IMR/PINRO
JOINT REPORT SERIES
Nr. 1-2016

JOINT REPORT

Survey report from the joint Norwegian/Russian ecosystem Survey in the Barents Sea and adjacent waters, August – October 2015

Institute of Marine Research - IMR

Polar Research Institute of Marine Fisheries and Oceanography - PINRO

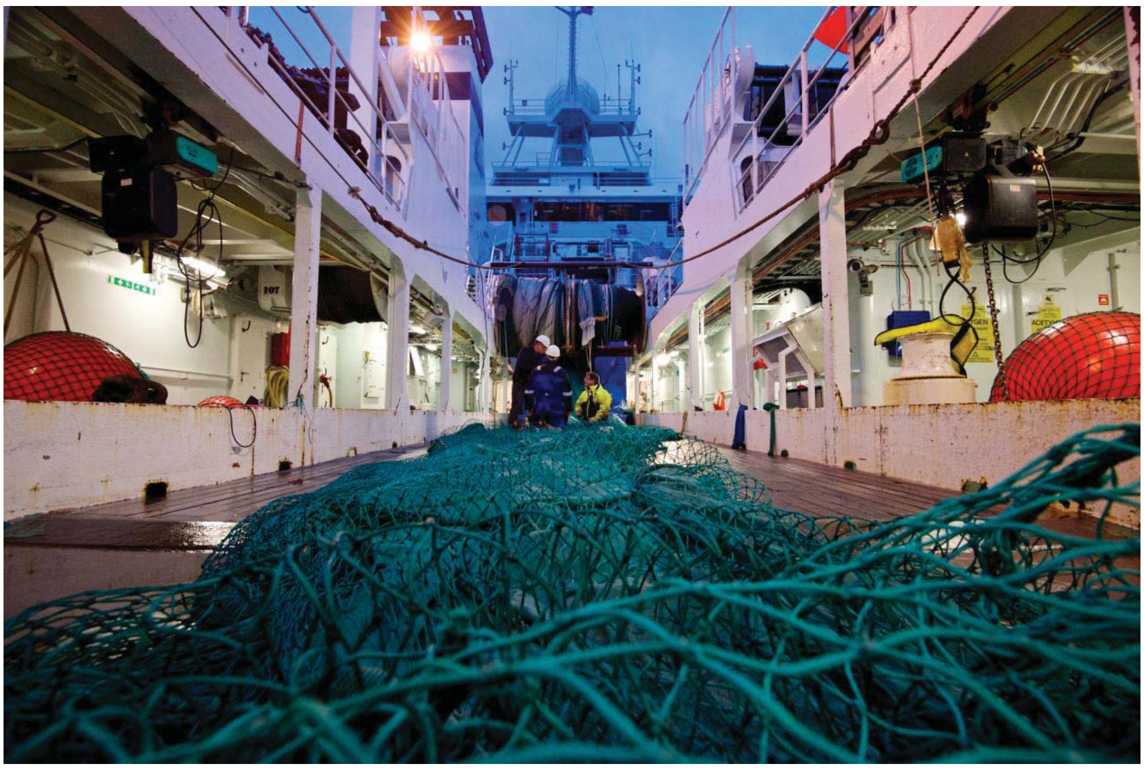
This report should be cited as:
Prozorkevich, D. Sunnanå K. 2016 (Ed.) Survey report from the joint Norwegian/Russian ecosystem survey in the Barents Sea and adjacent waters, August-October 2015. IMR/PINRO Joint Report Series, No. 1/2016, 77 pp. ISSN 1502-8828

The chapters of this report should be cited as:
Author's names. 2016. Chapter's name. In: Prozorkevich, D. Sunnanå K. 2016. (Ed.) Survey report from the joint Norwegian/Russian ecosystem survey in the Barents Sea and adjacent waters, August-October 2015. IMR/PINRO Joint Report eries, No. 1/2016. ISSN 1502-8828 147 pages.

Survey report

from the joint Norwegian/Russian ecosystem Survey

in the Barents Sea and adjacent waters, August – October 2015



Brainstorming on board G.O.Sars. Experimental pelagic trawl under development and testing

Photo: Aleksander Pavlenko (PINRO)

Bergen, February 2016

Innhold

1 Background

The aim of the survey is to monitor the status and changes of the Barents Sea ecosystem. The survey plan and tasks were agreed upon at the annual IMR-PINRO Meeting in March 2015. However, the agreed cruise plan was not followed for several reasons. IMR changed the the cruise tracks of “G.O.Sars” and thus the timing of the coverage of different parts of the Barents Sea. This corrupted the synoptic coverage of the south-western part of Barents Sea. PINRO experienced a delayed cruise start with the vessel “Vilnyus”. This corrupted the synoptic coverage of the area along the Novaya Zemlya. The problems with changed cruise plan mainly influenced the survey estimates of 0-group and polar cod.

It should be also noted that the annual Norwegian-Russian Fishing Commission in recent years have assembled in early October, some days after the survey is finished. All survey data, especially capelin data for the Barents Sea capelin assessment, must be prepared prior to the Commission. Therefore, it is important to avoid any delay of the survey start in the future.

The survey procedures were not followed by “Vilnyus” and “G.O. Sars” in the first part of the cruise. About the first 40 pelagic trawl hauls taken with small meshed net mounted inside of pelagic trawl at “Vinluys”. “G.O. Sars” followed neither standard trawling procedures (towed the pelagic trawl with high speed) nor procedure for treatment of the catch.

The Norwegian vessels did not carried out bottom trawl in the Loop hole in the Barents Sea, outside the economic zones. This was due to discrepancies in national legislations. This issue have not been discussed at the pre-planning survey meeting in March 2015. Thus, important information on the bottom species (cod, halibut and snow crab) in this area has been lost.

Except these unfortunate events the rest of the work was performed according to the procedures and plan.

The 12th joint Barents Sea autumn ecosystem survey (BESS) was carried out during the period from 13th August to 9th October 2015. Research vessel tracks and trawl stations during the 2015 ecosystem survey are shown in Figure 1.1. Hydrography and plankton stations are shown in Figure 1.2.

Research vessel “Johan Hjort” covered the western, central and some northern parts of the Barents Sea from 13.08 to 29.09. “Helmer Hanssen”, covered the area northwest and north of Svalbard (Spitsbergen) from 17.08 to 7.09. “G.O. Sars” covered the south-western part of Barents Sea from 11.09 to 27.09. Research vessel “Vilnyus” covered the eastern and northern part of Barents Sea from 18.08 to 09.10 (Figure 1.1).

This report presents most of the survey aspects, but some parts will be available later on the Internet (www.imr.no). A website dedicated to collating all information from the ecosystem survey including all the previous reports, maps, etc. is currently under preparation (http://www.imr.no/tokt/okosystemtokt_i_barentshavet/nn-no). Post-survey information which is not included in the written report (e.g. plankton and fish stomach samples which need long processing time) may also be found at this website.

The scientists and technicians taking part in the survey onboard the research vessels are listed in Appendix 1.

The sampling manual for this survey has been developed since 2004 and published on the Ecosystem Survey homepage by specialist and experts from IMR and PINRO (http://www.imr.no/tokt/okosystemtokt_i_barentshavet/sampling_manual/nb-no).
This manual includes methodological and technical descriptions of equipment, the trawling and capture procedures by the samplings tools, and the methods that are used in calculating the abundance and biomass for the biota. This manual is continuously updated.

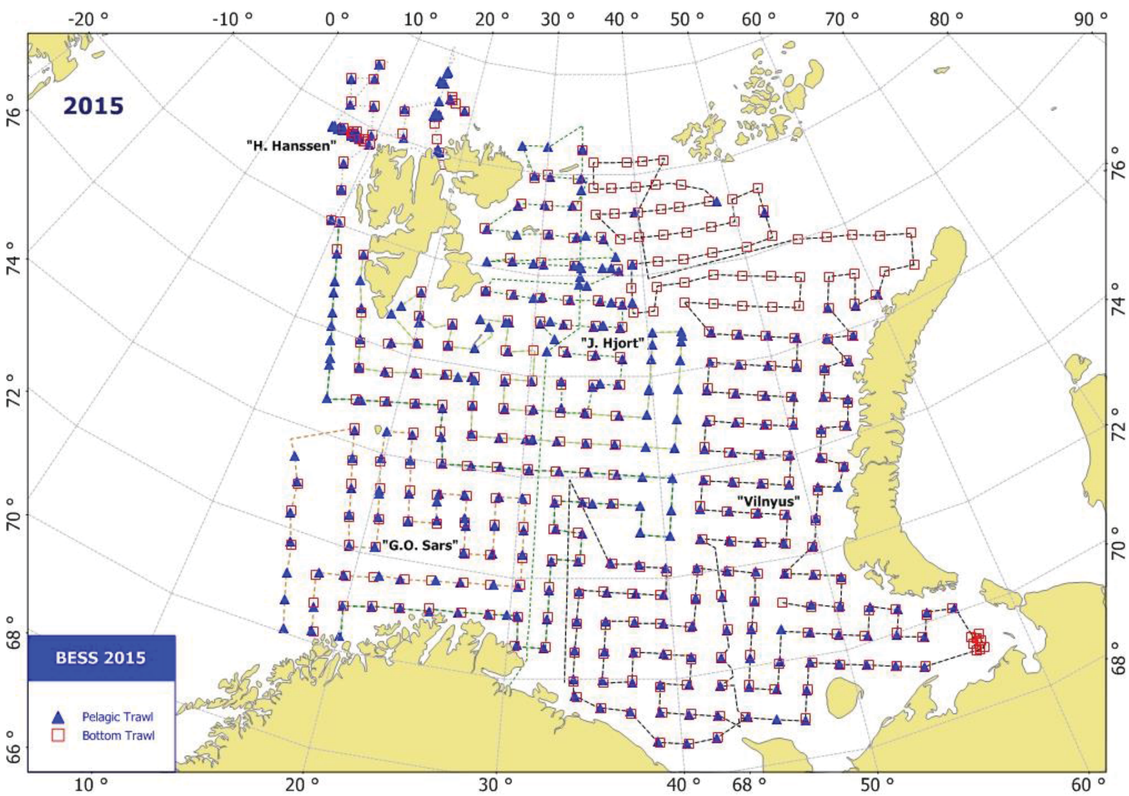


Figure 1.1. Ecosystem survey, August-October 2015. Research vessel tracks and trawl stations.

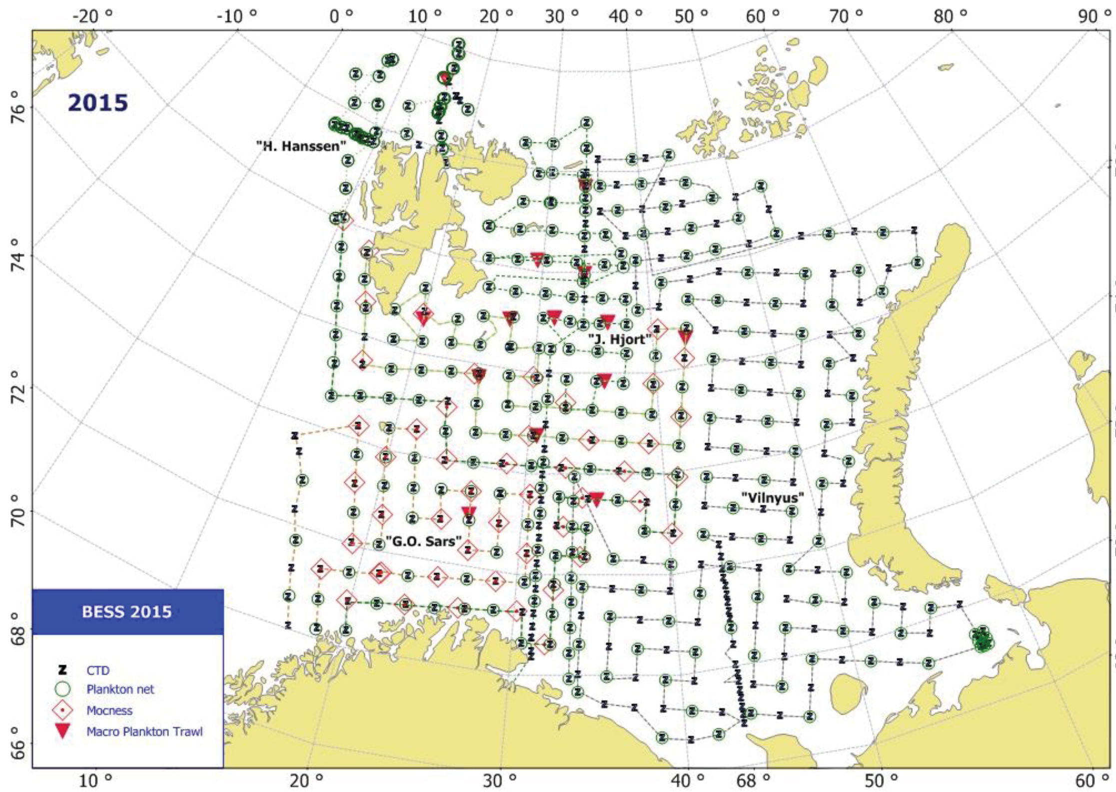


Figure 1.2. Ecosystem survey, August-October 2015. Hydrography and plankton stations.

2 Data monitoring

Text by H. Gjøsæter

Huge amounts of data are collected during the ecosystem surveys. Most data will add to those from earlier surveys to form time series, while some data belong to special investigations conducted once or to projects of short duration. Another way of classifying data is distinguishing between joint data, i.e. data collected jointly by IMR and PINRO, and data collected by visiting researchers from other institutions, using the survey vessels as a platform for data collection without being part of the overall aim with this survey.

Joint data are owned by IMR and PINRO and this joint ownership is realized through a full exchange of data during and after the survey. Since the data infrastructure is different at IMR and PINRO (see below), the data are converted to institute-specific formats before they are entered into databases on the institutes. However, some aggregated time series data are entered into a joint database called “Sjømil”, which is present both at IMR and PINRO. These data are also accessible outside of these two institutions, see below.

2.1 Data use

Joint data are contained in the databases of both PINRO and IMR and are freely accessible to all inside the institutions. At IMR, the management of the data is left to NMD, (Norsk Marint Datasenter = Norwegian marine data centre) which is a part of IMR. Norway and Russia have quite different data policy in general and this affects the accessibility to the data from outside of these institutions. In Norway, access is in principle granted to everyone for use in research while in Russia access to data collected by one institution for other persons or institutions is highly restricted. This also affects the management of data at IMR, since data collected by PINRO as part of a joint project with IMR can be used by researchers at IMR but cannot be distributed to third parties. In effect, the total amount of joint data cannot be distributed from IMR, and persons or institutions interested in using these data will have to contact IMR for access to Norwegian data and PINRO for access to Russian data.

2.2 Databases

IMR is now developing a new data-infrastructure through the project S2D. Old databases are replaced by a new family of databases administered by NMD. Although the data are split on several databases, for instance one for acoustic data, one for biological data, another for physical and yet another for chemical data, they are linked through a common reference database and all data can be seen through a common user interface. At PINRO they are also planning to move their data into a new set of databases but at present all data are placed in one database for all kinds of data. In addition to these institutional data repositories a joint database for some selected time series of aggregated data has been developed, called “Sjømil”. At present this database is present at IMR and PINRO, and the IMR database is accessible to the outside world through a web interface http://www.imr.no/sjomil/index.html . This database is general and has data from many other monitoring programs and from other areas than the Barents Sea.

3 Monitoring of marine enviroment

3.1 Hydrography

Text by A. Trofimov and R. Ingvaldsen
Figures by A. Trofimov and R. Ingvaldsen

3.1.1 Oceanographic sections

Figure 3.1.1.1 shows the temperature and salinity conditions along the standard oceanographic sections: Fugløya–Bear Island, Vardø–North, Kola, and Kanin. The mean temperatures in the main parts of these sections are presented in Table 3.1.1.1, along with historical data back to 1965.

The Fugløya–Bear Island and Vardø–North Sections cover the inflow of Atlantic and Coastal water masses from the Norwegian Sea to the Barents Sea. In 2015 the Vardø–North Section was sampled all the way to 81°N. The mean Atlantic Water (50–200 m) temperature in the Fugløya–Bear Island Section was 0.7°C higher than the long-term mean for the period 1965–2015 (Table 3.1.1.1). Going further east to the Vardø–North Section, the mean Atlantic Water (50–200 m) temperature anomaly increased and reached 1.2°C. Both sections show a temperature increase compared to 2014.

The Kola and Kanin Sections cover the flow of Coastal and Atlantic waters in the southern Barents Sea. In August 2015, the mean temperature of Atlantic waters in the central and outer parts of the Kola Section (surface, intermediate and deep layers) was 0.8–1.2°C higher than the average for the period 1951–2010 that was typical of warm and anomalously warm years. Compared to the previous year, the active layer (0–200 m) was 0.2°C warmer than in 2014 in the central part of the section and as warm as in 2014 in the outer part. The mean salinity of Atlantic waters (0–200 m) was 0.05 lower than the average for the period 1951–2010 in the central part of the Kola Section and close to the average in the outer part of it. The shallow inner part of the Kanin Section had a temperature of 6.1°C in the 0–bottom layer that was 1.6°C higher than both the long-term mean for the period 1965–2015 and that in 2014 (Table 3.1.1.1). The outer part had a temperature of 4.6°C in the 0–200 m that was 1.1°C higher than the long-term mean for the period 1965–2015 and 0.5°C higher than in 2014 (Table 3.1.1.1).

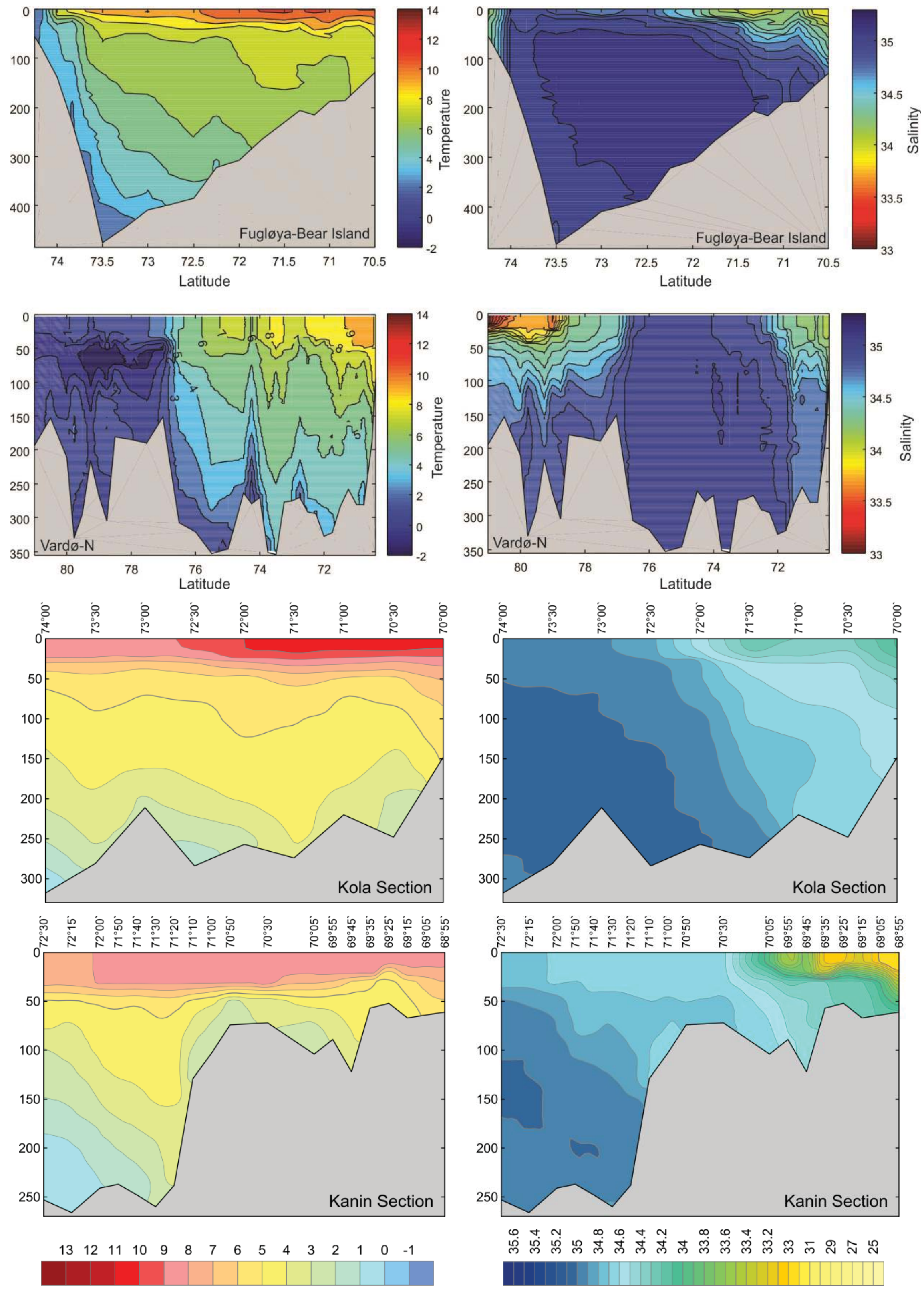


Figure 3.1.1.1. Temperature (°C, left panels) and salinity (right panels) along oceanographic sections in August–September 2015

Table 3.1.1.1. Mean water temperatures in the main parts of standard oceanographic sections in the Barents Sea and adjacent waters in August–September 1965–2015. The sections are: Kola (70º30´N – 72º30´N, 33º30´E), Kanin S (68º45´N – 70º05´N, 43º15´E), Kanin N (71º00´N – 72º00´N, 43º15´E), North Cape – Bear Island (NCBI, 71º33´N, 25º02´E – 73º35´N, 20º46´E), Bear Island – West (BIW, 74º30´N, 06º34´E – 15º55´E), Vardø – North (VN, 72º15´N – 74º15´N, 31º13´E) and Fugløya – Bear Island (FBI, 71º30´N, 19º48´E – 73º30´N, 19º20´E)

Year	Section and layer (depth in metres)								
	Kola	Kola	Kola	Kanin S	Kanin N	NCBI	BIW	VN	FBI
	0–50	50–200	0–200	0–bot.	0–bot.	0–200	0–200	50–200	50–200
1965	6.7	3.9	4.6	4.6	3.7	5.1	-	3.8	5.2
1966	6.7	2.6	3.6	1.9	2.2	5.5	3.6	3.2	5.3
1967	7.5	4.0	4.9	6.1	3.4	5.6	4.2	4.4	6.3
1968	6.4	3.7	4.4	4.7	2.8	5.4	4.0	3.4	5.0
1969	6.7	3.1	4.0	2.6	2.0	6.0	4.2	3.8	6.3
1970	7.8	3.7	4.7	4.0	3.3	6.1	-	4.1	5.6
1971	7.1	3.2	4.2	4.0	3.2	5.7	4.2	3.8	5.6
1972	8.7	4.0	5.2	5.1	4.1	6.3	3.9	4.6	6.1
1973	7.7	4.5	5.3	5.7	4.2	5.9	5.0	4.9	5.7
1974	8.1	3.9	4.9	4.6	3.5	6.1	4.9	4.3	5.8
1975	7.0	4.6	5.2	5.6	3.6	5.7	4.9	4.5	5.7
1976	8.1	4.0	5.0	4.9	4.4	5.6	4.8	4.4	5.8
1977	6.9	3.4	4.3	4.1	2.9	4.9	4.0	3.6	4.9
1978	6.6	2.5	3.6	2.4	1.7	5.0	4.1	3.2	4.9
1979	6.5	2.9	3.8	2.0	1.4	5.3	4.4	3.6	4.7
1980	7.4	3.5	4.5	3.3	3.0	5.7	4.9	3.7	5.5
1981	6.6	2.7	3.7	2.7	2.2	5.3	4.4	3.4	5.3
1982	7.1	4.0	4.8	4.5	2.8	5.8	4.9	4.1	6.0
1983	8.1	4.8	5.6	5.1	4.2	6.3	5.1	4.8	6.1
1984	7.7	4.1	5.0	4.5	3.6	5.9	5.0	4.2	5.7
1985	7.1	3.5	4.4	3.4	3.4	5.3	4.6	3.7	5.6
1986	7.5	3.5	4.5	3.9	3.2	5.8	4.4	3.8	5.5
1987	6.2	3.3	4.0	2.7	2.5	5.2	3.9	3.5	5.1
1988	7.0	3.7	4.5	3.8	2.9	5.5	4.2	3.8	5.7
1989	8.6	4.8	5.8	6.5	4.3	6.9	4.9	5.1	6.2
1990	8.1	4.4	5.3	5.0	3.9	6.3	5.7	5.0	6.3
1991	7.7	4.5	5.3	4.8	4.2	6.0	5.4	4.8	6.2
1992	7.5	4.6	5.3	5.0	4.0	6.1	5.0	4.6	6.1
1993	7.5	4.0	4.9	4.4	3.4	5.8	5.4	4.2	5.8
1994	7.7	3.9	4.8	4.6	3.4	6.4	5.3	4.8	5.9
1995	7.6	4.9	5.6	5.9	4.3	6.1	5.2	4.6	6.1
1996	7.6	3.7	4.7	5.2	2.9	5.8	4.7	3.7	5.7
1997	7.3	3.4	4.4	4.2	2.8	5.6	4.1	4.0	5.4
1998	8.4	3.4	4.7	2.1	1.9	6.0	-	3.9	5.8
1999	7.4	3.8	4.7	3.8	3.1	6.2	5.3	4.8	6.1
2000	7.6	4.5	5.3	5.8	4.1	5.7	5.1	4.2	5.8
2001	6.9	4.0	4.7	5.6	4.0	5.7	4.9	4.2	5.9
2002	8.6	4.8	5.8	4.0	3.7	-	5.4	4.6	6.5
2003	7.2	4.0	4.8	4.2	3.3	-	-	4.7	6.2
2004	9.0	4.7	5.7	5.0	4.2	-	5.8	4.8	6.4
2005	8.0	4.4	5.3	5.2	3.8	6.7	-	5.0	6.2
2006	8.3	5.3	6.1	6.1	4.5	-	5.8	5.3	6.9
2007	8.2	4.6	5.5	4.9	4.3	6.9	5.6	4.9	6.5
2008	6.9	4.6	5.2	4.2	4.0	6.2	5.1	4.8	6.4
2009	7.2	4.3	5.0	-	4.3	-	-	5.2	6.4
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
2012	8.2	5.3	6.0	6.2	5.2	-	-	5.7	6.4
2013	8.8	4.6	5.6	5.5	4.6	-	5.6	5.0	6.3
2014	8.0	4.6	5.4	4.5	4.1	-	-	5.2	6.1
2015	8.5	4.8	5.7	6.1	4.6	-	-	5.6	6.6
Average 1965–2015	7.6	4.0	4.9	4.5	3.5	5.8	4.8	4.4	5.9

3.1.2 Spatial variation

Horizontal distributions of temperature and salinity are shown for depths of 0, 50, 100 m and near the bottom in Figures 3.1.2.1–3.1.2.8, and anomalies of temperature and salinity at the surface and near the bottom are presented in Figures 3.1.2.9–3.1.2.12. Anomalies have been calculated using the long-term means for the period 1931–2010.

