4	3
		Onchidoridae g. sp.	2		2	
		Philine finmarchica				9
		Philinidae g. sp.	5	7	22	
		Propebela assimilis				1
		Propebela sp.				2
		Scaphander punctostriatus	2		1	3
		Scaphander sp.		3		
		Tachyrhynchus reticulatus			1	
		Turrisipho dalli			2	
		Turrisipho lachesis	4	8	6	19
		Turrisipho voeringi	1			
		Velutina sp.			3	
		Velutina velutina			1	
		Volutopsis norvegicus	1	5	6	7
	Polyplacophora	*Hanleya nagelfar*	2		4	
		Polyplacophora g. sp.		1	3	2
	Solenogastres	*Proneomenia sluiteri*	2	3	1	
		Proneomenia sp.			1	
		Solenogastres g. sp.	2	3		
Echinodermata	Asteroidea	*Asterias rubens*			1	
		Asterias sp.			1	
		Asteriidae g. sp.			1	
		Bathybiaster vexillifer		1		15
		Ceramaster granularis granularis	15	6	3	
		Crossaster papposus	11	35	18	48
		Ctenodiscus crispatus	45	48	53	116
		Henricia sp.	30	41	26	41
		Hippasteria phrygiana phrygiana	11	9	1	9
		Hymenaster pellucidus	5	14	7	24
		Icasterias panopla	12	33	29	66
		Korethraster hispidus			1	
		Leptasterias muelleri		7		
		Leptasterias sp.			10	22
		Leptychaster arcticus	13	9	3	
		Lophaster furcifer	5	14	9	16
		Pontaster tenuispinus	45	23	51	73
		Poraniomorpha hispida	14	4	2	
		Poraniomorpha sp.	1			
		Poraniomorpha tumida	4	10	7	30
		Pseudarchaster parelii	4			
		Pteraster militaris	12	26	14	28
		Pteraster obscurus	1	24	5	5
		Pteraster pulvillus	14	25	19	6
		Solaster endeca	1	6	13	
		Solaster sp.				37
		Solaster syrtensis	6	6	3	
		Stichastrella rosea	1			
		Tylaster willei				2
		Urasterias linckii	16	17	21	80
	Crinoidea	*Heliometra glacialis*	5	14	24	47
		Poliometra prolixa		11	4	
	Echinoidea	*Brisaster fragilis*	17			

Phylum	Class	Taxa	CE	HH	JH	VI
Echinodermata cont	Echinoidea cont.	*Echinus acutus*	9			
		Echinus esculentus			3	
		Spatangus purpureus	2			
		Strongylocentrotus droebachiensis		1	1	1
		Strongylocentrotus pallidus	25	33	45	72
		Strongylocentrotus sp.	4	12	1	
	Holothuroidea	*Cucumaria frondosa*			5	8
		Ekmania barthi	2	1		
		Holothuroidea g. sp.			1	2
		Molpadia arctica				4
		Molpadia borealis	31	14	29	44
		Myriotrochus rinkii	9	1	18	9
		Phyllophoridae g. sp.				9
		Psolus phantapus	5	5	3	19
		Psolus squamatus			1	
		Stichopus tremulus	5		6	
		Thyonidium sp.		1		
	Ophiuroidea	*Gorgonocephalus arcticus*	1	16	27	64
		Gorgonocephalus eucnemis	2	8	16	27
		Gorgonocephalus lamarcki			2	
		Gorgonocephalus sp.	2	13	3	1
		Ophiacantha bidentata	17	34	57	104
		Ophiocten sericeum	1	2	2	20
		Ophiopholis aculeata	30	53	63	55
		Ophiopleura borealis		6	20	59
		Ophioscolex glacialis	12	38	43	60
		Ophiura robusta			1	
		Ophiura sarsi	36	50	29	49
		Ophiuridae g. sp.			1	
Brachiopoda		*Brachiopoda* g. sp.			1	
	Rhynchonellata	*Hemithyris psittacea*	3	4	11	7
		Macandrevia cranium	9		3	
		Terebratulina retusa	7	14		
		Terebratulina sp.			8	
Bryozoa	Gymnolaemata	*Alcyonidium disciforme*			3	3
		Alcyonidium gelatinosum		1	28	4
		Alcyonidium sp.		1	4	1
		Bryozoa g. sp.	1	17	3	1
		Cellepora sp.	2		9	
		Defrancia lucernaria			2	
		Diplosolen intricarius		7	2	
		Eucratea loricata			17	
		Flustra sp.	1		22	2
		Flustridae g. sp.			1	
		Idmidronea sp.	1			
		Myriapora coarctata			1	
		Myriapora sp.		5		
		Myriozoella sp.				
		Parasmittina jeffreysii			2	
		Porella sp.			6	
		Retepora sp.	1		4	
		Sertella septentrionalis	1	21	5	
		Stegohornera lichenoides	1	9	12	

Phylum	**Class**	**Taxa**	**CE**	**HH**	**JH**	**VI**
Chordata cont.	Ascidiacea cont.	Ascidia prunum	19	4	17	
		Ascidia sp.		1		
		Ascidiacea g. sp.	10	16	12	37
		Boltenia echinata				2
		Botryllus schlosseri			18	
		Ciona intestinalis	5	4		13
		Didemnum albidum				
		Microcosmus glacialis			3	
		Pelonaia corrugata			1	
		Styela rustica		4	1	
		Styela sp.			3	
		Synoicum tirgens		1	1	

JOINT REPORT

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