The surface temperature was on average 1.2°C higher than the long-term mean almost all over the Barents Sea. Negative anomalies (–0.4°C on average) occupied under 10% of the surveyed area and were mostly found south of the Spitsbergen archipelago. Overall, temperature anomalies increased from negative and small positive values in the western part of the sea to the largest values (>1.5°C) in the central and mainly eastern parts. Compared to 2014, the surface temperature was much higher (by 1.3°C on average) in most of the Barents Sea (about three quarters of the surveyed area), especially in the north-eastern part of the sea. The surface waters were on average 1.0°C colder than in 2014 only in some places in the south-eastern and western Barents Sea, especially south of the Spitsbergen archipelago.

Arctic waters were, as usual, most dominant in the 50–100 m layer north of 77°N (Figure 3.1.2.3 and 3.1.2.5). The temperatures at depths of 50 and 100 m were mainly higher than the long-term mean (on average, by 1.2 and 1.0°C respectively) nearly all over the Barents Sea. Small negative anomalies (–0.3°C on average) were found in some small areas in the northern part of the sea, especially right south and east of the Spitsbergen archipelago. Compared to 2014, the 50 and 100 m temperatures were higher (on average, by 0.8 and 0.6°C respectively) in most of the Barents Sea (three quarters of the surveyed area). Negative differences in temperature between 2015 and 2014, changing with depth, on average, from –0.6°C at 50 m to –0.3°C at 100 m, took place in some areas in the central, south-eastern and north-western Barents Sea, especially south and south-east of the Spitsbergen archipelago.

The bottom temperature was in general 0.9°C above the average throughout the Barents Sea (Figure 3.1.2.10). Negative anomalies (–0.6°C on average) occupied under 10% of the surveyed area and were mainly found in the north-western part of the sea, especially south and east of the Spitsbergen archipelago. Compared to 2014, the bottom temperature was in general 0.5°C higher in most of the Barents Sea (two thirds of the surveyed area). Negative differences in temperature between 2015 and 2014 were on average –0.4°C and prevailed in some areas in the central, south-eastern, southern and northern parts of the sea, especially south and south-east of the Spitsbergen archipelago. In 2015, the area occupied by water with temperatures below zero was less than in the previous year.

The surface salinity was on average 0.4 higher than both the long-term mean and that in the previous year in most of the Barents Sea with the largest positive anomalies (>0.5) mainly north of 76°N (Figure 3.1.2.11). Negative anomalies were found in the south-western and south-eastern parts of the sea as well as south and south-west of the Spitsbergen archipelago. In August–September 2015, the surface waters were fresher compared to 2014 west and south-west of the Novaya Zemlya archipelago as well as in the western Barents Sea, especially south and south-west of the Spitsbergen archipelago. The bottom salinity was close to that in 2014 and slightly higher (by up to 0.1) than the long-term mean in more than three quarters of the surveyed area (Figure 3.1.2.12). Negative anomalies were mainly found in some areas in the south-western and south-eastern Barents Sea as well as in shallow waters in the north-western part of the sea. The largest negative differences in salinity between 2015 and 2014 were found in shallow wares between Bear and Hopen Islands.

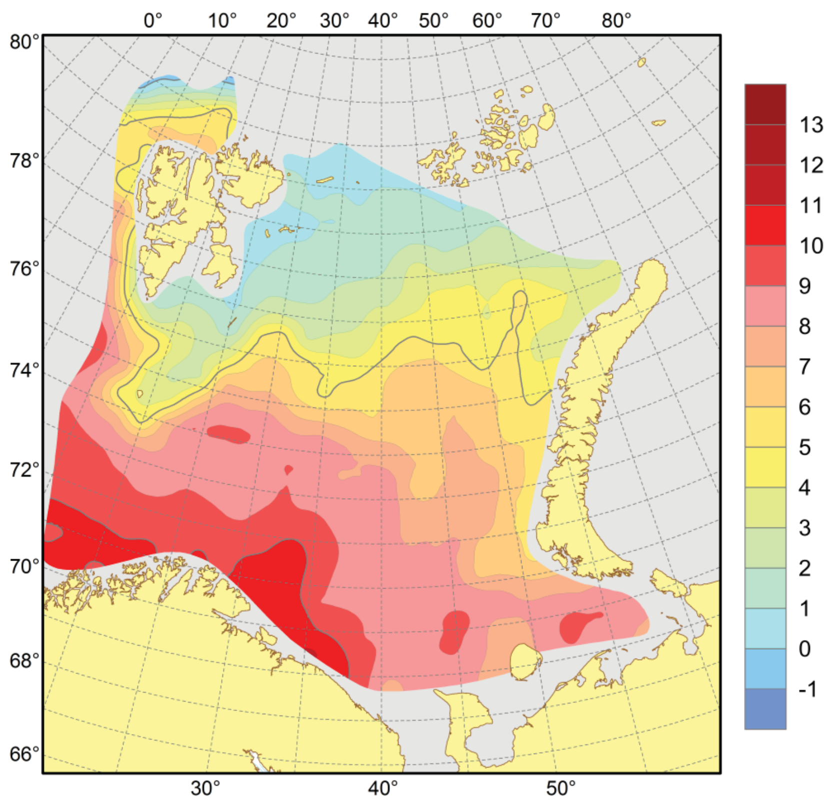


Figure 3.1.2.1. Distribution of surface temperature (°C), August–September 2015.

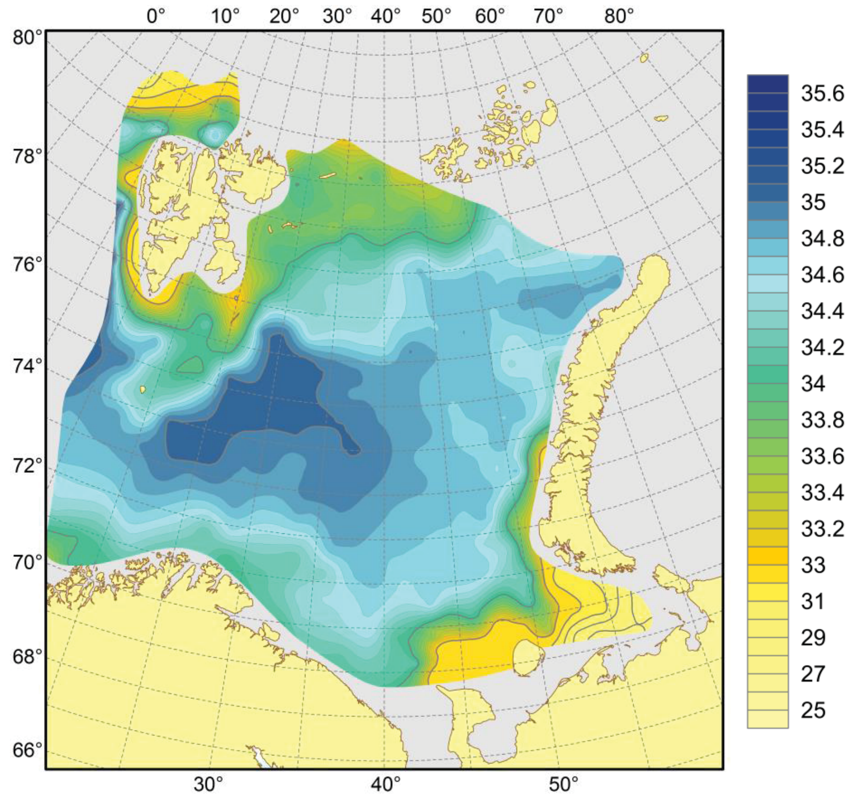


Figure 3.1.2.2. Distribution of surface salinity, August–September 2015

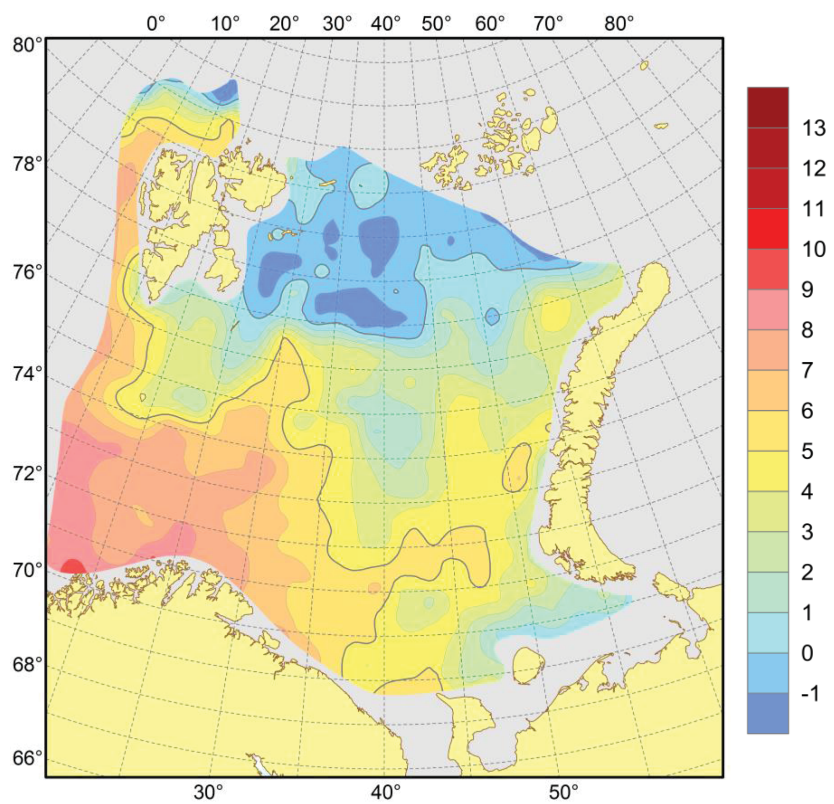


Figure 3.1.2.3. Distribution of temperature (°C) at the 50 m depth, August–September 2015

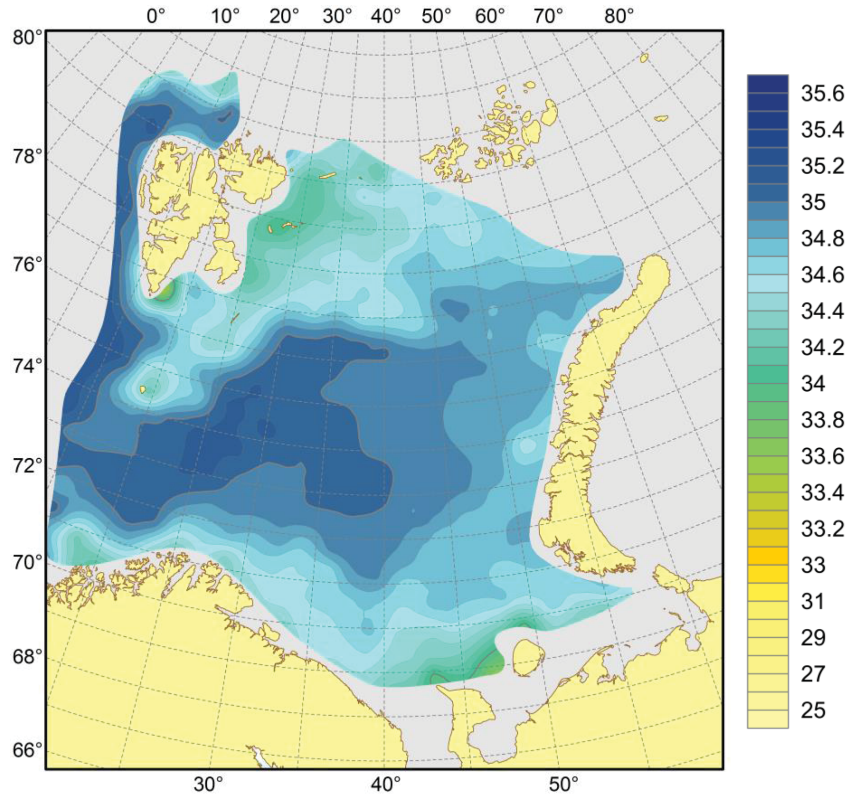


Figure 3.1.2.4. Distribution of salinity at the 50 m depth, August–September 2015

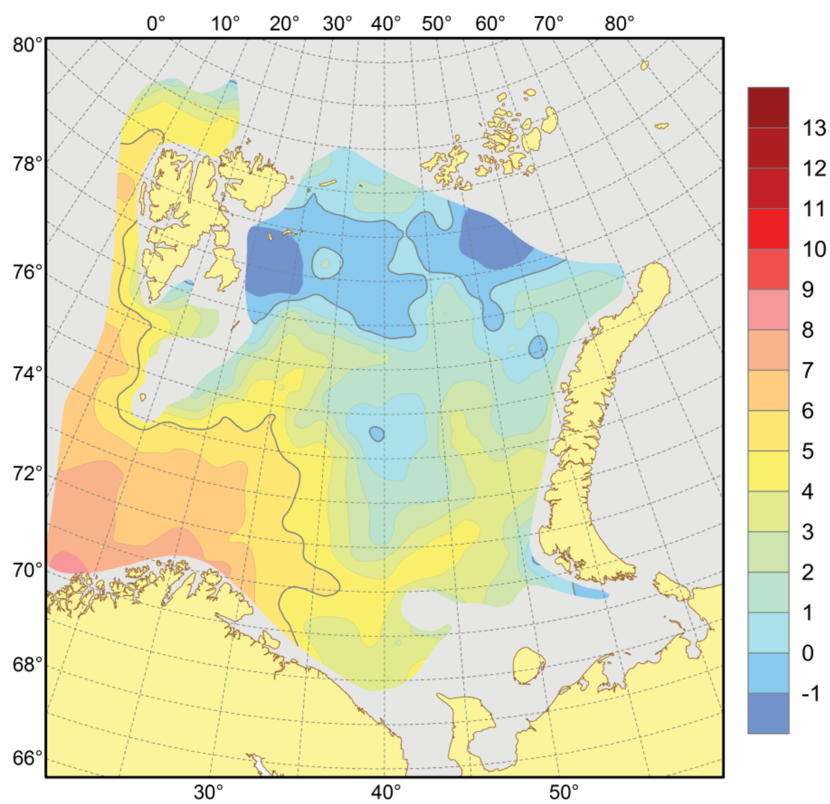


Figure 3.1.2.5. Distribution of temperature (°C) at the 100 m depth, August–September 2015

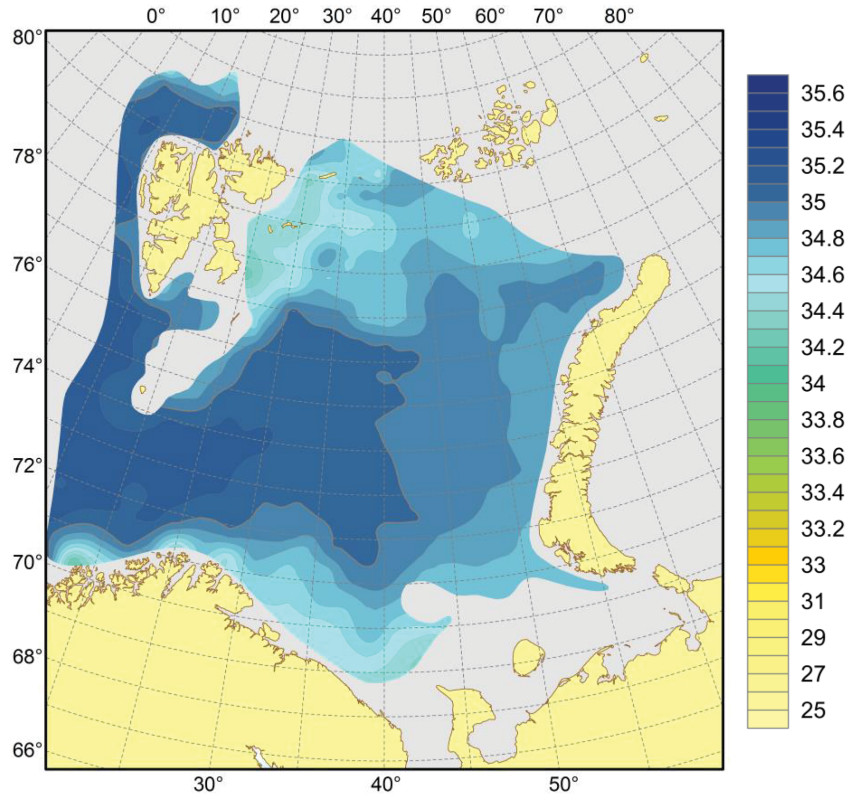


Figure 3.1.2.6. Distribution of salinity at the 100 m depth, August–September 2015

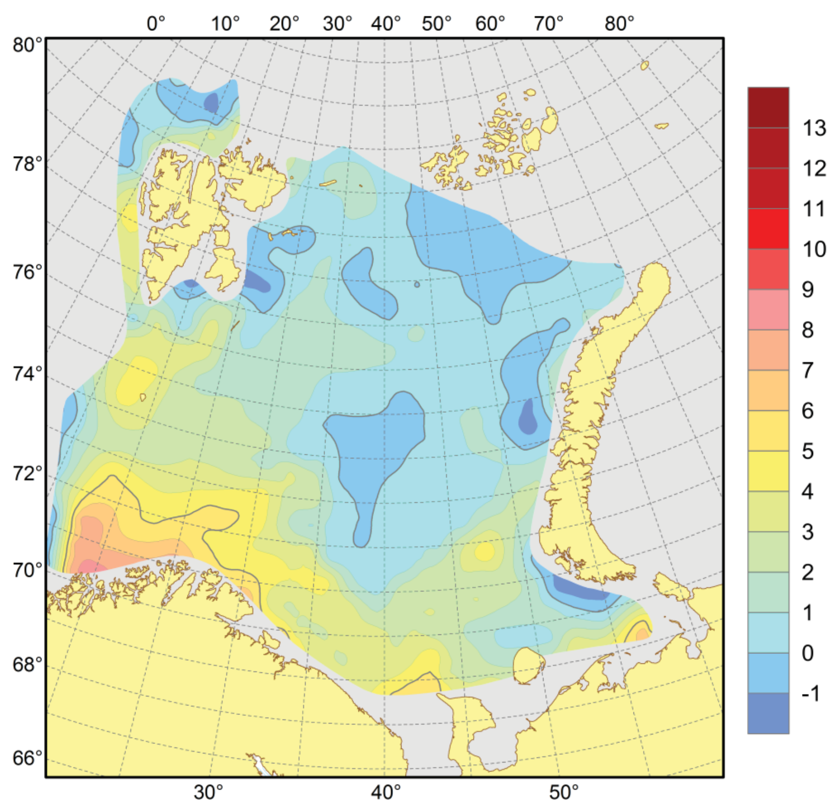


Figure 3.1.2.7. Distribution of temperature (°C) at the bottom, August–September 2015

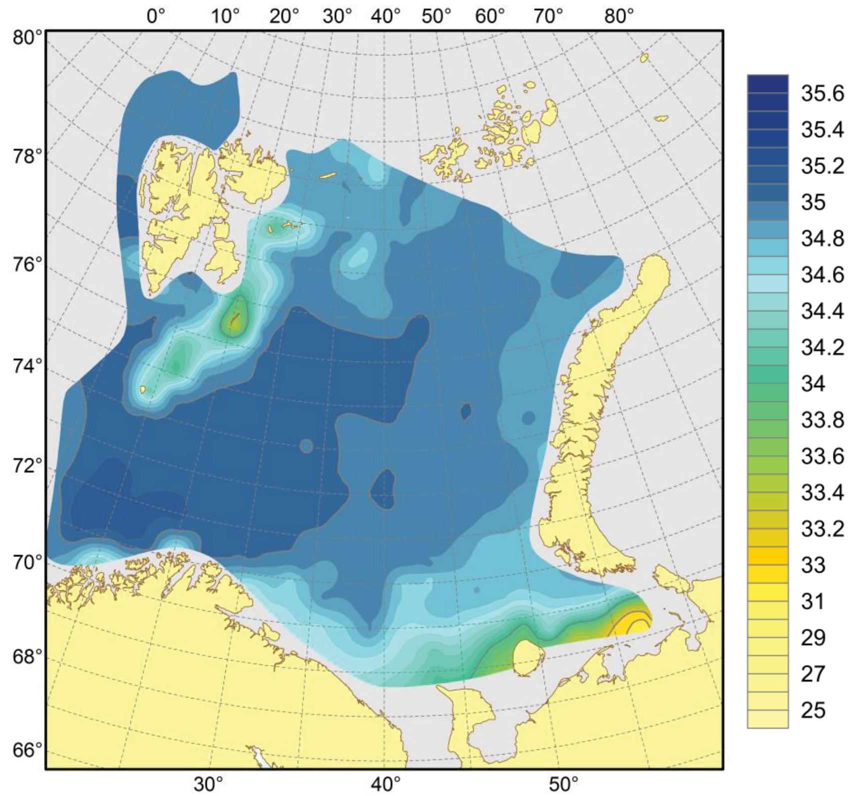


Figure 3.1.2.8. Distribution of salinity at the bottom, August–September 2015

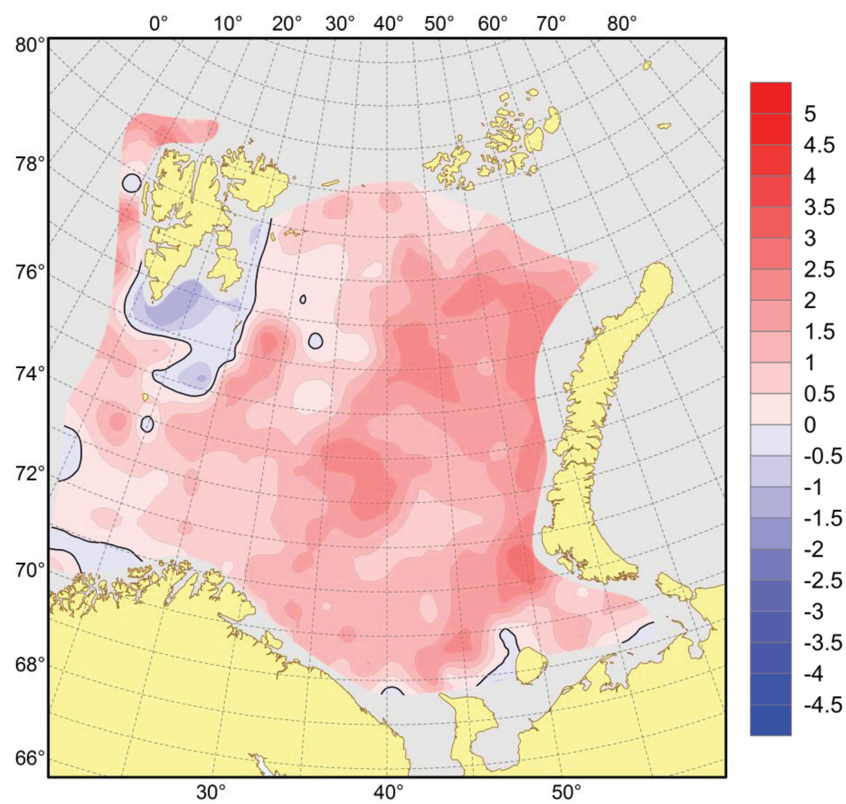


Figure 3.1.2.9. Surface temperature anomalies (°C), August–September 2015

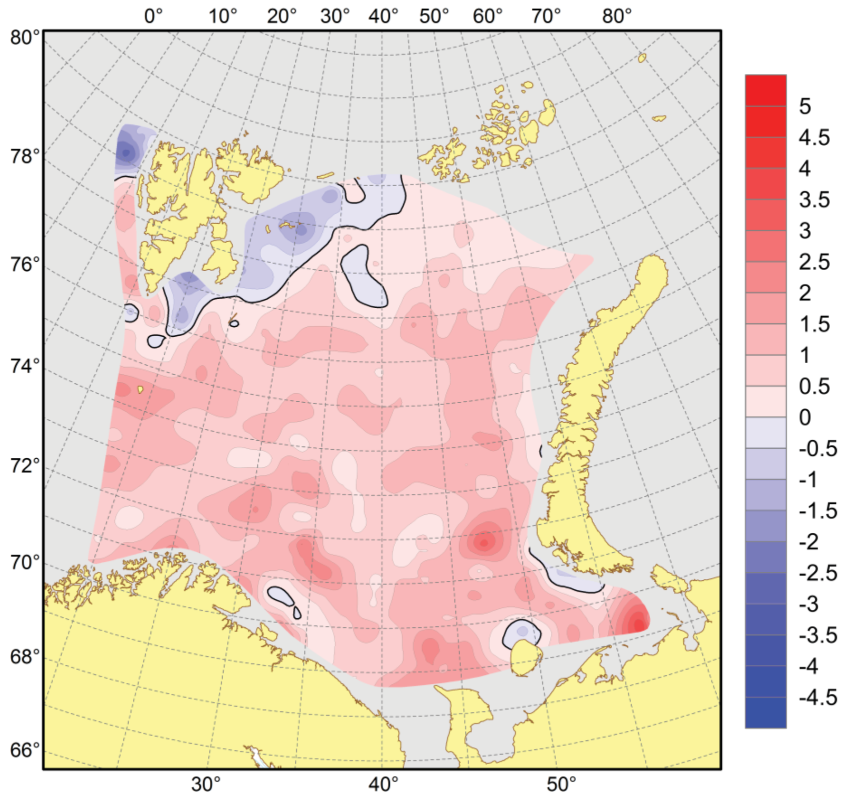


Figure 3.1.2.10. Temperature anomalies (°C) at the bottom, August–September 2015

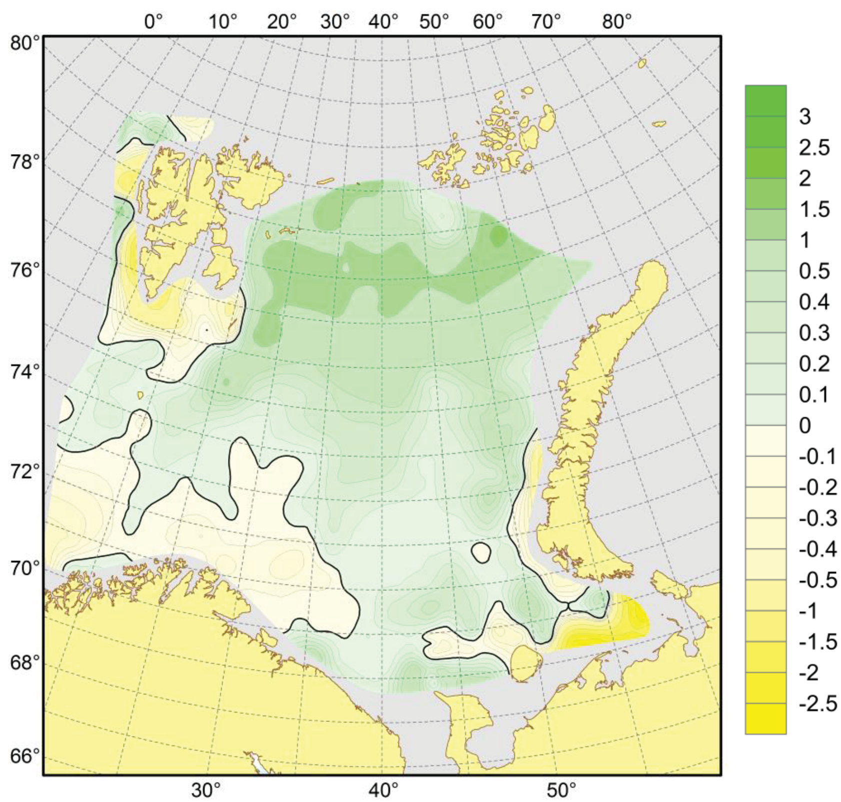


Figure 3.1.2.11. Surface salinity anomalies, August–September 2015

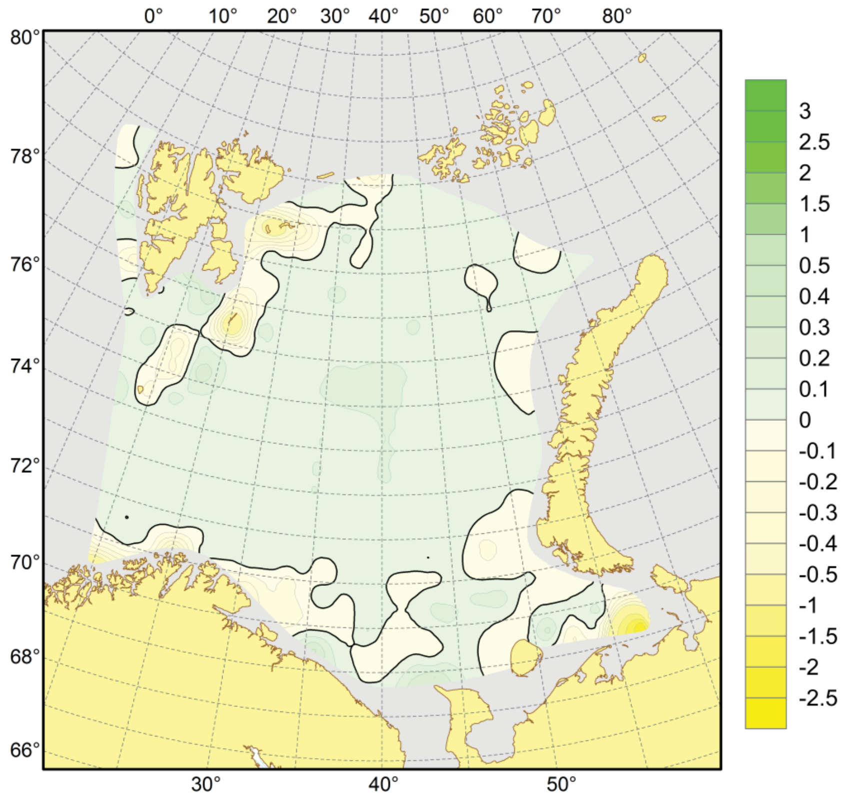


Figure 3.1.2.12. Salinity anomalies at the bottom, August–September 2015

3.2 Pollution

3.2.1 Chemical pollution

IMR routinely carries out monitoring of contaminants in the Barents Sea. This includes sampling of sea water, sediments and marine biota. The analysis includes different hydrocarbons, persistent organic pollutants (POPs) (PCB, DDT, HCH, HCB, brominated components) and radionuclides.

3.2.1.1 Sample collection

Samples of sediments and seawater were collected in the Barents Sea from 17 and 7 stations, respectively, from the Norwegian vessels “G. O. Sars” and “Johan Hjort” during the period August-September 2015. Samples of marine biota were collected from the same vessels from a large number of stations during the same period. An overview of stations where samples were collected is shown in Figure 3.2.1.1.

3.2.1.2 Seawater

Ten liters of seawater were collected per sample for Po-210 and Ra-226 analysis, while 50 liters of seawater were collected per samples for Sr-90 analysis. All samples were stored in plastic cans and acidified with hydrochloric acid. 200 liters of seawater were collected per sample for Am-241 and Pu-isotope analysis. Samples were either stored in plastic cans and acidified with hydrochloric acid, or pre-concentrated to 10 liters onboard. These samples were sent to NRPA at Østerås for further treatment.

Between 75 and 250 L seawater were either stored in plastic cans or passed through filters onboard for Cs-137-analysis. Samples in plastic cans will be brought back to IMR, where they will be analysed by the AMP-method, and the filters will be brought back to NRPA for further treatment.

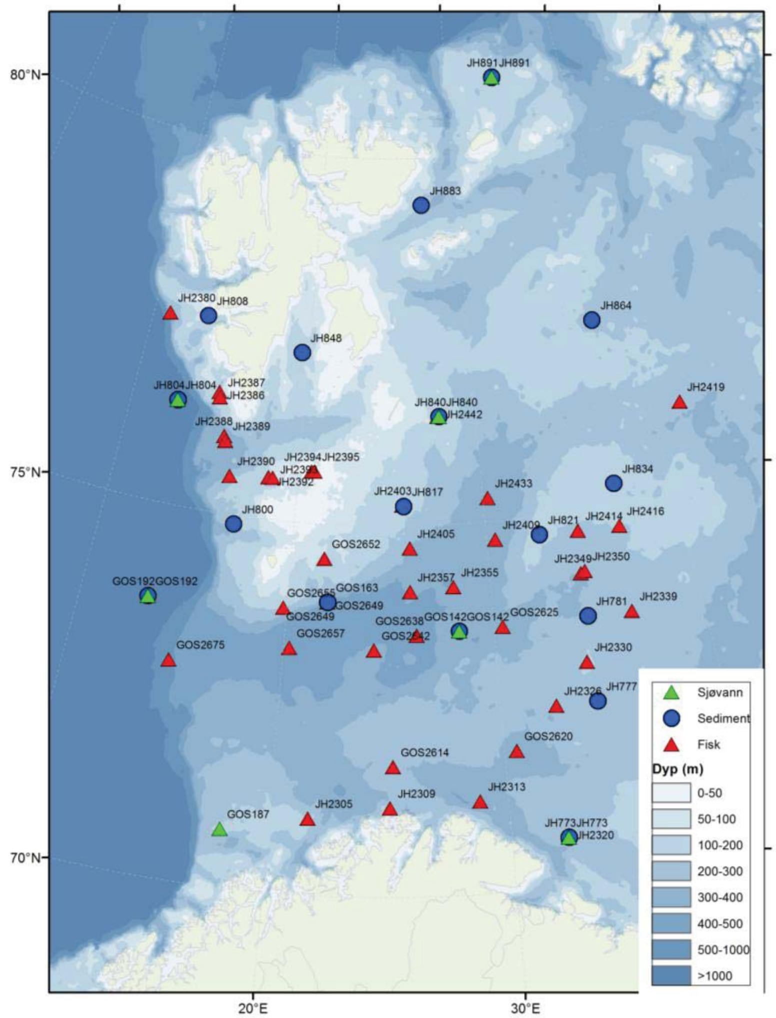


Figure 3.2.1.1. Overview over stations where samples of sediments, seawater and marine biota were collected. The samples will be analysed for organic pollutants and radionuclides.

3.2.2 Sediments

Both surface samples and sediment cores were collected from a selection of the stations. Some of the sediment cores taken on board “Johan Hjort” were cut onboard. The samples were frozen and brought back to IMR for further treatment. The samples will be analyzed for radionuclides, organic contaminants and trace metals.

3.2.3 Biota

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

3.2.4 "Komsomolets"

The yearly investigation of the area around the sunken Russian submarine "Komsomolets" was conducted on board "G. O. Sars". Results from the 2014-investigation show that the concentrations of Cs-137 in sediments and bottom water in the area are comparable to levels found in adjacent areas (Figure 3.2.4.1), i.e., our samples do not indicate a leakage from the submarine.

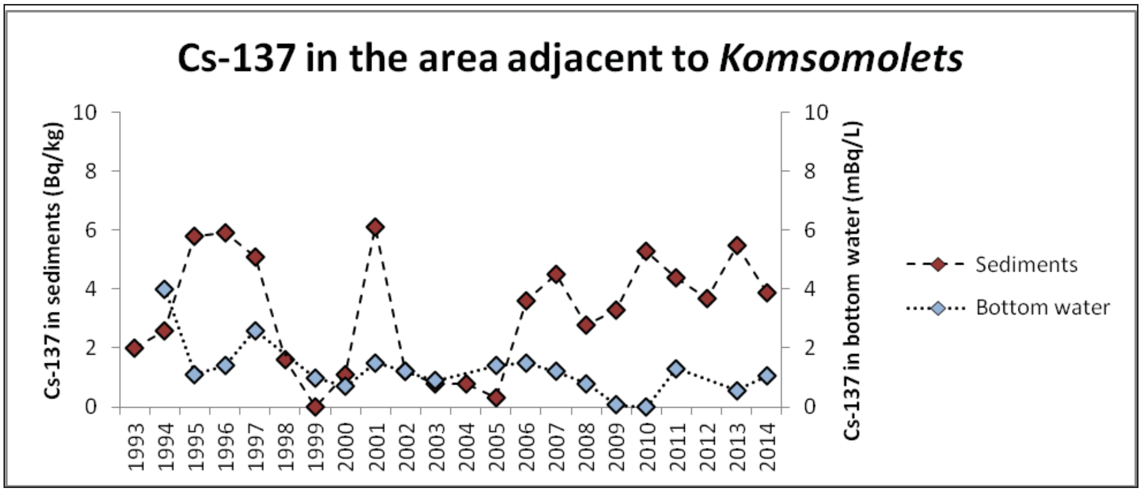


Figure 3.2.4.1. Activity concentrations of Cs-137 in sediments and bottom water near the wreck of the Russian submarine "Komsomolets" in the period 1993-2014.

3.2.5 Equipment used

- A shipboard pump was used to collect surface (5 m) seawater.
- A CTD/rosette multi-bottle sampler with 12 or 24 10 L samplers was used to collect seawater from depths below 5 meters.
- A filter system consisting of a prefilter (1 micron) and two $Cu_2[Fe(CN_6)]$-impregnated cotton filters connected in series was used for collecting radiocaesium-samples.
- A Smøgen boxcorer was used for sediment sampling.

3.2.6 Analyses

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

3.3 Anthropogenic matter

Text by Tatiana Prokhorova and Bjørn Einar Grøsvik
Figures by Pavel Krivosheya

Floating anthropogenic matter in 2015 was observed onboard vessels "Vilnyus" and "Johan Hjort". Anthropogenic matter, taken by pelagic and bottom trawls, were registered by both Russian and Norwegian vessels during the survey. As usual, in the areas of intensive fishing and shipping, matter was observed more often.

Plastic dominated among floating matter on the surface (Figure 3.3.1). Floating matter distributed mainly along the branches of the main sea currents. Thus, plastic could enter directly into the observed areas, or by ocean currents into the Barents Sea. Cardboard, logs and timber were observed in the southern part of the survey. Floating matter was absent along the Novaya Zemlya Archipelago, compared to 2014.

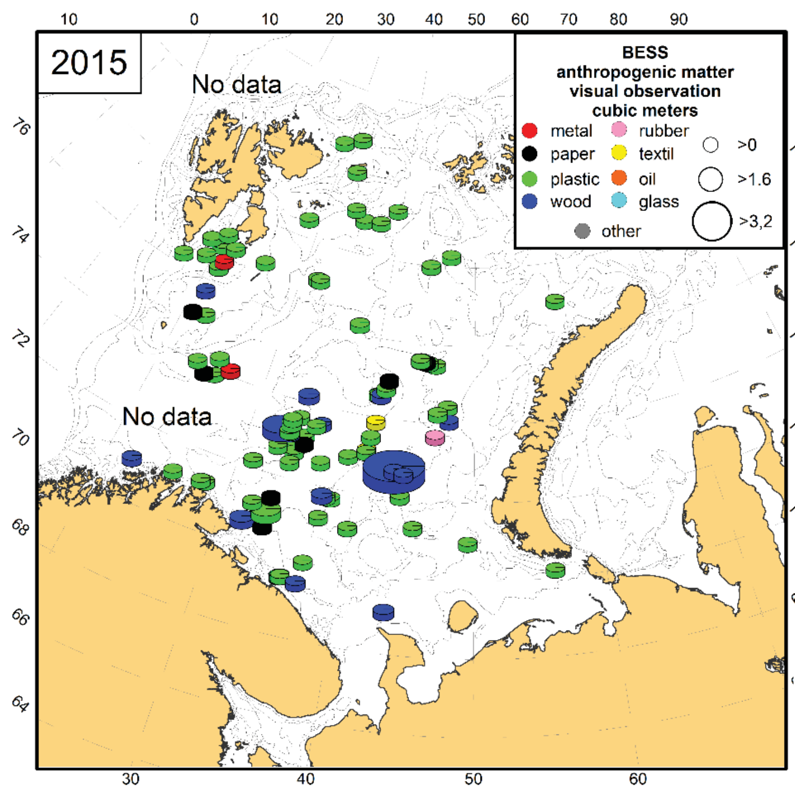


Figure 3.3.1. Type of observed anthropogenic matter (m^3) at the surface in the BESS 2015.

As in previous years (2010-2014), plastic was the most abundant matter in pelagic trawl hauls (Figure 3.3.2). Distribution of anthropogenic matter in the pelagic trawl catches was similar to 2014. Considering the low catchability by pelagic trawl for low-density polymers, the total amount of this matter in the Barents Sea could be much higher.

Plastic dominated also observations in the bottom trawl catches, as 87 % of the registrations of anthropogenic matter were made of plastic (Figure 3.3.3). The occurrences of matter in the bottom trawls increased compared to last years. Plastic was observed in the southern part of the survey, compared to 2014. Timber presented in bottom trawls in the central part of the Barents Sea, to the north and north-east of the Svalbard/Spitsbergen Archipelago. Other types of pollutants were rarely found.

Big lumps of threads, lines and nets were found during the survey. Fishing gear or part of them negatively effect both demersal fish and bottom organisms, as they still are the capable to capture organisms.

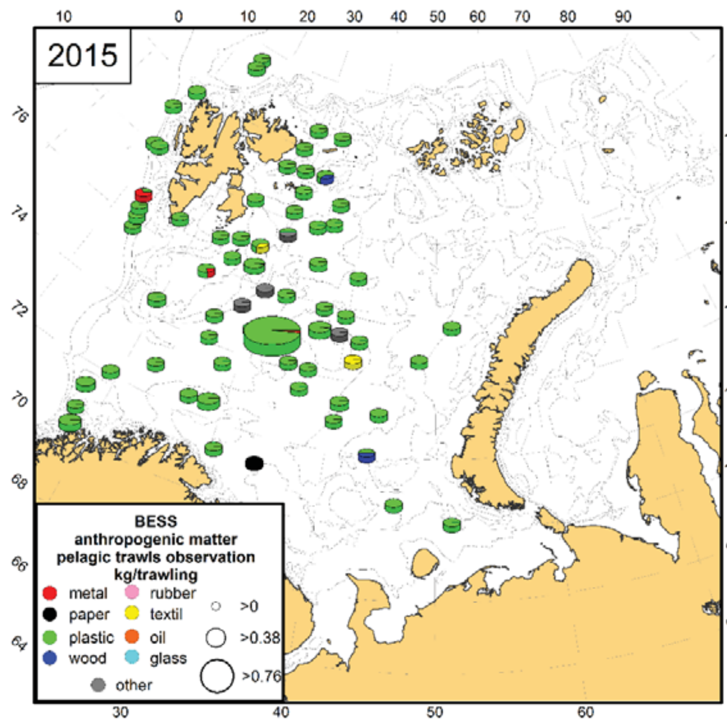


Figure 3.3.2. Type of garbage collected in the pelagic trawls (kg) in the BESS 2015.

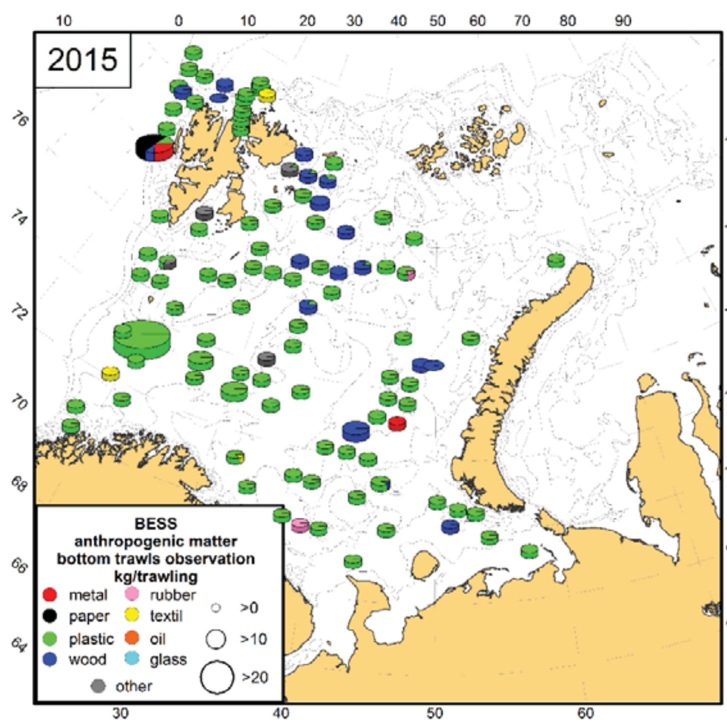


Figure 3.3.3. Type of garbage collected in the bottom trawls (kg) in the BESS 2015

4 Monitoring the plankton community

4.1 Nutrients and chlorophyll a

No results available. Take contact with responsible scientific group at IMR and PINRO.

4.2 Phytoplankton

Text and figure by Olga Tyukina

4.2.1 Sampling of phytoplankton in 2015

To evaluate species composition and structure characteristics of phytoplankton communities, phytoplankton samples were collected during the BESS survey onboard of Russian research vessel. Totally 126 samples on 42 stations were collected on the oceanographic section “Kola Meridian” and in the north-eastern Barents Sea (Figure 4.2.1).

Samples from three water layers (surface, 5 m upper of pycnocline and near bottom) were collected separately. Volume of samples was 1,5-2 liters. Samples were fixed for further analysis.

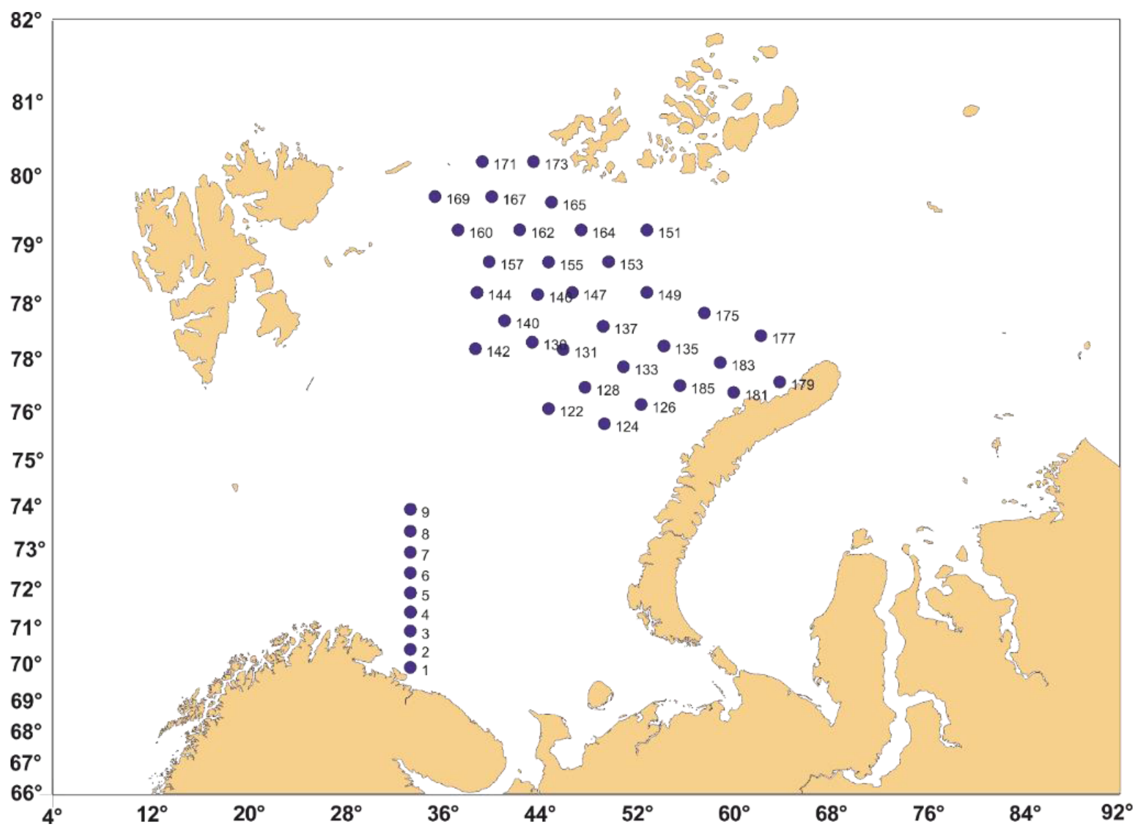


Figure 4.2.1. Location of phytoplankton sampling in BESS 2015 taken by R/V Vilnyus.

4.3 Zooplankton

4.3.1 Spatial distribution and biomasses

Text by Padmini Dalpadado, Andrey Dolgov and Irina Prokopchuk
Figures by Padmini Dalpadado

The total number of stations in 2015 increased compared to the previous year from 232 to 263. The Norwegian survey part was monitored by MOCNESS and WP-2 nets, the Russian part by Juday net. Previous investigations show that the total zooplankton biomass by the three gears is comparable.

Biomass distribution based on BESS 2015 data is shown in Figure 4.3.1.1. The average biomass value for 2015 (7.3 g m^{-2} dry weight) is not directly comparable with 2014 (6.7 g m^{-2}) as the area cover differed in the two years, especially between Svalbard/Spitsbergen and Franz Josef Land. It was not monitored in 2014 due to extensive ice cover. The general biomass distribution pattern however, is somewhat similar in both years with high biomasses in the west and low biomasses in the central of Barents Sea.

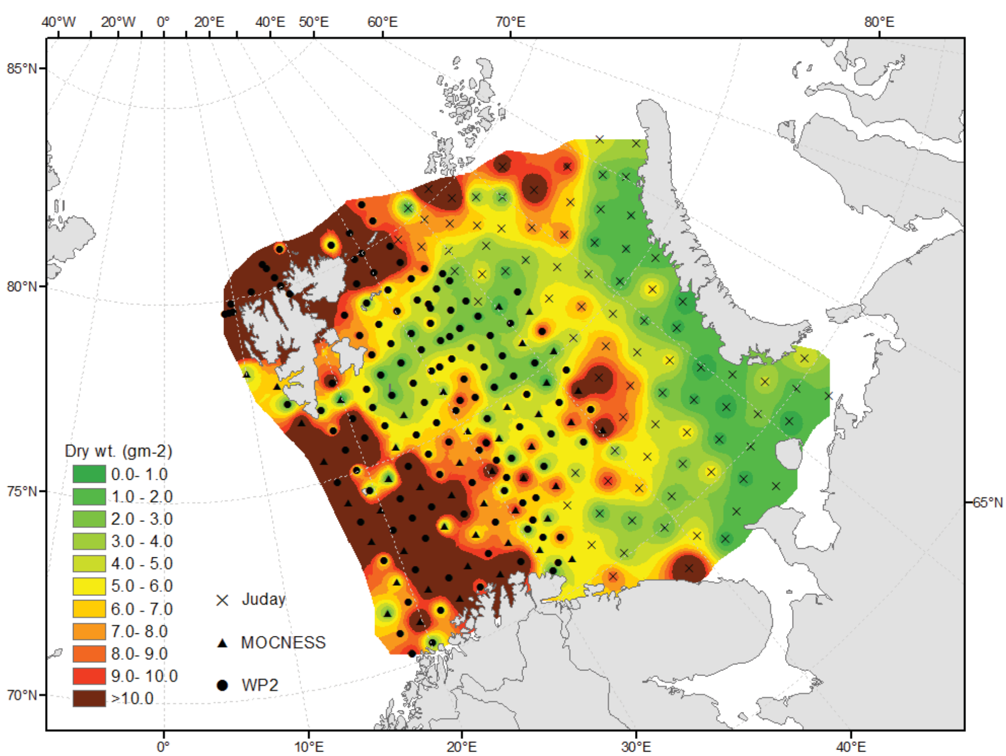


Figure 4.3.1.1. Distribution of zooplankton dry weight (g m^{-2}) in the 0m-bottom layer in BESS 2015.

The region with high biomass (>8 g m^{-2}) area in the west is much larger in 2015 compared to 2014, spreading northwards to west of Svalbard/Spitsbergen. In contrast, biomass in the eastern region was reduced in 2015 (3-10 g m^{-2} in 2015) instead 2014 (> 10 g m^{-2}). Furthermore the area south of the Svalbard/Spitsbergen showed a significant increase in biomass, from 1-5 g m^{-2} in 2014 to 5-10 g m^{-2} in 2015 spreading northwards to west of archipelago.

The area with low biomass in the central and southern parts was reduced in 2015 compared to the two previous years. This could be due to several reasons, among other, due to less predation pressure from the capelin stock, which has unusually remained high (>3 million tons) for the last 6 years, but has drastically reduced in 2014-2015.

Results on *Calanus* abundance from the Fugløya-Bjørnøya section from the western entrance to the Barents Sea seem to indicate that *Calanus finmarchicus* abundance remained high in 2015 and 2014, likely contributing to the high biomass over larger areas observed in the west. (See the section 4.3.2. for more detail description.)

4.3.2 Calanus composition at the Fugløya-Bear Island (FB) transect

Text and figures by P. Dalpadado and J. Rønning

The stations in the FB transect are taken at fixed positions located at the western entrance to the Barents Sea. The numbers of sampled stations are normally 5 to 8 depending on weather conditions. In this report, four stations, representing different water masses (coastal; Atlantic; and mixed Atlantic/Arctic water) from 1995 to 2015, have been analyzed for species composition of the three most abundant species *Calanus finmarchicus*, *C. glacialis* and C. *hyperboreus*. In addition, we have also examined the proportion of *C. finmarchicus* and *C. helgolandicus* (Stage V and adults) in the samples.

C. helgolandicus is quite similar in appearance especially to *C. finmarchicus*, but is a more southerly species with a different spawning period. *C. helgolandicus* has in recent years become more frequent in the North Sea and southern parts of the Norwegian Sea (Svinøy transect), and it is expected that it could potentially increase its abundance in the western part of the Barents Sea in the years to come. Results so far seem to indicate that the abundance of *C. helgolandicus* at the western entrance to the Barents Sea is rather low and has remained more or less unchanged during the study period (not shown).

Though *C. finmarchicus* display inter-annual variations in abundance, comparison of abundance during three periods shows somewhat stable values, with the latter period having a slight increase. (Figure 4.3.2.1, Table 4.3.2.1). The highest abundances of *C. finmarchicus* were recorded in 2010 over the whole transect except for the northernmost locality at 74º00’N, where the abundance was considerably lower (Figure 4.3.2.2). On average over all years since 2004, it is the locality at 73º30’N that shows the highest number of individuals. In 2015, very high abundances of *C. finmarchicus* (>100,000 no.m^{-2}) were observed at 73º30’N similar to in 2010. As expected *C. glacialis* has its highest abundance at the two northernmost stations, localities that are typical of a mixture of Atlantic and Arctic waters. The highest mean abundance (ca 15000 no.m^{-2}) was observed for the year 1997 (not shown). The most stable occurrence and the highest average abundance are found at the northernmost locality a 74º00’N having a mixture of Atlantic and Arctic water masses.

For *C. glacialis* there seem to be a decrease in abundance since 2007 with very low abundances in 2008, and 2012-2014, with an increase again in 2015 (Table 4.3.2.1). The lowest average abundance for *C. glacialis* recorded during 2013-2015 (388 no.m^{-2}) is somewhat comparable to 2007—2012 (407 no.m-2), slightly lower compared to 2001-2006 (517 no.m^{-2}) and much lower in comparison with 1995-2000 (1877 no.m^{-2}). The lowest average abundance for *C. hyperboreus* recorded during 2013-2015 were higher than in 2007-2012 (49 no.m^{-2}), compared to 2001-2006 (179 no.m^{-2}) and 1995-2000 (108 no.m^{-2}).

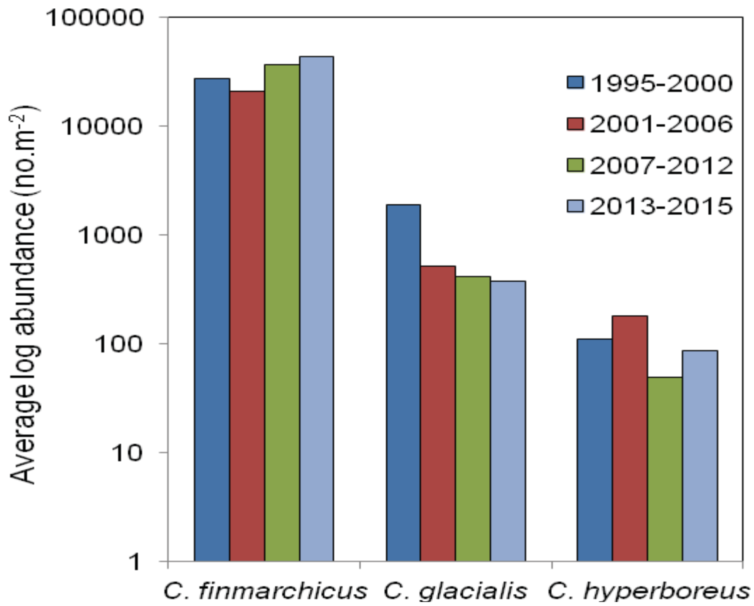


Figure 4.3.2.1. Abundance of *Calanus* species at the FB section during three periods: 1995-2000, 2001-2006, 2007-2012 and 2013-2015.

4.3.3 Biomass indices and distribution of krill and amphipods

by E. Eriksen, P. Dalpadado and A. Dolgov
Figure by E. Eriksen

In 2015 the krill and amphipods were identified to species level on board the Norwegian vessels at 21% of all stations from the catches by pelagic “Harstad” trawl.

Euphausiids

In 2015, krill were distributed in the western, central, eastern Barents Sea and around Svalbard/Spitsbergen (Figure 4.3.3.1). The biomass values expressed in the report are in g wet wt. m^{-2}. In 2013, the highest catches were mostly distributed in the central area while in 2014, in the western area, and in 2015 the krill were distributed mainly in the south and southeast of Svalbard/Spitsbergen. The night catches in 2015, (mean14.22 gram per m^2), were higher than in 2014 (4.85 gram per m^2) and long term mean (7.32 gram per m^2). The number of the night stations in 2015 was half of the day stations during the survey (Table 4.3.3.1). During the night most of krill migrate to upper water layer for feeding, and therefore it is more available for the trawl. However, higher catches (more than 50 gram per m^2) were mainly observed in shallow area located south of Svalbard/Spitsbergen.

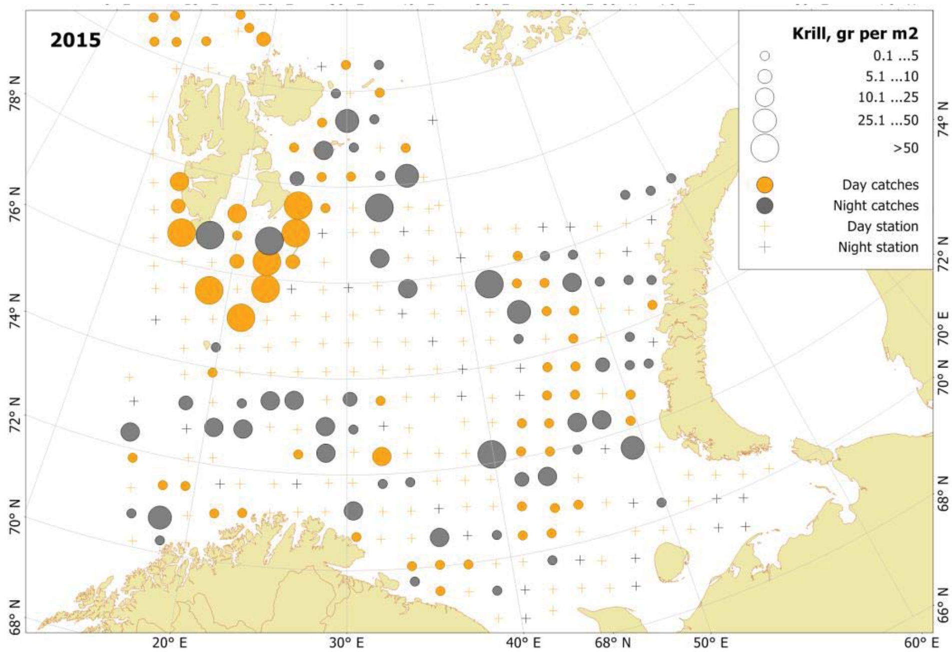


Figure 4.3.3.1. Krill distribution, based on pelagic trawl stations covering the upper water layers (0-60 m), in the Barents Sea in August-September 2015.

Based on the euphausiid species identification on board the Norwegian vessels, in 2015 *Meganyctiphanes norvegica* were mostly observed in the western and central area, while *Thysanoessa inermis* distributed mainly in north, south and southeast of Svalbard/Spitsbergen (Figure 4.3.3.2). *Thysanoessa longicaudata* were only observed at one station north of Svalbard.

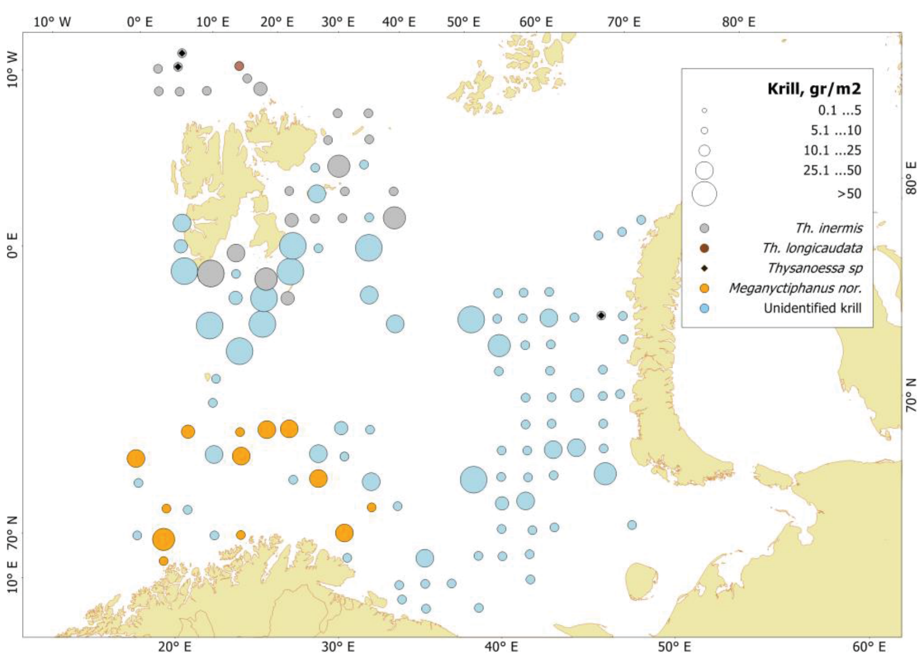


Figure 4.3.3.2. Krill species distribution, based on trawl stations covering the upper water layers (0-60 m), in the Barents Sea in August-September 2015.

In 2015, the total biomass of krill was estimated as 18 million tonnes wet wt. It is much higher than long term mean (8.7 million tonnes) and rather high even after the heavy feeding summer season. The highest krill biomasses distributed outside of main capelin area (see Figure 5.2.1.2 in the report), and most likely this has lead to high biomass of krill.

Table 4.3.3.1. Day and night total catches (gram per m^2) of krill taken by the pelagic trawl in the upper water layers (0-60 m).

Year	Day			Night		
	N	Mean gm-2	Std Dev	N	Mean gm-2	Std Dev
1980	237	1.49	11.38	90	4.86	23.96
1981	214	1.19	9.14	83	7.95	21.53
1982	192	0.18	1.19	69	6.29	22.57
1983	203	0.32	2.76	76	0.39	1.91
1984	217	0.15	1.64	66	1.72	9.17
1985	217	0.07	0.54	75	0.80	4.42
1986	229	3.03	11.70	76	11.90	37.82
1987	200	4.90	22.44	88	3.82	13.08
1988	207	2.69	30.16	81	11.84	55.84
1989	296	1.99	8.45	129	3.71	13.01
1990	283	0.11	0.76	115	1.18	6.32
1991	284	0.03	0.33	124	7.03	25.11
1992	229	0.11	1.18	77	0.92	2.92
1993	194	1.21	6.69	79	2.23	7.36
1994	175	3.01	10.23	72	7.27	18.78
1995	166	4.86	18.86	80	9.13	34.46
1996	282	4.34	26.62	118	9.32	21.53
1997	102	4.12	22.71	167	3.58	12.94
1998	176	2.24	16.00	185	5.68	23.95
1999	140	1.50	9.64	90	4.64	13.09
2000	202	1.52	9.53	67	3.54	11.49
2001	212	0.07	0.63	66	5.77	19.60
2003	203	1.26	9.54	74	2.84	11.23
2004	229	0.34	2.94	80	6.49	22.47
2005	314	3.50	30.53	86	9.02	24.78
2006	227	1.23	6.66	103	9.66	31.54
2007	192	1.79	10.93	112	9.04	39.29
2008	199	0.11	1.02	77	16.92	43.57
2009	241	0.42	2.56	131	10.29	25.02
2010	198	1.76	13.00	105	14.98	43.35
2011	212	0.13	0.69	95	19.46	77.70
2012	243	4.00	12.35	84	11.48	34.21
2013	222	0.11	0.88	83	13.23	42.16
2014	196	4.16	27.85	98	4.85	27.36
2015	199	9.70	54.43	97	14.22	44.61
1980-2015	215	1.93		94	7.32	

Amphipods(mainly Hyperiids)

In 2015, amphipods were found north, south and east for Svalbard/Spitsbergen and in the eastern area (Figure 4.3.3.3). The highest catches were taken eastof Svalbard/Spitsbergen, and were mostly represented by the Arctic *Themisto libellula*. In 2015, the mean catches taken during the day were higher than night catches, and were 3.6 and 2.7 gram per m^2. In 2012 and 2013 no catches of amphipods were taken, while in 2014 some restricted catches of amphipods of 17.6 gram per m2 were taken north for Svalbard/Spitsbergen and catches of 0.1gram per m2 were taken in the western area. The highest catches were taken east of Svalbard/Spitsbergen (ranged between 5 and 59 gram per m^2) The region east of Svalbard was relatively colder in 2015, compared to the previous years and coincided to great degree with the high abundances of amphipods we observe in 2015 in this region.

In 2015, the estimated biomass of amphipods was 566 thousand tonnes for the covered area.

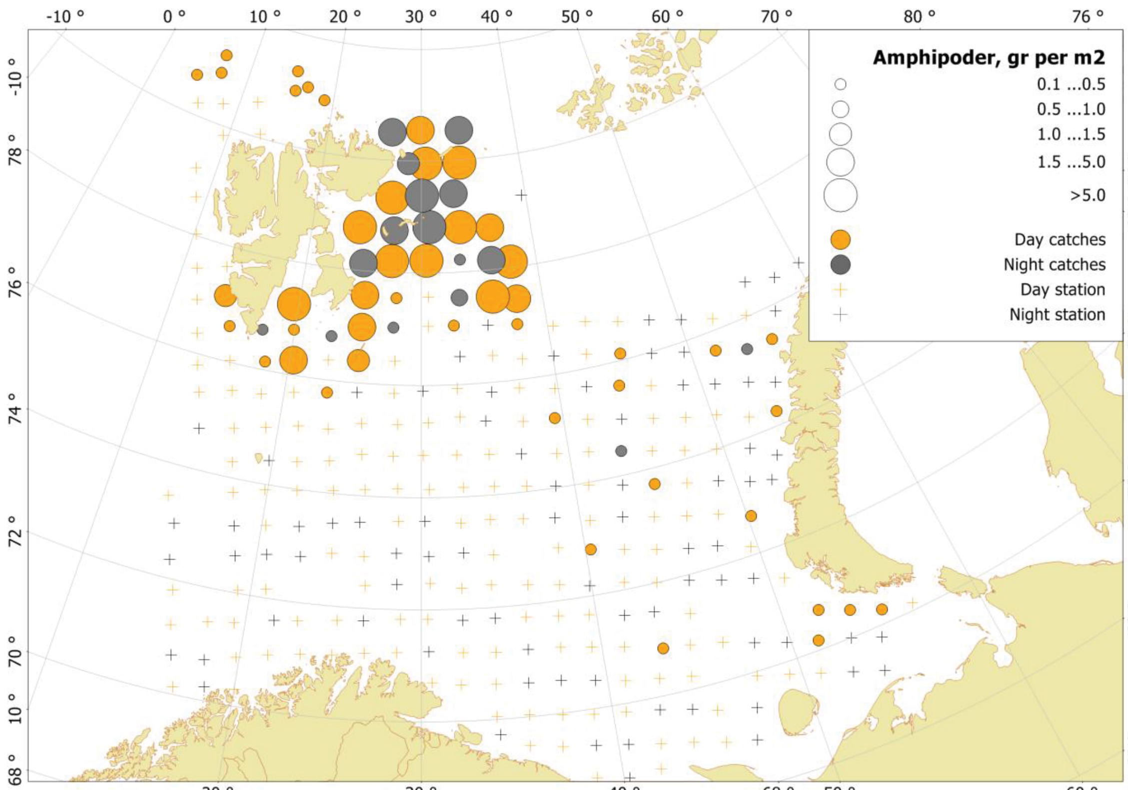


Figure 4.3.3.3. Amphipods distribution, based on trawl stations covering the upper water layers (0-60 m), in the Barents Sea in August-September 2015.

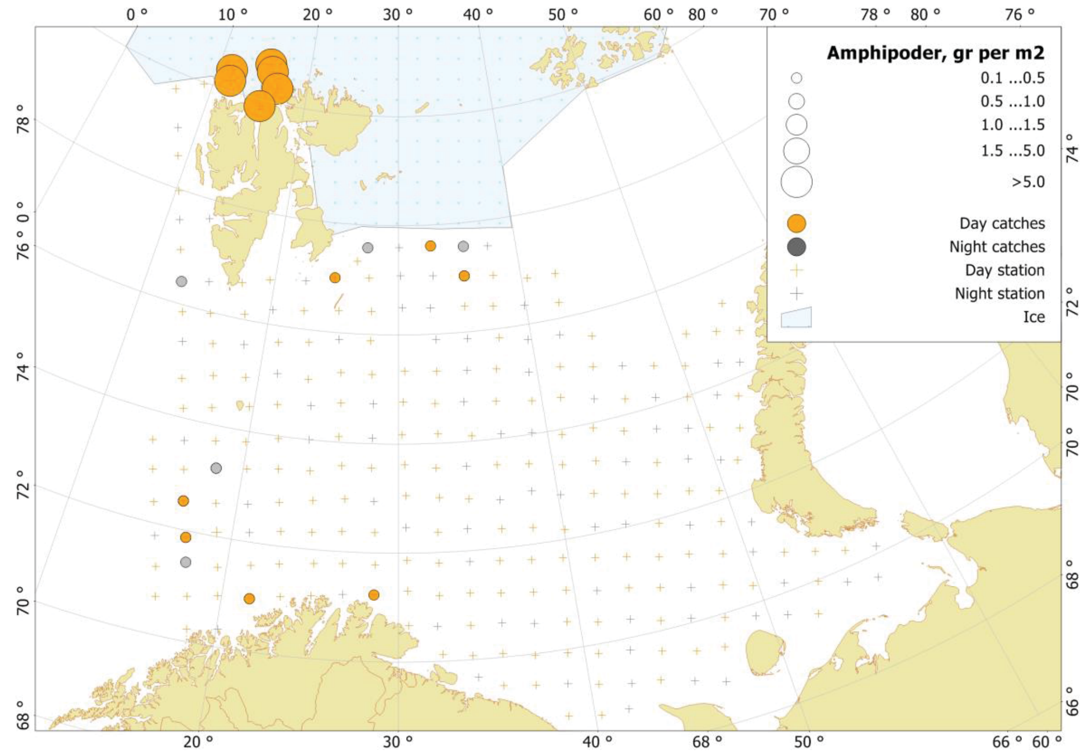


Figure 4.3.3.2. Amphipods distribution, based on trawl stations covering 0-60m, in the Barents Sea in August-October 2014.

4.3.4 Biomass indices and distribution of jellyfish

by Eriksen E., Prokhorova T., Falkenhaug T. and Dolgov A.

In August-September 2015, jellyfish were found in the entire studied area of the Barents Sea. The lion's mane jellyfish (*Cyanea capillata*) was the most common jellyfish collected at all stations.

In 2015, the number stations with no jellyfish were similar to 2014, and were 30 and 28 respectively. However, the coverage area was larger due to the Barents Sea was ice free in 2015, while area north and east of Svalbard was covered with ice in 2014. Jellyfish biomass was low in all western areas from the Norwegian coast to Spitsbergen and increased from southwest to northeast and southeast (Figure 4.3.4.1). The highest catches were taken in the central, southern and eastern areas. Number of station with high jellyfish biomass (> 10 000 kg per sq nm) was lower in 2015 than in 2015, and was 71 and 131 respectively.

The total jellyfish biomass caught by pelagic trawls in upper water layers 0-60 m was 2.3 million tonnes in the Barents Sea in August-October 2015 (Figure 4.3.4.2). During last 5 years (2011-2015) the estimated total biomass of jellyfish has been higher than the long term mean (1.1 million tonnes).

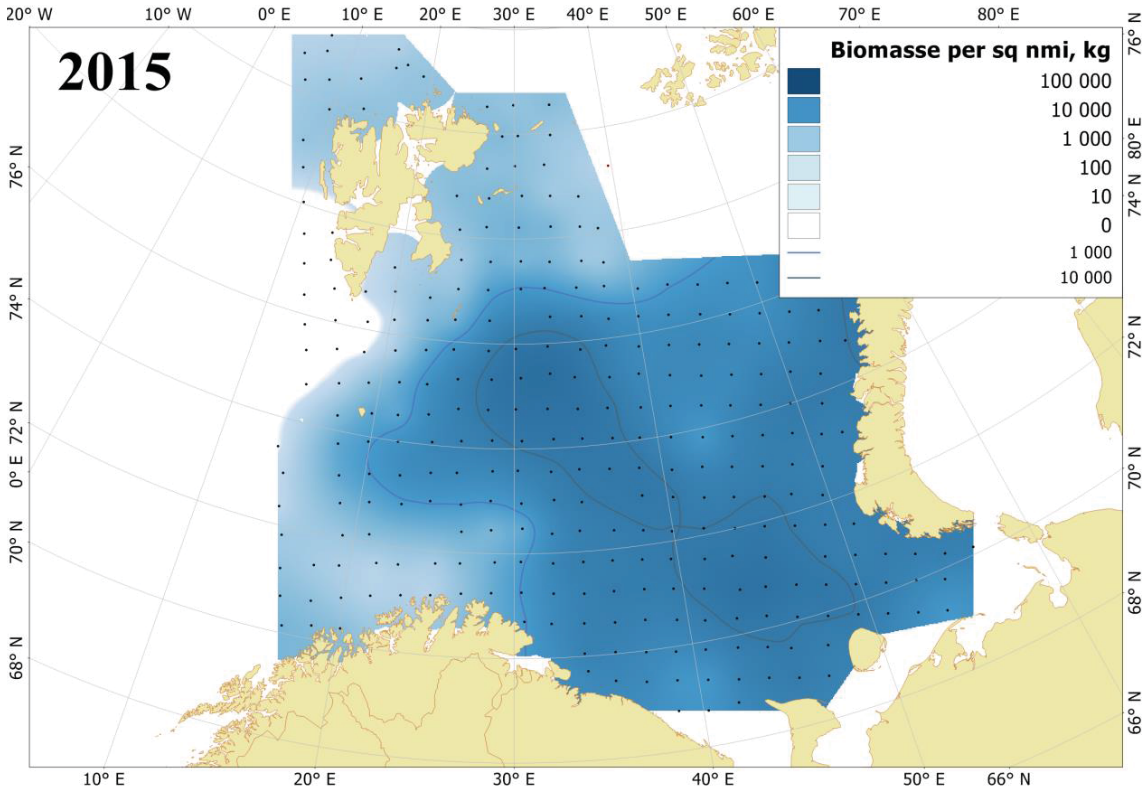


Figure 4.3.4.1. Distribution of jellyfish biomass in the Barents Sea, August-October 2015.

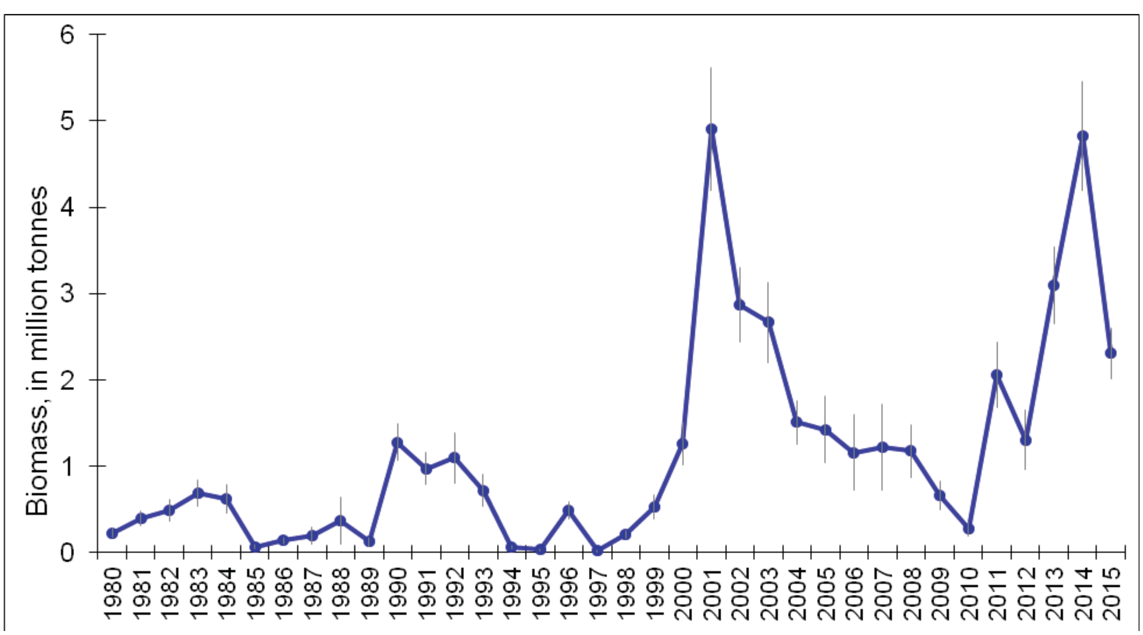


Figure 4.3.4.2. The total jellyfish biomass, mostly *Cyanea capillata*, in million tonnes with 95% confidence interval (grey line) for the period 1980-2015.

Single specimens of blue stinging jellyfish *Cyanea lamarckii* were found at two stations close to the deeper (more than 1000 m depth) western part of the surveyed area. One specimen of *C. lamarckii* was found at a station located at 71°05'N; 23°16'E and 2 specimens at a station located at 70°43'N; 18°09'E. *C. lamarckii* was also recorded in 2014 (4 specimens at three stations), but further north. *C. lamarckii* is not reproducing in the Barents Sea, and the presence of this warm-temperate species may be linked to the inflow of Atlantic water masses.

Single specimens of helmet jelly *Periphylla periphylla* was found at six pelagic (totally 9 specimens) and six bottom (6 specimens) stations between 72°20'-81°05'N and 9°04'-35°09'E. In 2014, *P. periphylla* were found in seven pelagic (27 specimens) and one bottom (2 specimens) stations approximately in the same area.

Other gelatinous plankton recorded during the survey were: the moon jellyfish *Aurelia aurita* (class Scyphozoa), Ctenophores and different genera of the class Hydrozoa: *Sarsia* (order Anthoathecata), *Aglantha* (order Trachymedusae), *Cuspidella* (order Leptothecata), and *Physophora hydrostatica* (order Siphonophorae). The small and fragile gelatinous plankton may be easily destroyed by other organisms (such as larger fish or/and invertebrates) in the trawl cod end, which will contribute to an underestimation of the abundance of gelatinous zooplankton.

5 Monitoring the pelagic fish community

5.1 Fish recruitment: fish distribution and abundance/biomass indices

Text by E. Eriksen, T. Prokhorova and D. Prozorkevich
Figures by E. Eriksen

During this survey the main distribution of most of 0-group species were covered. However survey design, especially timing of “G.O.SARS”, was not sufficient and caused not synoptic coverage of the south-western and central parts of Barents Sea.

The 2015 year class of capelin and redfish was estimated as above the average. The 2015 year class of haddock, long rough dab and Greenland halibut are close to the long term mean level and saithe as below the average. Poor year classes of cod, herring and polar cod were observed. Abundance indices calculated for nine 0-group commercial fish species from 1980-2015 are shown in Tables 5.1.1 and 5.1.2.

The total biomass of the four 0-group fish, which were presented usually (cod, haddock, herring and capelin), was 678 thousand tonnes in August-October, which is lowest since 2003 and 2.2 times lower than long term mean of 1.5 million tonnes. In 2015 0-group redfish and polar cod biomass time series were established and presented in the report and Table 5.1.4. Redfish biomass in 2015 was higher than previous years, and above long tern average of 180 thousand tonnes. Polar cod biomass was very low and 9 times lower than long term average of 99 thousand tonnes. Capelin biomass was higher than other 0-group species biomass and contributed to 29.5% of the total 0-group fish biomass. Low 0-group fish biomasses were as consequence of poor year classes of herring, cod and polar cod. Most of the biomass distributes in the central and north-central part of the Barents Sea. Biomass indices calculated for six 0-group fish species from 1993-2015 are shown in Table 5.1.3.

Length measurements of 0-group fish taken on board indicated that the lengths of some of 0-group fish as herring, saithe, polar cod and long rough dab were lower than the long term mean (1980-2015), while 0-group cod, haddock, redfish, and sandeel were similar to long term mean or some larger in size. Length frequency distributions of the main species are given in Table 5.1.4.

Table 5.1.1. 0-group abundance indices (in millions) with 5% confidence limits, not corrected for capture efficiency. Record high year classes in bold. LTM-long term mean of 1980-2015.

Year	Capelin			Cod			Haddock			Herring			Redfish		
	Abundance index	Confidence limit		Abundance index	Confidence limit		Abundance index	Confidence limit		Abundance index	Confidence limit		Abundance index	Confidence limit	
1980	197278	131674	262883	72	38	105	59	38	81	4	1	8	277873	0	701273
1981	123870	71852	175888	48	33	64	15	7	22	3	0	8	153279	0	363283
1982	168128	35275	300982	651	466	835	649	486	812	202	0	506	106140	63753	148528
1983	100042	56325	143759	3924	1749	6099	1356	904	1809	40557	19526	61589	172392	33352	311432
1984	68051	43308	92794	5284	2889	7679	1295	937	1653	6313	1930	10697	83182	36137	130227
1985	21267	1638	40896	15484	7603	23365	695	397	992	7237	646	13827	**412777**	40510	785044
1986	11409	98	22721	2054	1509	2599	592	367	817	7	0	15	91621	0	184194
1987	1209	435	1983	167	86	249	126	76	176	2	0	5	23747	12740	34755
1988	19624	3821	35427	507	296	718	387	157	618	8686	3325	14048	107027	23378	190675
1989	251485	201110	301861	717	404	1030	173	117	228	4196	1396	6996	16092	7589	24595
1990	36475	24372	48578	6612	3573	9651	1148	847	1450	9508	0	23943	94790	52658	136922
1991	57390	24772	90007	10874	7860	13888	3857	2907	4807	81175	43230	119121	41499	0	83751
1992	970	105	1835	44583	24730	64437	1617	1150	2083	37183	21675	52690	13782	0	36494
1993	330	125	534	38015	15944	60086	1502	911	2092	61508	2885	120131	5458	0	13543
1994	5386	0	10915	21677	11980	31375	1695	825	2566	14884	0	31270	52258	0	121547
1995	862	0	1812	74930	38459	111401	472	269	675	1308	434	2182	11816	3386	20246
1996	44268	22447	66089	66047	42607	89488	1049	782	1316	57169	28040	86299	28	8	47
1997	54802	22682	86922	67061	49487	84634	600	420	780	45808	21160	70455	132	0	272
1998	33841	21406	46277	7050	4209	9890	5964	3800	8128	79492	44207	114778	755	23	1487
1999	85306	45266	125346	1289	135	2442	1137	368	1906	15931	1632	30229	46	14	79
2000	39813	1069	78556	26177	14287	38068	2907	1851	3962	49614	3246	95982	7530	0	16826
2001	33646	0	85901	908	152	1663	1706	1113	2299	844	177	1511	6	1	10
2002	19426	10648	28205	19157	11015	27300	1843	1276	2410	23354	12144	34564	130	20	241
2003	94902	41128	148676	17304	10225	24383	7910	3757	12063	28579	15504	41653	216	0	495
2004	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
2012	**310519**	225728	395311	105176	37917	172435	1814	762	2866	26480	299	316769	58535	0	128715
2013	94673	28224	161122	90101	62782	117421	7245	4731	9759	70972	8394	133551	928	310	1547
2014	48933	5599	92267	102977	72975	132980	4185	2217	6153	16674	5671	27677	77658	35010	120306
2015	147961	87971	207951	8744	3008	14479	6005	2816	9194	11207	0	25819	101653	40258	163048
LTM	89080			29567			4322			28367			62088		

Table 5.1.1. Continued.

	Saithe			Gr halibut			Long rough dab			Polar cod (east)			Polar cod (west)			Polar cod Total
Year	Abundance index	Confidence limit		Abundance index	Confidence limit		Abundance index	Confidence limit		Abundance index	Confidence limit		Abundance index	Confidence limit		SUM
1980	3	0	6	111	35	187	1273	883	1664	28958	9784	48132	9650	0	20622	38608
1981	0	0	0	74	46	101	556	300	813	595	226	963	5150	1956	8345	5745
1982	143	0	371	39	11	68	1013	698	1328	1435	144	2725	1187	0	3298	2622
1983	239	83	394	41	22	59	420	264	577	1246	0	2501	9693	0	20851	10939
1984	1339	407	2271	31	18	45	60	43	77	127	0	303	3182	737	5628	3309
1985	12	1	23	48	29	67	265	110	420	19220	4989	33451	809	0	1628	20029
1986	1	0	2	**112**	60	164	**6846**	4941	8752	12938	2355	23521	2130	180	4081	15068
1987	1	0	1	35	23	47	804	411	1197	7694	0	17552	74	31	117	7768
1988	17	4	30	8	3	13	205	113	297	383	9	757	4634	0	9889	5017
1989	1	0	3	1	0	3	180	100	260	199	0	423	18056	2182	33931	18255
1990	11	2	20	1	0	2	55	26	84	399	129	669	31939	0	70847	32338
1991	4	2	6	1	0	2	90	49	131	88292	39856	136727	**38709**	0	110568	127001
1992	159	86	233	9	0	17	121	25	218	7539	0	15873	9978	1591	18365	17517
1993	366	0	913	4	2	7	56	25	87	41207	0	96068	8254	1359	15148	49461
1994	2	0	5	39	0	93	1696	1083	2309	**267997**	151917	384078	5455	0	12032	**273452**
1995	148	68	229	15	5	24	229	39	419	1	0	2	25	1	49	26
1996	131	57	204	6	3	9	41	2	79	70134	43196	97072	4902	0	12235	75036
1997	78	37	120	5	3	7	97	44	150	33580	18788	48371	7593	623	14563	41173
1998	86	39	133	8	3	12	27	13	42	11223	6849	15597	10311	0	23358	21534
1999	136	68	204	14	8	21	105	1	210	129980	82936	177023	2848	407	5288	132828
2000	206	111	301	43	17	69	233	120	346	116121	67589	164652	22740	14924	30556	138861
2001	20	0	46	51	20	83	162	78	246	3697	658	6736	13490	0	28796	17187
2002	553	108	998	51	0	112	731	342	1121	96954	57530	136378	27753	4184	51322	124707
2003	65	0	146	13	0	34	78	45	110	11211	6100	16323	1627	0	3643	12838
2004	**1400**	865	1936	72	29	115	36	20	52	37156	19040	55271	341	101	581	37497
2005	55	37	74	10	4	15	200	109	291	6545	3202	9888	3231	1283	5178	9776
2006	139	56	221	11	2	21	707	434	979	26016	9997	42036	2112	465	3760	28129
2007	53	6	100	1	0	2	262	46	479	25883	8494	43273	2533	0	5135	28416
2008	45	22	69	6	0	13	956	410	1502	6649	845	12453	91	0	183	6741
2009	22	0	46	7	4	10	115	51	179	23570	9661	37479	21433	5642	37223	45003
2010	402	126	678	14	8	20	128	18	238	31338	13644	49032	1306	0	3580	32643
2011	27	0	59	20	11	29	58	23	93	37431	15083	59780	627	26	1228	38058
2012	69	2	135	30	16	43	173	0	416	4173	48	8298	17281	0	49258	21454
2013	3	1	5	21	13	28	5	0	14	1634	0	4167	148	28	268	1782
2014	1	0	2	10	3	16	309	89	528	2779	737	4820	746	79	1414	3525
2015	47	0	101	27	2	52	575	361	789	128	18	237	6074	2001	10146	6201
LMT	166			27			524			32068			8225			40293

Table 5.1.2. 0-group abundance indices (in millions) with 5% confidence limits, corrected for capture efficiency. LTM- long term mean of 1980-2015.

	Capelin			Cod			Haddock			Herring			Saithe			Polar cod (east)			Polar cod (west)		
Year	Abundance index	Confidence limit		Abundance index	Confidence limit		Abundance index	Confidence limit		Abundance index	Confidence limit		Abundance index	Confidence lim		Abundance index	Confidence limit		Abundance index	Confidence limit	
1980	740289	495187	985391	276	131	421	265	169	361	77	12	142	21	0	47	203226	69898	336554	82871	0	176632
1981	477260	273493	681026	289	201	377	75	34	117	37	0	86	0	0	0	4882	1842	7922	46155	17810	74500
1982	599596	145299	1053893	3480	2540	4421	2927	2200	3655	2519	0	5992	296	0	699	1443	154	2731	10565	0	29314
1983	340200	191122	489278	19299	9538	29061	6217	3978	8456	195446	69415	321477	562	211	912	1246	0	2501	87272	0	190005
1984	275233	161408	389057	24326	14489	34164	5512	3981	7043	27354	3425	51284	2577	725	4430	871	0	2118	26316	6097	46534
1985	63771	5893	121648	66630	32914	100346	2457	1520	3393	20081	3933	36228	30	7	53	143257	39633	246881	6670	0	13613
1986	41814	642	82986	10509	7719	13299	2579	1621	3537	93	27	160	4	0	9	102869	16336	189403	18644	125	37164
1987	4032	1458	6607	1035	504	1565	708	432	984	49	0	111	4	0	10	64171	0	144389	631	265	996
1988	65127	12101	118153	2570	1519	3622	1661	630	2693	60782	20877	100687	32	11	52	2588	59	5117	41133	0	89068
1989	862394	690983	1033806	2775	1624	3925	650	448	852	17956	8252	27661	10	0	23	1391	0	2934	164058	15439	312678
1990	115636	77306	153966	23593	13426	33759	3122	2318	3926	15172	0	36389	29	4	55	2862	879	4846	246819	0	545410
1991	169455	74078	264832	40631	29843	51419	13713	10530	16897	267644	107990	427299	9	4	14	823828	366924	1280732	281434	0	799822
1992	2337	250	4423	166276	92113	240438	4739	3217	6262	83909	48399	119419	326	156	495	49757	0	104634	80747	12984	148509
1993	952	289	1616	133046	58312	207779	3785	2335	5236	291468	1429	581506	1033	0	2512	297397	0	690030	70019	12321	127716
1994	13898	70	27725	70761	39933	101589	4470	2354	6586	103891	0	212765	7	1	12	2139223	1230225	3048220	49237	0	109432
1995	2869	0	6032	233885	114258	353512	1203	686	1720	11018	4409	17627	415	196	634	6	0	14	195	0	390
1996	136674	69801	203546	280916	188630	373203	2632	1999	3265	549608	256160	843055	430	180	679	588020	368361	807678	46671	0	116324
1997	189372	80734	298011	294607	218967	370247	1983	1391	2575	463243	176669	749817	341	162	521	297828	164107	431550	62084	6037	118131
1998	113390	70516	156263	24951	15827	34076	14116	9524	18707	476065	277542	674589	182	91	272	96874	59118	134630	95609	0	220926
1999	287760	143243	432278	4150	944	7355	2740	1018	4463	35932	13017	58848	275	139	411	1154149	728616	1579682	24015	3768	44262
2000	140837	6551	275123	108093	58416	157770	10906	6837	14975	469626	22507	916746	851	446	1256	916625	530966	1302284	190661	1E+05	248072
2001	90181	0	217345	4150	798	7502	4649	3189	6109	10008	2021	17996	47	0	106	29087	5648	52526	119023	0	252146
2002	67130	36971	97288	76146	42253	110040	4381	2998	5764	151514	58954	244073	2112	134	4090	829216	496352	1162079	215572	36403	394741
2003	340877	146178	535575	81977	47715	116240	30792	15352	46232	177676	52699	302653	286	0	631	82315	42707	121923	12998	0	30565
2004	53950	11999	95900	65969	47743	84195	39303	26359	52246	773891	544964	1002819	4779	2810	6749	290686	147492	433879	2892	989	4796
2005	148466	51669	245263	72137	50662	93611	91606	67869	115343	125927	20407	231447	176	115	237	44663	22890	66436	25970	9987	41953
2006	515770	325776	705764	25061	11469	38653	28505	18754	38256	294649	102788	486511	280	116	443	182713	73645	291781	15965	3414	28517
2007	480069	272313	687825	42628	26652	58605	8401	5587	11214	144002	25099	262905	286	3	568	191111	57403	324819	22803	0	46521
2008	995101	627202	1362999	234144	131081	337208	9864	1144	18585	201046	68778	333313	142	68	216	42657	5936	79378	619	25	1212
2009	673027	423386	922668	185457	123375	247540	33339	19707	46970	104233	31009	177458	62	0	132	168990	70509	267471	154687	37022	272351
2010	318569	201973	435166	135355	68199	202511	23669	14503	32834	117087	32045	202129	1066	362	1769	267430	111697	423162	12045	0	33370
2011	594248	58009	1130487	448005	251499	644511	19114	14209	24018	83051	48024	118078	96	0	225	249269	100355	398183	4924	218	9629
2012	988600	728754	1248445	410757	170242	651273	5281	2626	7936	177189	35046	2111493	229	5	453	25026	1132	48920	125306	0	357381
2013	316020	127310	504731	385430	269640	501219	16665	11161	22169	289391	67718	511064	11	4	18	11382	0	29002	1011	262	1760
2014	163630	31980	295280	464124	323330	604919	11765	6160	17371	136305	42164	230447	4	0	9	17349	5184	29515	5298	500	10096
2015	457481	274631	640331	37474	17244	57704	15089	6204	23973	82749	0	190673	406	0	930	795	107	1484	49584	15385	83784
LTM	301278			116136			11913			165575			484			259033			66681		

Table 5.1.3. Biomass indices of 0-group capein, cod, haddock and herring (in thousand tonnes). The indices are corrected for capture efficiency.

Year	Capelin	Cod	Haddock	Herring	Polar cod	Redfish	Total biomass
1993	3	475	34	1035	125	8	1680
1994	6	666	54	173	485	118	1501
1995	2	1546	14	12	0	27	1599
1996	98	919	34	438	145	0	1634
1997	82	657	12	352	85	0	1188
1998	51	117	168	988	45	0	1368
1999	158	32	39	440	185	0	853
2000	55	319	44	404	395	15	1232
2001	51	11	58	9	35	0	165
2002							
2003	149	160	115	471	15	0	909
2004	33	317	686	2243	125	0	3404
2005	60	431	749	406	30	30	1707
2006	335	181	329	1321	85	53	2304
2007	312	123	69	275	0	2139	2919
2008	396	632	54	106	75	536	1800
2009	197	955	346	289	145	201	2134
2010	100	786	134	254	55	255	1584
2011	228	1855	215	151	60	0	2509
2012	519	1429	39	1156	65	144	3352
2013	151	957	241	1363	5	4	2721
2014	67	965	100	169	15	205	1520
2015	272	130	178	98	11	231	921
Mean	151	621	169	552	99	180	1773

Table 5.1.4. Length distribution (%) of 0-group fish in the Barents Sea and adjacent waters

Length, mm	Cod	Haddock	Capelin	Herring	Saithe	Redfish	Polar cod	Gr. halibut	LRD	Sandeel
10 - 14 mm						1.8			0.1	
15 - 19 mm			0.02		10.12	4.13		0.74	0.21	
20 - 24 mm	0.24		0.26		32.58	1.58	0.10	0.86	3.44	
25 - 29 mm	1.68	0.01	1.10		19.55	2.13	0.28	1.04	14.94	
30 - 34 mm	1.50	0.09	2.79	0.12	9.52	8.98	20.93		31.24	0.15
35 - 39 mm	1.60	0.03	5.83	0.50	10.46	20.06	42.60		32.48	0.04
40 - 44 mm	1.98	0.04	11.05	0.80	4.76	26.13	25.72		15.07	1.32
45 - 49 mm	4.18	0.16	16.47	0.80	0.87	23.01	6.32		2.34	1.81
50 - 54 mm	4.09	0.16	28.80	5.00		9.54	2.61	0.82	0.21	16.35
55 - 59 mm	4.60	0.74	20.20	6.00	0.40	2.57	0.51	3.17		15.93
60 - 64 mm	4.85	0.47	8.85	20.68	1.08	0.11	0.59	4.81		25.20
65 - 69 mm	9.79	0.80	4.00	31.52	0.40		0.24	20.04		0.74
70 - 74 mm	9.64	1.74	0.58	25.31	0.60		0.08	16.24		12.56
75 - 79 mm	7.51	4.32	0.03	4.98	1.08		0.01	9.03		1.38
80 - 84 mm	11.95	9.74	0.00	3.31	1.68		0.01	15.98		1.23
85 - 89 mm	8.94	6.18		0.54	0.38			20.34		2.74
90 - 94 mm	13.88	11.88		0.13	3.14			5.95		6.68
95 - 99 mm	6.04	12.00		0.19	0.56			0.98		2.64
100 - 104 mm	3.74	7.44		0.09	1.80					3.19
105 - 109 mm	3.63	11.77		0.01						1.72
110 - 114 mm	0.07	9.53		0.01						3.15
115 - 119 mm	0.02	7.08								1.58
120 - 124 mm	0.02	5.34			0.80					1.59
125 - 129 mm	0.04	3.04								
130 - 134 mm		3.23			0.20					
135 - 139 mm		1.90								
140 - 144 mm		1.19								
145 - 149 mm		0.57								
150 - 154 mm		0.35								
155 - 159 mm		0.13								
160 - 164mm		0.05								
Mean length, cm	7.51	10.13	5.06	6.63	3.43	4.03	3.84	7.52	3.27	6.78
Long term mean length, cm	7.5	9.1	4.8	7.1	9.0	3.9	4.1	6.2	3.4	5.7

5.1.1 Capelin (*Mallotus villosus*)

The 0-group capelin were distributed widely in the Barents Sea (Figure 5.1.1.1). At the same time, a few capelin were found around Svalbard/Spitsbergen Archipelago and in the southeastern Barents Sea. The western area was covered one month later than the central area, and most likely less capelin were found in the western area. The density legend in the figure is based on the catches, measured as number of fish per square nautical mile. More intensive colouring indicates denser concentrations. In 2015 more dense concentrations were found in the north-central Barents Sea.

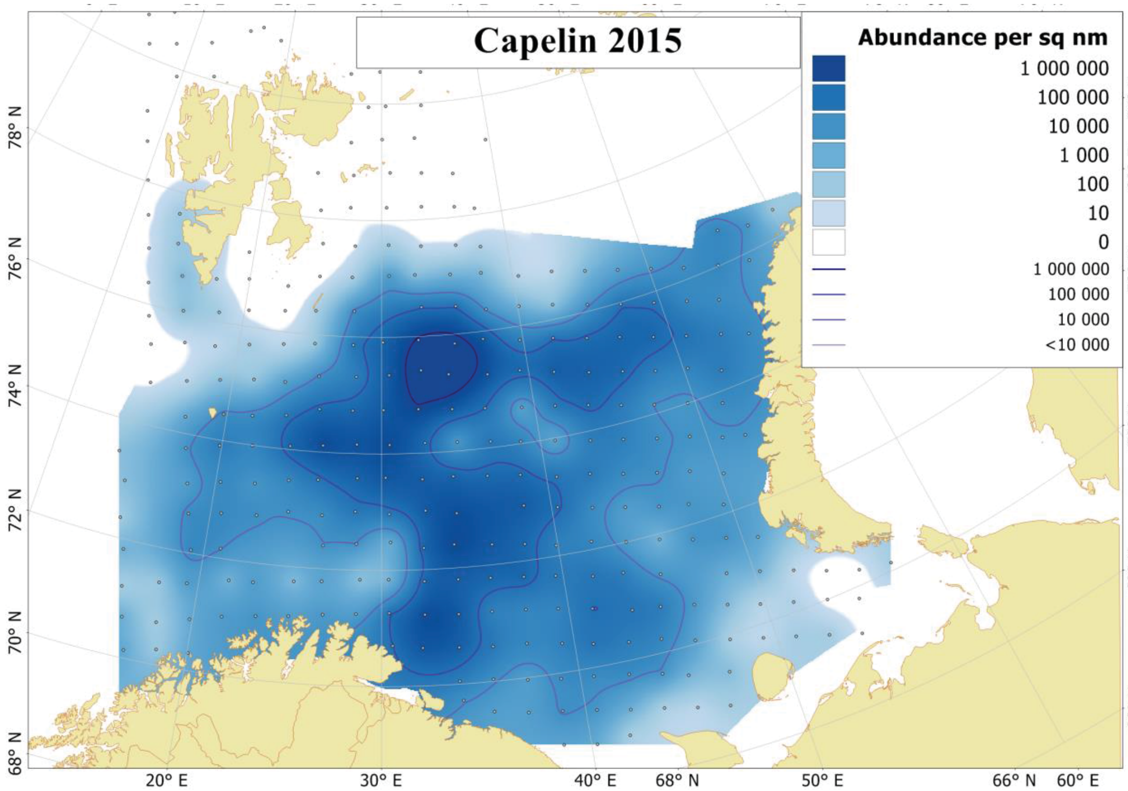


Figure 5.1.1.1. Distribution of 0-group capelin, August-October 2015.

The calculated density varied from 132 individuals to 22 million fish per square nautical mile, with mean density of 454 thousand fish per square nautical mile, that was higher than in 2014.

In 2015, sometimes were difficult to split 0-group and 1-year fish for individuals with 6-7 cm length, so otoliths from such fishes were analysed. The average length was 5.0 cm which is larger than in 2013-2014 (4.7 cm) and the long term mean (4.8 cm). The capelin length varied from 1.5 to 7.0 cm, however length of most of fish (77%) were between 4 and 6 cm.

The 0-group capelin biomass was about 272 thousand tonnes, and this is about 4 times higher than in 2014 (67 thousand tonnes) and 1.8 times higher than the long term level (151 thousand tonnes for period 1993-2015). The capelin biomass is shown in Table 5.1.3.

Most of the 0-group capelin likely originates from late spring spawning, however an unknown part of 0-group capelin of 3 cm body length or less were most likely from summer spawning. These small fish distributed mostly in the southern Barents Sea (Figure 5.1.1.2). Abundance of this part (2 %) is low in comparison with 2014 (6 %) and 2013 (8 %). This small 0-group capelin may probably have a worse condition for overwintering due to less time to grow up during the first feeding season.

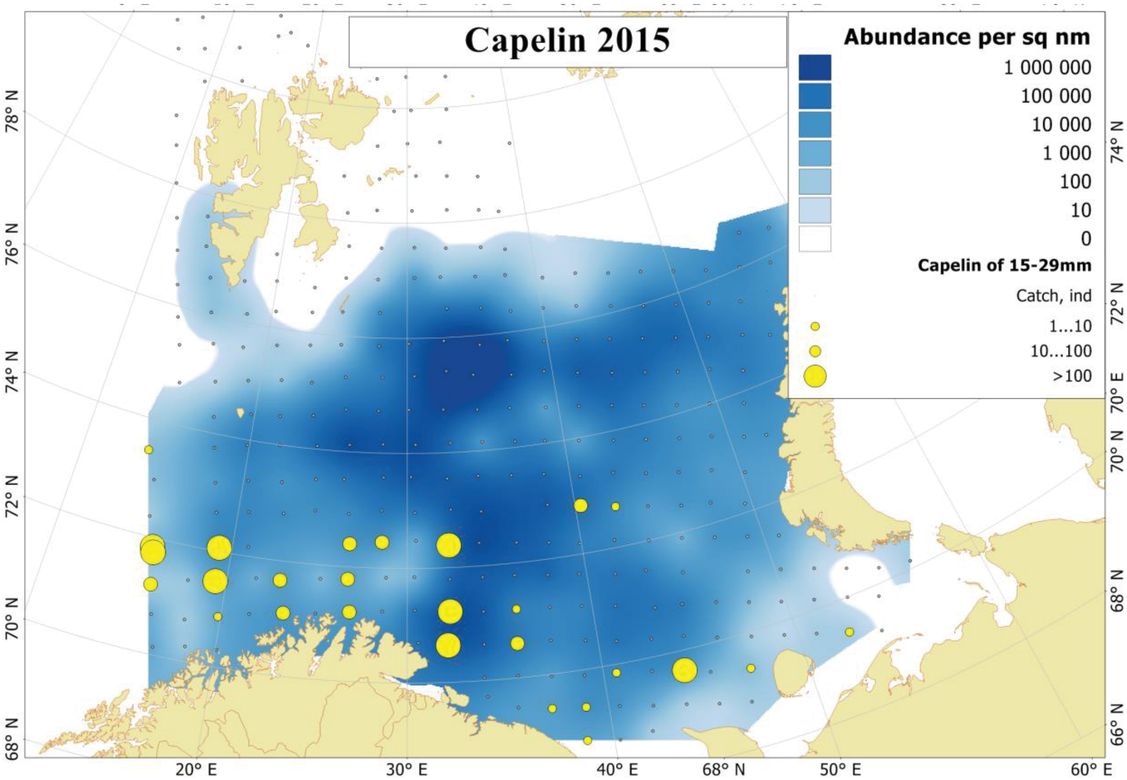


Figure 5.1.1.2. Distribution of small 0-group capelin of 15-29 mm body length, August- October 2015.

The abundance index of 0-group capelin in 2015 was 2.8 times higher than in 2014 and 1.5 times higher than the long term mean. The 2015 year class was found as above average.

5.1.2 Cod (*Gadus morhua*)

0-group cod were widely distributed in 2015, and the main dense concentrations were found in the north-central part of the sea, close to Finmark coast (Northern Norway) and west of Svalbard/Spitsbergen Archipelago (Figure 5.1.2.1). The western part was covered one month later then the central part, and cod were found neither in pelagic either demersal catches in the south-western area.

The calculated density was from 132 to 2.4 million fish per square nautical mile, which was half of 2014 densities. The mean density of 273 thousand fish per square nautical mile was observed in 2015.

The lengths of 0-group cod was between 2.0 and 13.5 cm. Most of the fish (62%) were between 6.5 and 9.5 cm, with a mean length of 7.5 cm, which is higher than in 2013-2014 and at same level as the long term of 7.5cm (Table 5.1.4).

The 0-group cod biomass (130 thousand tonnes) is 7.4 times lower than in 2014 and 4.8 times lower than the long term mean (Table 5.1.3).

The abundance index of 2015 year class is 3.1 times lower than long term mean. The 2015 year class may be characterized as weak.

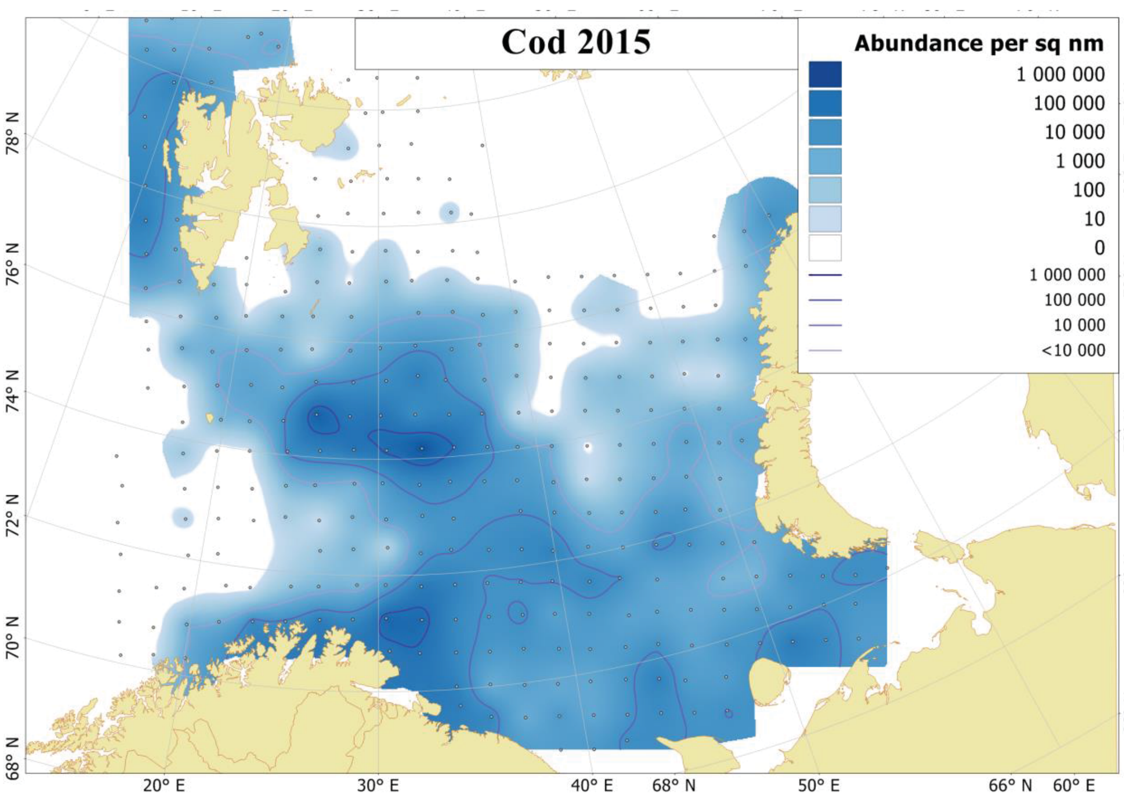


Figure 5.1.2.1. Distribution of 0-group cod, August-October 2015.

5.1.3 Haddock (*Melanogrammus aeglefinus*)

0-group haddock was relatively widely distributed in the central part of the survey area in 2015 (Figure 5.1.3.1). However, in the south-western area no haddock were observed. The main dense concentrations were found in the central part of the sea.

The calculated density varied between 123 and 1.1 million fish per square nautical mile. The mean calculated density per trawl was 18 thousand fish, that is higher than in 2014.

The length of 0-group haddock varied between 2.5 and 16.5 cm, while the length of most fish was between 8.0 and 12.0 cm (Table 5.1.4). The mean length of haddock was 10.1 cm, which is higher than in 2014 and the long term mean (9.1 cm). The large 0-group haddock may most likely indicate suitable living conditions for haddock in 2014.

The 0-group haddock biomass was 178 thousand tonnes and it is 1.8 times higher than in 2014 and at the long term mean (for period 1993-2015) (Table 5.1.3).

The number of fish belonging to the 2015 year class is higher than in 2014 and the long-term mean and can be characterized as above average year class.

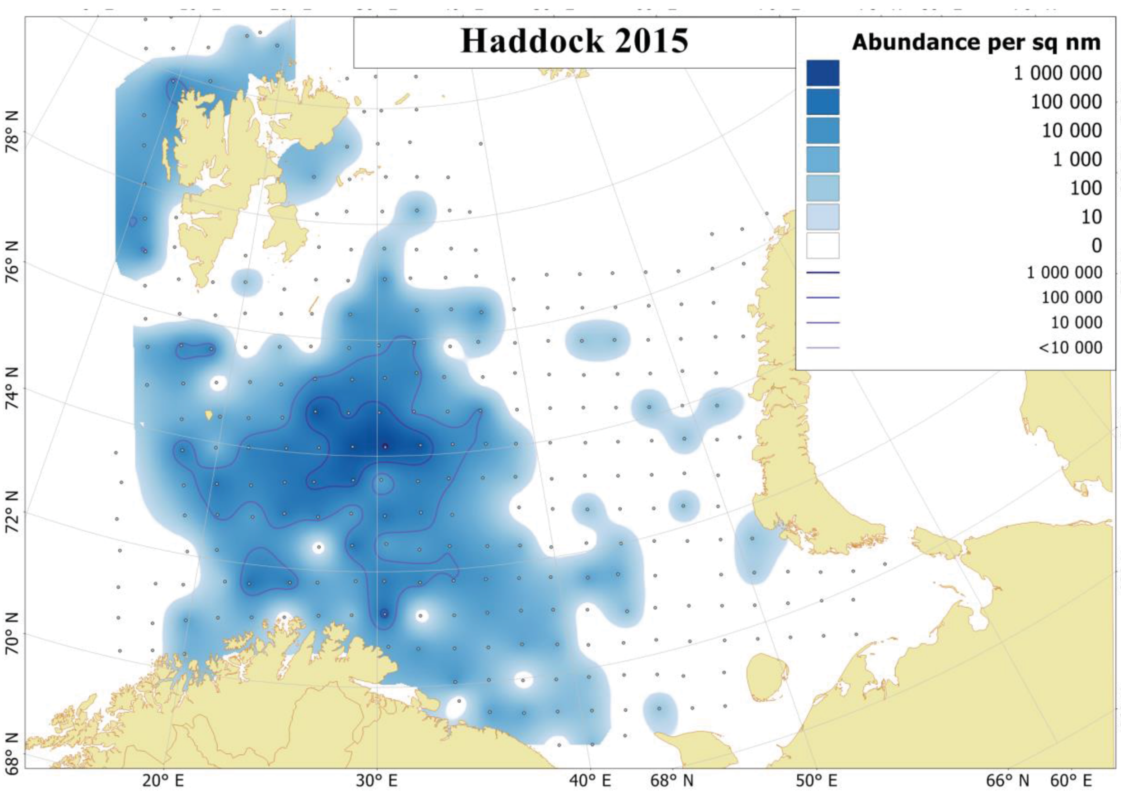


Figure 5.1.3.1. Distribution of 0-group haddock, August- October 2015.

5.1.4 Herring (*Clupea harengus*)

0-group herring were distributed in the central and northwestern area in 2015. The main dense concentration of herring was located in the north-central area and west off Svalbard (Fig. 5.1.4.1).

The calculated density varied from 132 to 5.3 million fish per square nautical mile. The mean calculated density was 30 thousand fish per square nautical mile.

The length of 0-group herring varied between 3.0 and 11.5 cm, and most of the fish (77%) were 6.0-7.5 cm long (Table 5.1.4). In 2015 the mean length of 0-group herring was 6.6 cm, that is lower than the long term mean of 7.1 cm.

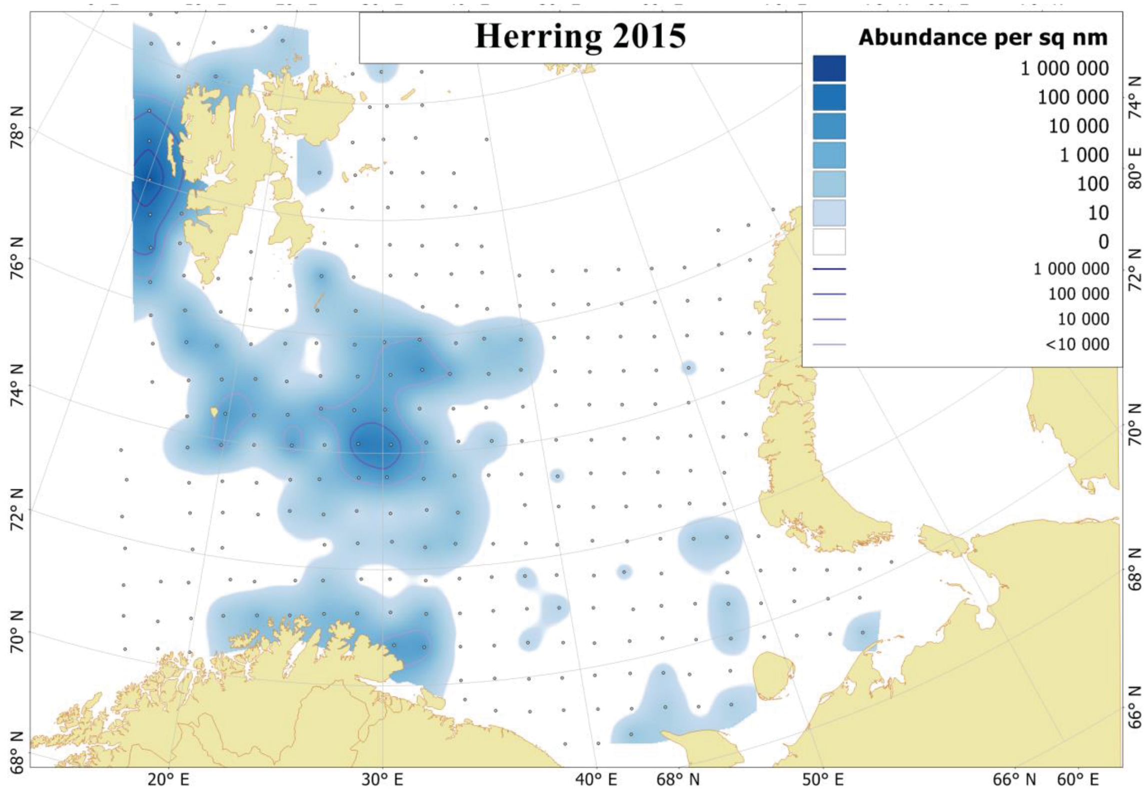


Figure 5.1.4.1. Distribution of 0-group herring, August- October 2015.

The 0-group herring biomass was 98 thousand tonnes and it is lower than in 2014 (169 thousand tonnes) and 5.6 times lower than the long term mean of 552 thousand tonnes (Table 5.1.3).

The 2015 year-class of herring is close to the 2011 level and it is below than the long term mean, and therefore can be characterized as weak.

5.1.5 Polar cod (*Boreogadus saida*)

As in previous years, the distribution of 0-group polar cod was split into two components: western and eastern (Figure 5.1.5.1). The western component was observed around the Svalbard/Spitsbergen Archipelago. Polar cod of the western component distributes usually along the western coast of Novaya Zemlya. Distribution of polar was wider than in 2014.

The length of polar cod varied between 2.0 and 8.0 cm, and most of the fish were between 3.0 and 4.0 cm long (Table 5.1.4). The mean length of 0-group polar cod (3.9 cm) was lower than in 2013 (5.0 cm) and was approximately equal to the long term mean of 4.0 cm.

The abundance index for each component was calculated separately. Calculated abundance of the eastern component was low: 4.6% of the 2014 value and 0.3% of the average (Table 5.1.1). The abundance index of western component was 9.4 times higher than in the 2014 and 1.3 times lower than the long term mean. Several years the abundance indices of polar cod were extremely low, and most likely indicated worse living conditions or/and significant reduce the spawning biomass in the Barents Sea.

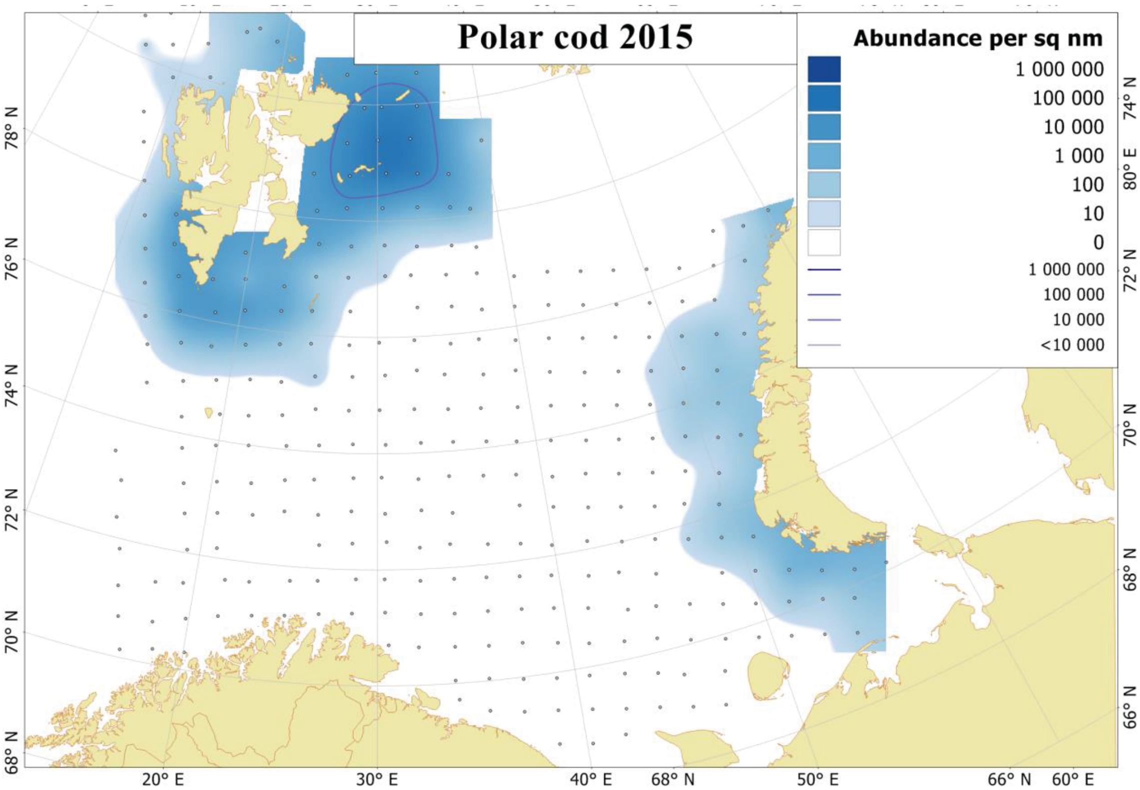


Figure 5.1.5.1. Distribution of 0-group polar cod, August-October 2015.

5.1.6 Saithe (*Pollachius virens*)

Saithe were found at higher number of station (16) in 2015 than in previous years (3-4). Saithe were mostly found in the western and central areas (Figure 5.1.6.1).

The calculated density varied from 146 to 21.4 thousand fish per square nautical mile. The mean calculated density was 30 thousand fish per square nautical mile. The maximum calculated density was only 138 fish per nautical mile. Both density and catch rates were higher than in previous years.

The length of 0-group saithe varied between 1.5 and 13.5 cm. The length of smallest fish was lower than earlier observed (5.5 cm). The mean length of saithe was 3.5 cm, which is notably lower the long term mean of 9.0 cm (Table 5.1.4).

Since 2005 (except in 2010) abundance indices of 0-group saithe have been lower than the long term average. The 2015 year class is slightly lower than the long term mean. The 2015 year class of saithe in the Barents Sea may be characterized as below the average. The index of 0-group saithe in the Barents Sea is only a minor part of the total 0-group abundance, and therefore not representative as recruitment (at age 0) for the saithe stock.

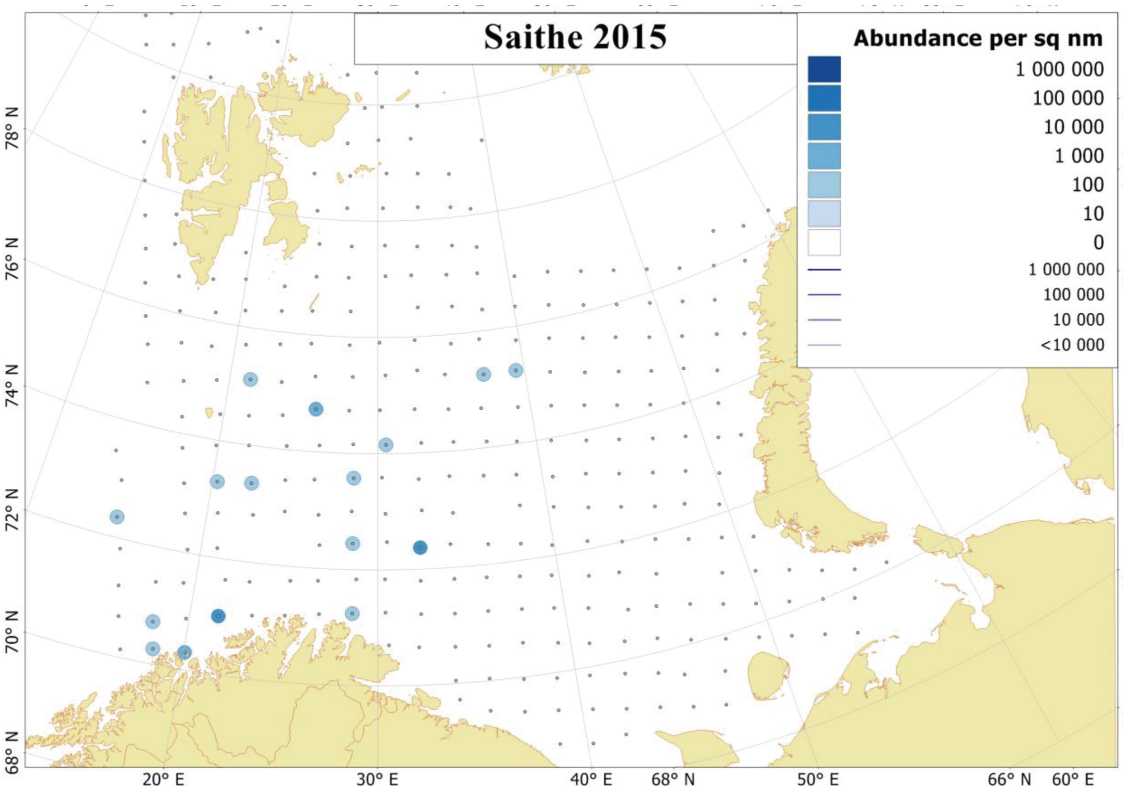


Figure 5.1.6.1. Distribution of 0-group saithe, August-September 2014.

5.1.7 Redfish (mostly *Sebastes mentella*)

0-group redfish was widely distributed in the western part of the Barents Sea: from the north western of the Svalbard/Spitsbergen Archipelago to the Norway coast between 70 °N and 81 °N (Figure 5.1.7.1). The densest concentrations were located west of Svalbard/Spitsbergen Archipelago. 0-group redfish were found west of Svalbard in the deeper area of continental edge in the last year, therefore it indicate that more fish distributed west of coverage area in 2015.

The calculated density was between 63 and 12.5 million fish per square nautical mile. Mean calculated density was 282 thousand fish, which higher than in 2012 -2014.

In 2015 the length of 0-group redfish was 0.5-6.5 cm and the mean fish length was 4.0 cm. Most of the fish (88%) were 3.0-5.5 cm long (Table 5.1.4). This mean fish length is almost similar to the long term mean of 3.9 cm. The large abundance and size of 0-group redfish may most likely indicate both increasing the redfish spawning biomass and suitable living conditions for redfish in 2015.

0-group redfish biomass in 2015 was 1.1 times higher than in 2014 and 1.3 times higher than the long term mean (Table 5.1.3).

The abundance of 0-group redfish is highest since 2008 and 1.6 times higher than the long term mean. So the 2015 year-class can be characterized as above average. 0-group redfish were found west of Svalbard in the deeper area of continental edge in 2014. The index of 0-group redfish in the Barents Sea is some unknown part of the total 0-group abundance, and therefore representative only for the shelf area of the Barents Sea.

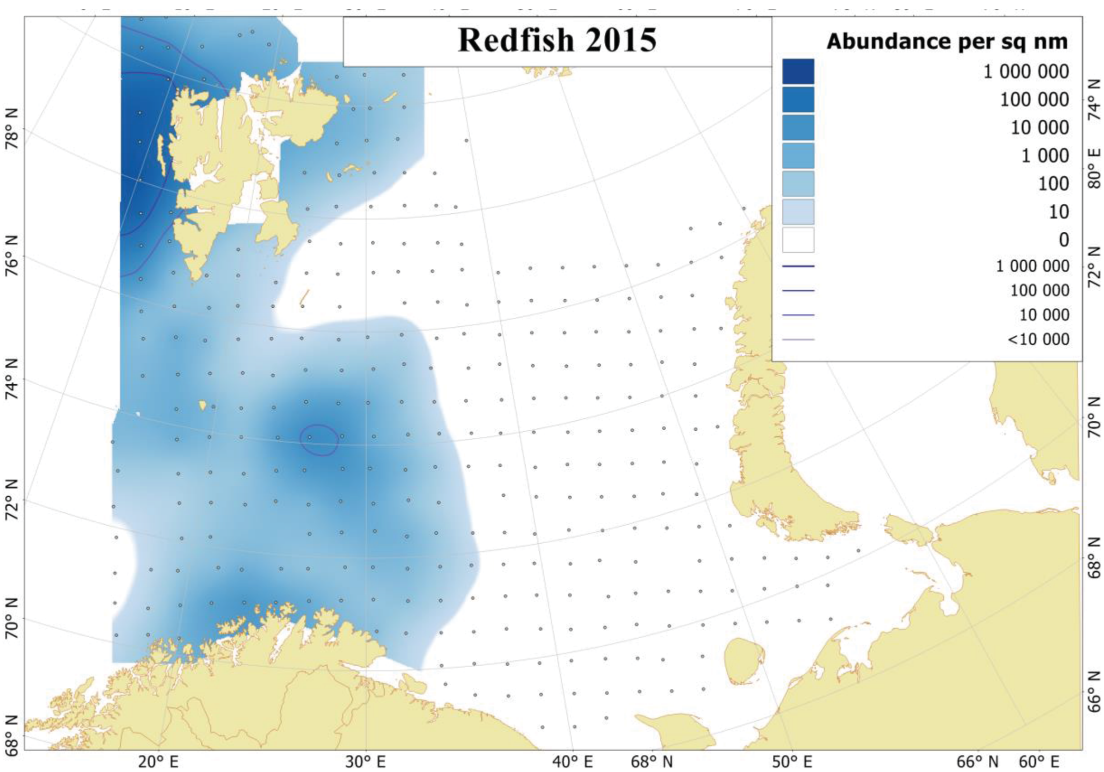


Figure 5.1.7.1. Distribution of 0-group redfishes, August- October 2015.

5.1.8 Greenland halibut (*Reinhardtius hippoglossoides*)

Since 2005 only low concentrations 0-group Greenland halibut were found. Greenland halibut were mostly observed around the Svalbard/Spitsbergen (Figure 5.1.8.1). The survey did not cover numerous of Svalbard/Spitsbergen fjords, where 0-group Greenland halibut are abundant, and therefore this index not give the real recruitment (at age 0) to the stock. However, this may reflect the minimum abundance index of the year-class strength in the standard long term surveyed area.

Fish length varied between 1.5 and 9.5 cm, while most of the fish were between 6.5 and 9.0 cm. The mean length of fish was 7.5 cm, which is higher than in 2007-2014 and the long term mean (6.2 cm) (Table 5.1.4).

The calculated density varied from 132 to 7.1 thousand fish per square nautical mile.

In 2012-2014 abundance of Greenland halibut continuously decreased, and 2015 year-class index is close to the long term mean.

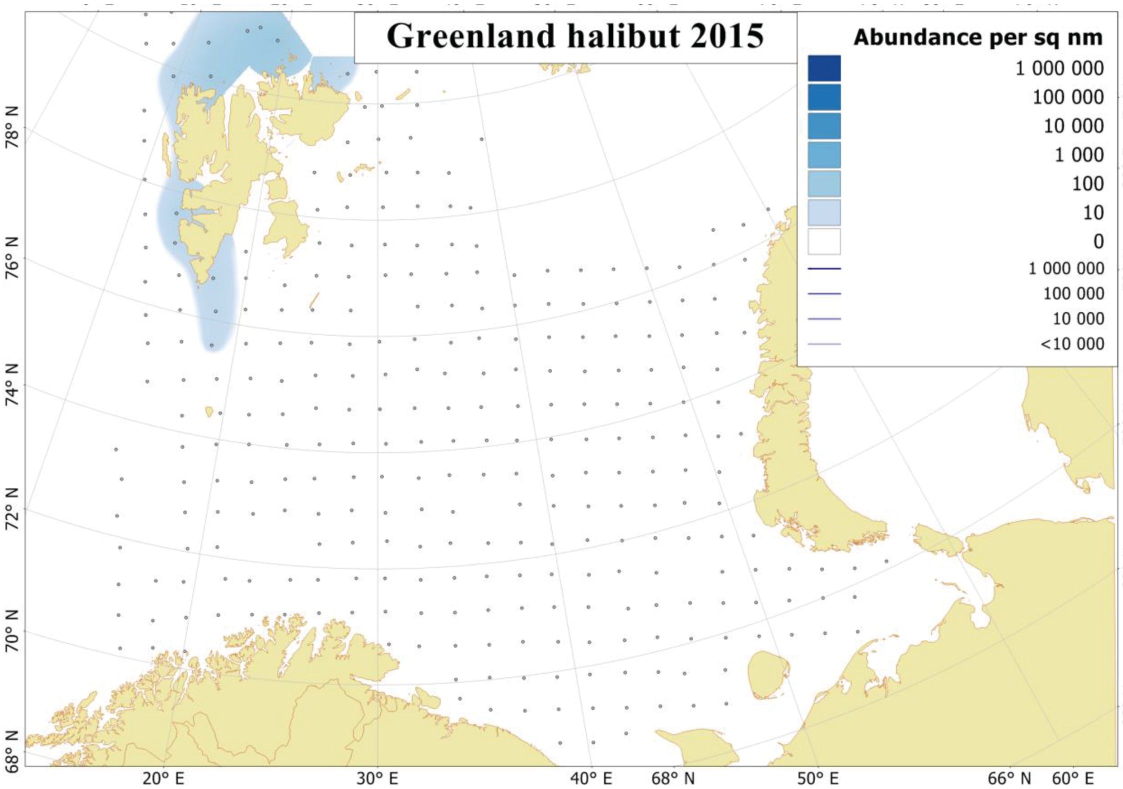


Figure 5.1.8.1. Distribution of 0-group Greenland halibut, August-October 2015.

5.1.9 Long rough dab (*Hippoglossoides platessoides*)

0-group long rough dab were widely distributed in the survey area (Figure 5.1.9.1). 0-group long rough dab were observed both in pelagic and bottom catches that indicated start of settlement. Settlement was more widespread in the south-west are due to late coverage (second part of September) of the area. Thus, the abundance indices will be most likely underestimated in 2015.

The calculated densities ranged between 138 and 40 thousand fish per square nautical mile with an average of 1.5 thousand fish per square nautical mile. That was 6 times higher than in 2014.

Fish length varied between 1.0 and 5.5 cm (Table 5.1.4). The mean length of fish was 3.2 cm and this is approximately the same in 2012-2014 and the long term average (3.4 cm).

The long rough dab index in 2015 was the highest since 2009 and close to the long term mean.

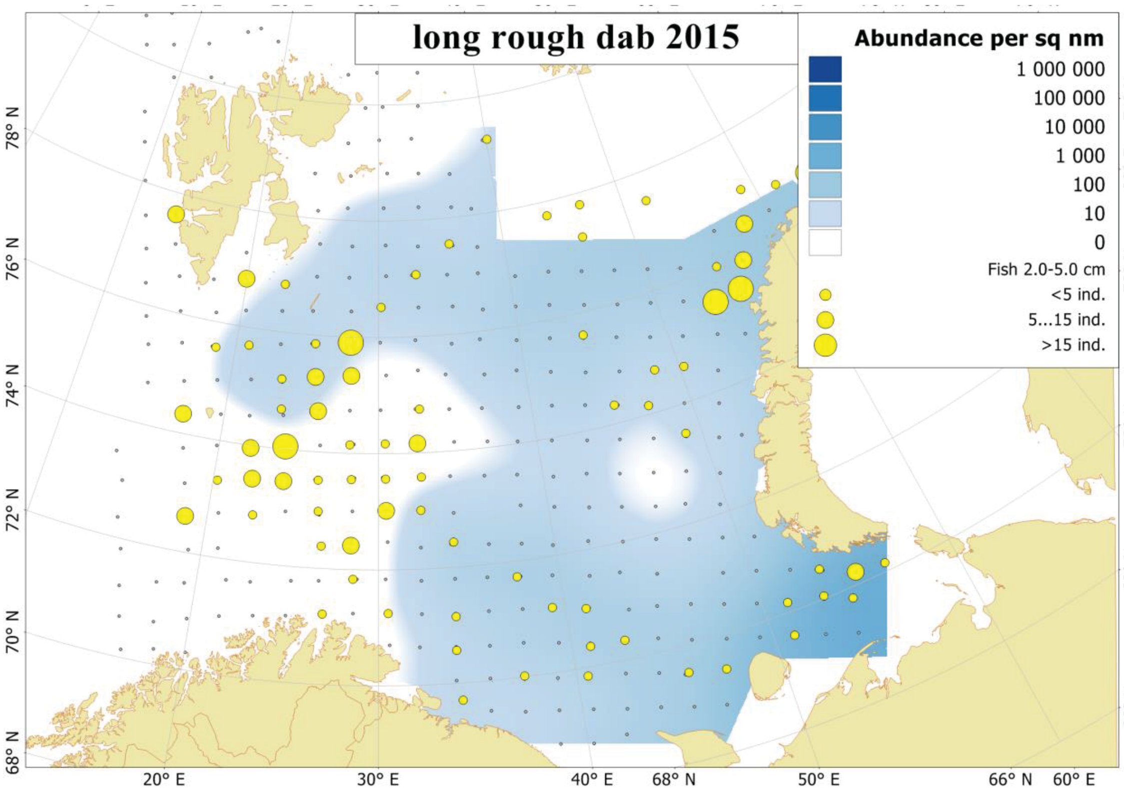


Figure 5.1.9.1. Distribution of 0-group long rough dab, August-October 2015.

The highest calculated density concentration was 74 thousand fish per square nautical mile (3.1 thousand fish per square nautical mile in 2013) with an average of 237. That was much higher than it was observed in 2013.

Fish length varied between 1.0 and 5.0 cm (Table 5.1.4). The mean length of fish was 3.1 cm. This is approximately the same as in 2012 (2.9 cm) and2013 (3.1 cm) and slightly below than the long term average (3.4 cm). The long rough dab index in 2014 was the highest since 2009. However, it is below than the long term mean, and therefore the 2014 year-class can be characterized as relative poor.

5.1.10 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*). Distribution of three wolfish species is shown in the map (Figure 5.1.10.1). 0-group of Atlantic wolfish were found in the western part of the surveyed area, Spotted wolfish in the western and in the central part, while Northern wolfish were found in the 3 stations in the central part.

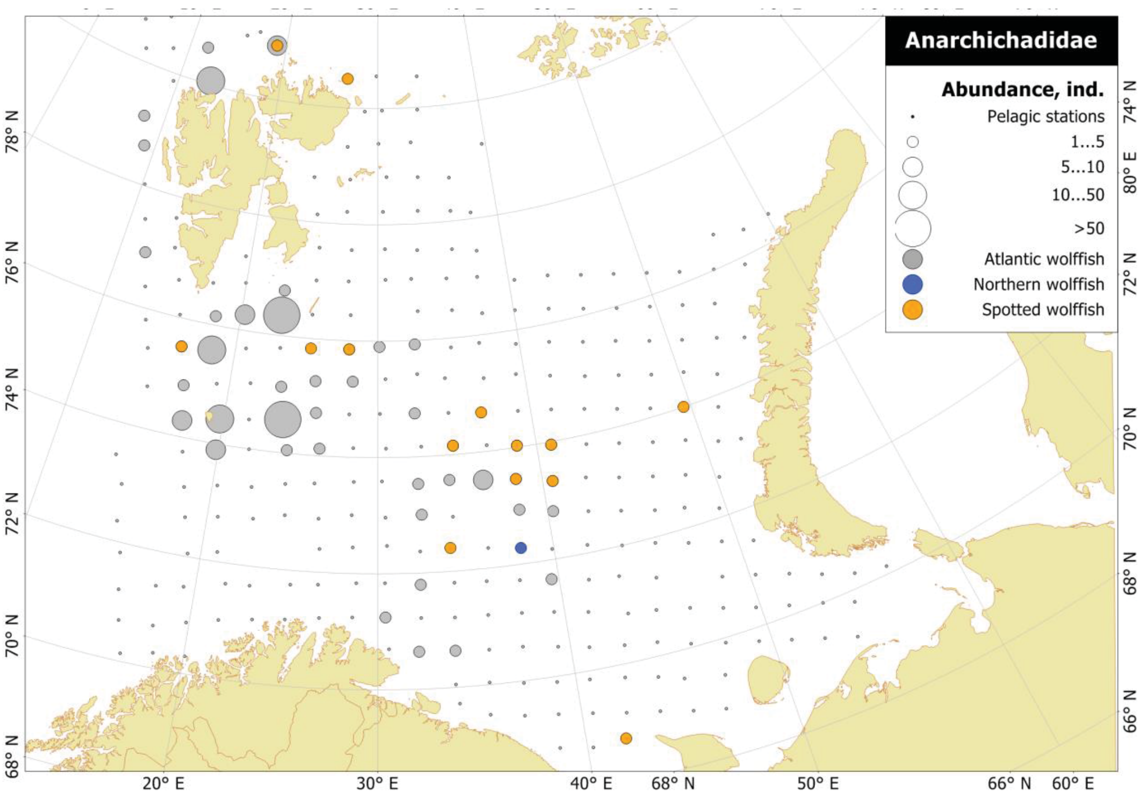


Figure 5.1.10.1. Distribution of 0-group wolffishes, August-October 2015.

The length of the 0-group Atlantic wolfish was 2.5-9.0 cm (mean length 5.6 cm), Spotted wolfish – 4.5-10.5 cm (mean length – 8.4 cm) and Northern wolfish – 9.0 cm.

No index is calculated for this species. But the distribution of 0-group 2015 year class was close to the 2014.

5.1.11 Sandeel (Ammodytes marinus)

In 2015, 0-group sandeel were widely distributed and found in the south-eastern and the western part of the Barents Sea (Figure 5.1.11.1). The denser concentrations were found as usually in the southern part.

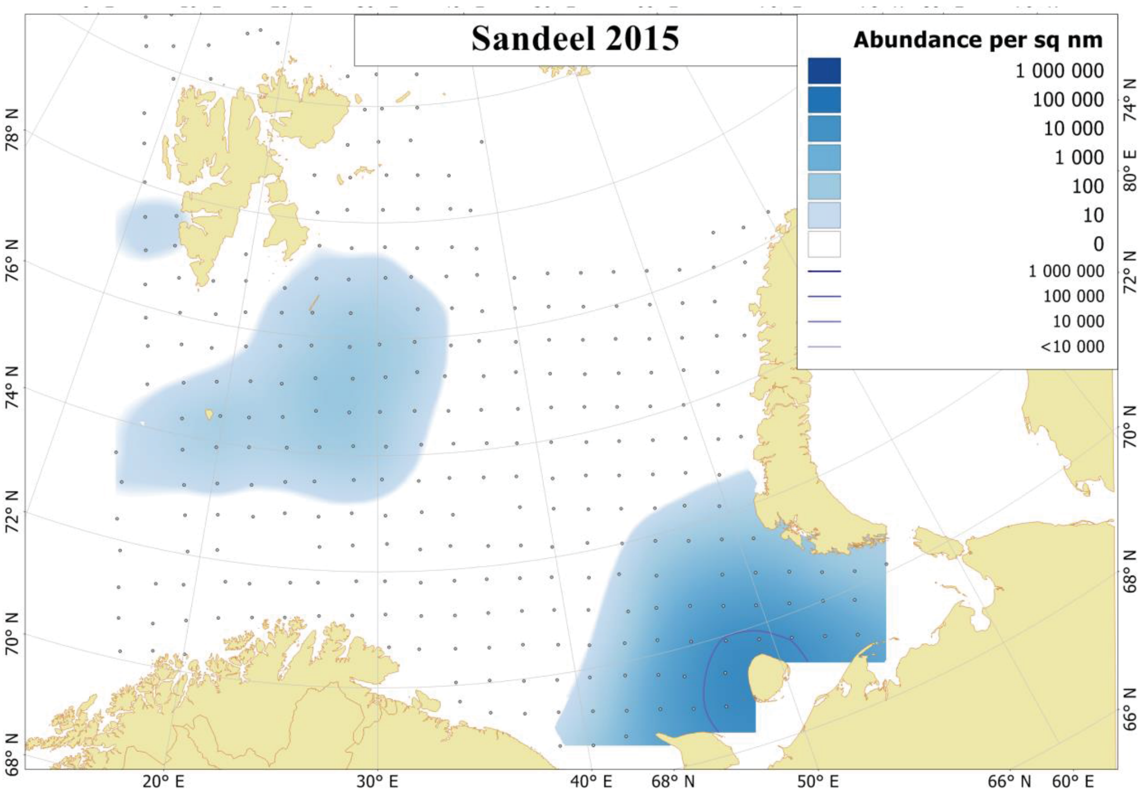


Figure 5.1.11.1. Distribution of 0-group sandeel, August-October 2015.

The calculated density was from 147 to 445 thousand fish per square nautical mile, with an average of 6.0 thousand fish per square nautical miles, that is higher than in 2012-2014.

The fish length varied between 3.0 to 12.5 cm, however most fish have length 5.0-7.5 cm (Table 5.1.4). Sometimes otoliths were taken to determine the maximum length of 0-group. Average length in 2015 was 6.8 cm, which is higher than in 2012-2014 and the long term mean (5.7 cm).

The abundance and biomass of sandeel ($2.8*10^9$ individuals and 1.4 million tonnes, respectively) was similar to last two years, however it was almost half of long term mean ($5.7*10^9$ individuals and 2.9 million tonnes, respectively).

5.1.13 Blue whiting (*Micromesistius poutassou*)

No observations of 0-group blue whiting of 6.8 cm were recorded during the survey.

5.2 Pelagic fish abundance and distribution

Text by G. Skaret and D. Prozorkevich
Figures by J. Alvarez and D. Prozorkevich

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

5.2.1 Capelin (*Mallotus villosus*)

Distribution

The geographical density distribution of capelin of age group 1 and total stock are shown in Figures 5.2.1.1 and 5.2.1.2. The distribution was much more southerly and also more compact than what was found in 2011-2013. Notably, in the areas east of Svalbard/Spitsbergen including the regions around Kong Karls land and Kvitøya with high capelin concentrations in 2011-2013, hardly any capelin were recorded during this years' survey. The main capelin hotspot this year was around Great (Perseus) Bank, with smaller aggregations to the north-east of Great (Perseus) Bank and around Hopen island. Young capelin were mainly found to the south of 78ºN, and the total distribution area of young capelin was lower than in previous years, in particular in the eastern Barents Sea.

The area in between Svalbard/Spitsbergen archipelago and Franz Josef Land north of 78° was not accessible in the 2014 survey due to extensive ice cover. Both young and adult capelin were distributed here in 2011-2013, and adult capelin regionally in high concentrations. In 2015, however, hardly any capelin was found in the area which was ice covered in 2014.

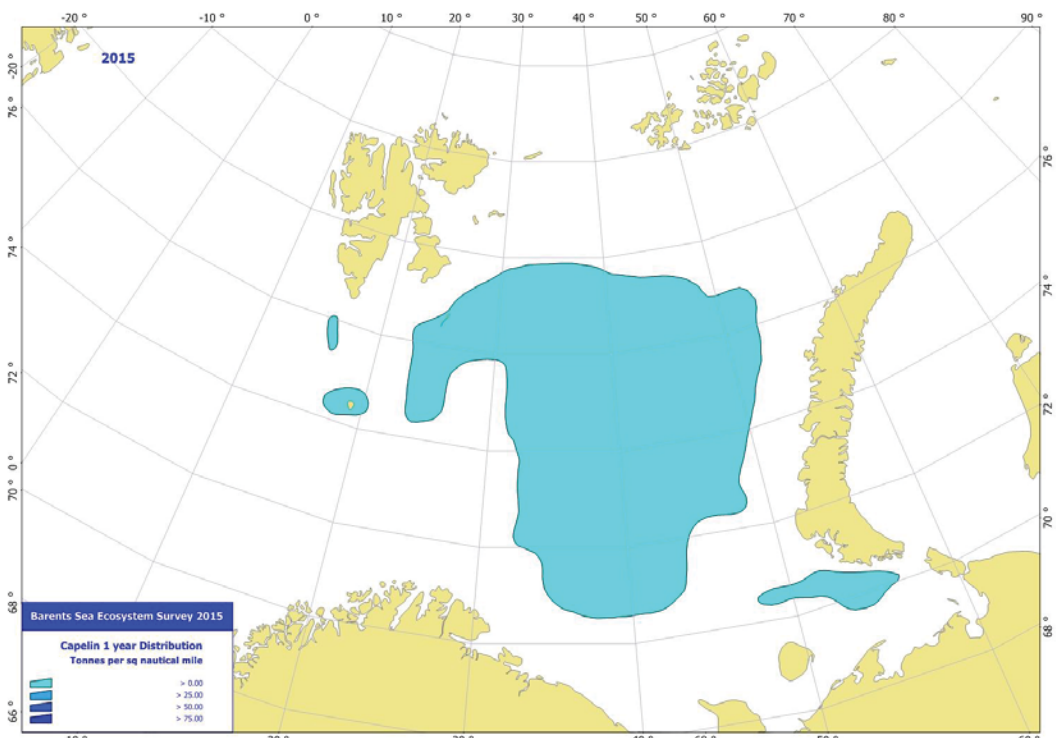


Figure 5.2.1.1. Estimated density distribution of 1-year-old capelin (t/sq nautical mile), August-October 2015.

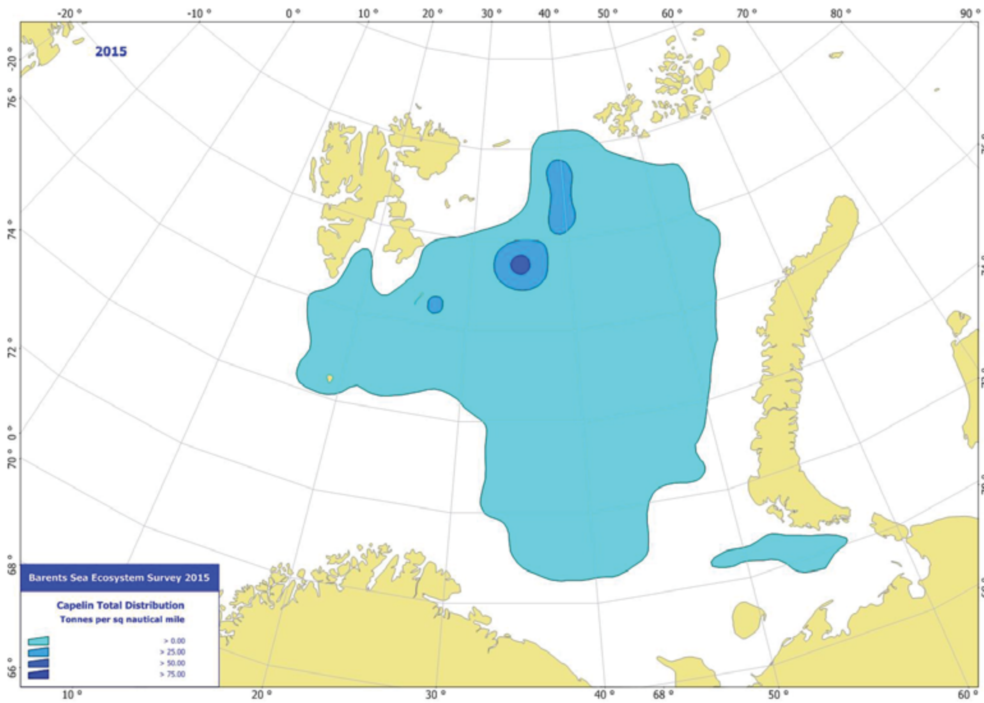


Figure 5.2.1.2. Estimated total density distribution of capelin (t/sq nautical mile), August-October 2015.

Abundance estimate and size by age

A detailed stock size estimate is given in Table 5.2.1.1, and the time series of abundance estimates is summarized in Table 5.2.1.2. The mature part of the stock is basis for the prognosis of spawning stock in spring 2016, 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 2016.

The main results of the abundance estimation in 2015 are summarized in Table 5.2.1.3. The 2014 estimate is shown on a shaded background for comparison. The total stock is estimated at about 0.8 million tonnes, which is well below the long term mean level (about 3 million tonnes, Table 5.2.1.2), only about 21% of the stock size estimated for 2013, and about 43 % of the 2014 stock size estimate. About 45 % (0.37 million tonnes) of the 2015 stock has length above 14 cm and is considered to be maturing.

The 2014 year class (1-year group) consists, according to this estimate, of about 40 billion individuals. This estimate is well below the long-term average. The mean weight (3.8 g) is small higher than that measured last year and slightly above the long-term average. The biomass of the 2014 year class is about 0.15 million tonnes, which is the lowest since the 2005 year class, and well 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-year group estimate might be more uncertain than that for older capelin.

The estimated number for the 2013 year class (2-year group) is about 40 billion, which is the lowest estimated abundance of 2-year-olds since 2006. The mean weight of this group in 2015 is 10.8 g, which is the highest since 2009, and roughly equals the long-term average (Table 5.2.1.2). The estimated biomass of the 2-year-olds is about 0.41 million tonnes in 2015; the lowest since 2006 and well below the long term average.

The 2012 year class (3 year-olds) is estimated at about 13 billion individuals; about 1/3 of the amount of 3 year-olds observed in 2014. The mean weight of 17.9 g higer last years' mean weight and is about 2 g below the long-term average. Total estimated biomass of 3-year-olds is about 0.23 million tonnes, which is well below the long-term average.

The 2011 year class (now 4 years old) is estimated at about 2 billion individuals with a mean weight of 22.5 g, adding up to a biomass of about 40 thousand tonnes. A negligible 5-year-olds were found.

In general, the average weight of the all age groups of capelin tend to increase but still remains at a low level (figure 5.2.1.3).

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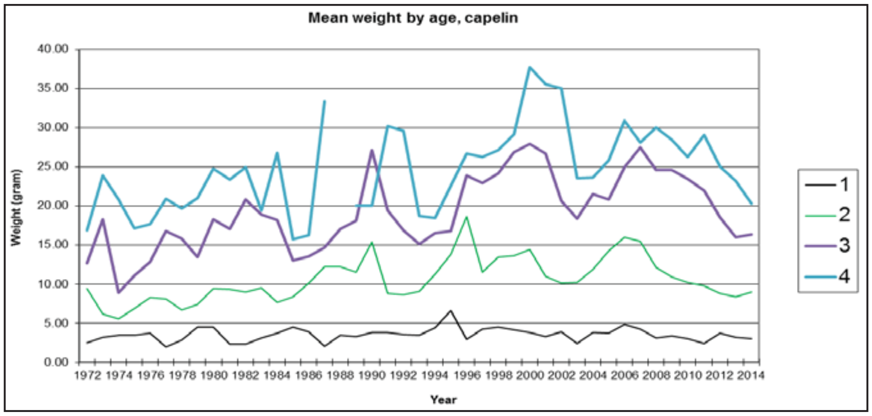

Figure 5.2.1.3. Weight at age (grams) for capelin from capelin surveys and BESS.

Table 5.2.1.1. Barents Sea capelin. Acoustic estimate in August-October 2015.

Length (cm)	Age group / year class 1 2014	2 2013	3 2012	4 2011	5+ 2010-	Sum (10^9)	Biomass (10^3 t)	Mean weight (g)
6.5 - 7.0	1.017					1.017	1.32	1.3
7.0 - 7.5	1.549					1.549	1.55	1.0
7.5 - 8.0	1.942					1.942	3.69	1.9
8.0 - 8.5	2.165					2.165	4.33	
8.5 - 9.0	2.240					2.240	5.60	
9.0 - 9.5	3.171					3.171	9.20	2.9
9.5 - 10.0	4.421					4.421	15.03	3.4
10.0 - 10.5	6.928	0.195				7.122	28.49	4.0
10.5 - 11.0	8.225	0.170				8.395	38.62	4.6
11.0 - 11.5	5.629	1.523				7.151	37.90	5.3
11.5 - 12.0	1.586	2.778	0.001			4.365	27.06	6.2
12.0 - 12.5	0.329	4.473	0.254			5.056	36.91	7.3
12.5 - 13.0	0.192	4.871	0.021			5.084	43.21	8.5
13.0 - 13.5	0.121	6.450	0.387			6.959	68.20	9.8
13.5 - 14.0	0.006	6.750	0.402			7.158	80.17	11.2
14.0 - 14.5	0.002	6.035	1.388			7.425	94.30	12.7
14.5 - 15.0	0.001	3.424	1.999	0.093		5.517	82.76	15.0
15.0 - 15.5		1.940	2.851	0.077		4.868	81.30	16.7
15.5 - 16.0		1.291	2.318	0.160		3.769	71.99	19.1
16.0 - 16.5		0.514	1.764	0.187		2.465	56.45	22.9
16.5 - 17.0		0.046	1.038	0.139		1.223	31.31	25.6
17.0 - 17.5		0.003	0.414	0.190	0.003	0.610	17.14	28.1
17.5 - 18.0			0.117	0.000		0.117	3.64	31.1
18.0 - 18.5			0.005	0.012		0.017	0.60	35.2
18.5 - 19.0			0.001			0.001	0.03	34.0
TSN (10^9)	39.524	40.463	12.96	0.858	0.003	93.807		
TSB (10^3 t)	151.1	438.9	232.2	19.4	0.1		841.7	
Mean length (cm)	9.9	13.5	15.3	16.2	17.2	12.3		
Mean weight (g)	3.8	10.8	17.9	22.5	28.1			9.0
SSN (10^9)	0.003	13.253	11.895	0.858	0.003	26.012		
SSB (10^3 t)	0.03	178.92	181.99	13.90	0.05		374.89	

Tabell 5.2.1.2. 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										
Year	1		2		3		4		5		Sum 1+
	B	AW	B	AW	B	AW	B	AW	B	AW	B
1973	1.69	3.2	2.32	6.2	0.73	18.3	0.41	23.8	0.01	30.1	5.16
1974	1.06	3.5	3.06	5.6	1.53	8.9	0.07	20.8	+	25	5.72
1975	0.65	3.4	2.39	6.9	3.27	11.1	1.48	17.1	0.01	31	7.80
1976	0.78	3.7	1.92	8.3	2.09	12.8	1.35	17.6	0.27	21.7	6.41
1977	0.72	2	1.41	8.1	1.66	16.8	0.84	20.9	0.17	22.9	4.80
1978	0.24	2.8	2.62	6.7	1.20	15.8	0.17	19.7	0.02	25	4.25
1979	0.05	4.5	2.47	7.4	1.53	13.5	0.10	21	+	27	4.15
1980	1.21	4.5	1.85	9.4	2.83	18.2	0.82	24.8	0.01	19.7	6.72
1981	0.92	2.3	1.83	9.3	0.82	17	0.32	23.3	0.01	28.7	3.90
1982	1.22	2.3	1.33	9	1.18	20.9	0.05	24.9			3.78
1983	1.61	3.1	1.90	9.5	0.72	18.9	0.01	19.4			4.24
1984	0.57	3.7	1.43	7.7	0.88	18.2	0.08	26.8			2.96
1985	0.17	4.5	0.40	8.4	0.27	13	0.01	15.7			0.85
1986	0.02	3.9	0.05	10.1	0.05	13.5	+	16.4			0.12
1987	0.08	2.1	0.02	12.2	+	14.6	+	34			0.10
1988	0.07	3.4	0.35	12.2	+	17.1					0.42
1989	0.61	3.2	0.20	11.5	0.05	18.1	+	21.0			0.86
1990	2.66	3.8	2.72	15.3	0.44	27.2	+	20.0			5.82
1991	1.52	3.8	5.10	8.8	0.64	19.4	0.04	30.2			7.30
1992	1.25	3.6	1.69	8.6	2.17	16.9	0.04	29.5			5.15
1993	0.01	3.4	0.48	9.0	0.26	15.1	0.05	18.8			0.80
1994	0.09	4.4	0.04	11.2	0.07	16.5	+	18.4			0.20
1995	0.05	6.7	0.11	13.8	0.03	16.8	0.01	22.6			0.20
1996	0.24	2.9	0.22	18.6	0.05	23.9	+	25.5			0.51
1997	0.42	4.2	0.45	11.5	0.04	22.9	+	26.2			0.91
1998	0.81	4.5	0.98	13.4	0.25	24.2	0.02	27.1	+	29.4	2.06
1999	0.65	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			4.32
2001	0.37	3.3	2.40	11.0	0.81	26.7	0.04	35.5	+	41.4	3.62
2002	0.23	3.9	0.92	10.1	1.04	20.7	0.02	35.0			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			0.33
2006	0.29	4.8	0.35	16.1	0.14	24.8	0.01	30.6	+	36.5	0.79
2007	0.93	4.2	0.85	15.5	0.10	27.5	+	28.1			1.88
2008	0.97	3.1	2.80	12.1	0.61	24.6	0.05	30.0			4.43
2009	0.42	3.4	1.82	10.9	1.51	24.6	0.01	28.6			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
2012	0.54	3.7	1.37	8.8	1.62	18.5	0.06	25.0			3.59
2013	1.04	3.2	1.81	8.4	0.94	15.9	0.16	23.2	+	29.1	3.96
2014*	0.32	3.0	0.95	8.9	0.64	16.3	0.04	20.3			1.95
2015	0.15	3.8	0.44	10.8	0.23	17.9	0.02	22.5	+	28.1	0.84
Average	0.65	3.56	1.34	10.60	0.86	19.25	0.20	24.75	0.07	28.13	2.98

*Not compensated for incomplete survey coverage

Table 5.2.1.3. Table on summary of stock size estimates for capelin in 2014-2015. The table is not correced for incomplete survey coverage in 2014.

Year class		Age	Number (10^9)		Mean weight (g)		Biomass (10^3 t)	
2014	2013	1	39.52	105.15	3.8	3.01	151.1	316.6
2013	2012	2	40.46	106.59	10.8	8.94	438.9	952.7
2012	2011	3	12.96	39.29	17.9	16.30	232.2	640.4
2011	2010	4	0.86	1.96	22.5	20.26	19.4	39.7
Total stock in:								
2015	2014	1-5	93.81	252.99	9.0	7.71	841.7	1949.4
Target strength estimation based on formula: TS= 19.1 log (L) – 74.0, corresponding to $\sigma = 5.0 \cdot 10^7 \cdot L^{1.91}$								

Total mortality calculated from surveys

Table 5.2.1.4 shows the number of fish in the various year classes, and their “survey mortality” in transition from age one to two. As there has been no fishing on these age groups, the figures for total mortality constitute only natural mortality (M).

The estimates of M have varied considerably, but give quite good indications of the predation on capelin, given the constraints of survey uncertainties. In 2008, 2010 and 2013, M was estimated to a negative value. This shows that in those years either the one-year group was underestimated or the two-year group was overestimated or a combination of those. This year the estimate of M was the highest since 2005. It is highly likely that the estimate of 2-year-olds this year is biased low due to incomplete survey coverage, and that this will bias high the estimate of M, but the extent of this source of systematic error is not known.

Table 5.2.1.4. Barents Sea capelin. Survey mortalities from age 1 to age 2.

		Age			
Year	Year class	1 (10^9)	2 (10^9)	Mortality %	Mortality 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	1.37
2005-2006	2004	26.9	21.7	19	0.21
2004-2005	2003	51.2	13.0	75	1.37
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	-3	-
2010-2011	2009	247.7	181.2	27	0.31
2011-2012	2010	209.6	156.4	25	0.29
2012-2013	2011	145.9	216.2	-	-
2013-2014	2012	324.5	106.6	67	1.11
2014-2015	2013	105.2	40.5	62	0.95

5.2.2 Herring (*Clupea harengus*)

Distribution in 2015

Young herring was widely distributed in the Barents Sea in 2015 (Figure 5.2.2.1). The eastern distribution border was at 45° E, and the western boundary along the continental slope. The main concentrations were found between 20° and 40° E from the Murman coast to 75° N.

Figure 5.2.2.1. Estimated total density distribution of herring (t/nautical mile^2), August-October 2015.

Abundance estimation

There has recently been a low abundance of juvenile herring in the Barents Sea. In 2010, herring were practically absent in the eastern and central parts of the Barents Sea. In 2011, the herring abundance further decreased, and the level of the juvenile stock proportion was only 10% of average annual level.

In 2012-2014, biomass of young herring increased, but decreased a little bit in 2015 to 845 000 tonnes. At the same time the number of herring in 2015 was the highest since 2005. This is a positive signal with regards to the herring recruitment. Estimated abundance of herring based on acoustics is shown in Table 5.2.2.1.

The total number of herring in the Barents Sea (ages 1-4) in 2015 was estimated at 13.6 billion individuals, which is lower than the long term level but somewhat higher than in 2014 (13.011 billion individuals). Comparative estimates of abundance and biomass of herring are shown in Table 5.2.2.2.

Table 5.2.1.1. Norwegian spring spawning herring. Acoustic estimate in the Barents Sea in August-October 2015.

Length (cm)	Age/Yearclass 1 2014	2 2013	3 2012	4 2011	5 2010	Sum 10^6	Biomass (10^3 t)	Mean weigt(g)	Mean length (cm)
10.0 - 10.5	1149					1149	5.4	4.7	10.25
10.5 - 11.0						0	0.0		10.75
11.0 - 11.5	34					34	0.2	6.5	11.25
11.5 - 12.0						0	0.0		11.75
12.0 - 12.5						0	0.0		12.25
12.5 - 13.0						0	0.0		12.75
13.0 - 13.5						0	0.0		13.25
13.5 - 14.0		367				367	6.2	17	13.75
14.0 - 14.5		740				740	14.6	19.7	14.25
14.5 - 15.0		539				539	12.1	22.5	14.75
15.0 - 15.5		1204				1204	27.3	22.7	15.25
15.5 - 16.0		326	712			1038	28.4	27.4	15.75
16.0 - 16.5		527				527	13.6	25.8	16.25
16.5 - 17.0		195	143			338	10.7	31.7	16.75
17.0 - 17.5		320				320	11.0	34.5	17.25
17.5 - 18.0		3				3	0.1	33	17.75
18.0 - 18.5		105				105	4.3	41.2	18.25
18.5 - 19.0		108				108	3.8	35	18.75
19.0 - 19.5			336			336	19.3	57.5	19.25
19.5 - 20.0		118				118	6.5	55	19.75
20.0 - 20.5		142	32			174	10.8	61.9	20.25
20.5 - 21.0		144				144	9.4	65.3	20.75
21.0 - 21.5		435				435	31.1	71.4	21.25
21.5 - 22.0		417				417	31.7	76	21.75
22.0 - 22.5		491	3			494	40.1	81.2	22.25
22.5 - 23.0		438	29			467	41.2	88.3	22.75
23.0 - 23.5		664	73			737	68.8	93.3	23.25
23.5 - 24.0		507	274			781	80.0	102.4	23.75
24.0 - 24.5		625	273			898	98.2	109.3	24.25
24.5 - 25.0		191	369			560	65.4	116.7	24.75
25.0 - 25.5		240	370			610	73.6	120.6	25.25
25.5 - 26.0		150	132	8		290	35.8	123.6	25.75
26.0 - 26.5		27	203	10		240	34.1	142.1	26.25
26.5 - 27.0			149	1		150	21.4	142.6	26.75
27.0 - 27.5			111	7		118	18.4	156	27.25
27.5 - 28.0				48		48	7.7	159.6	27.75
28.0 - 28.5				60		60	10.3	171.3	28.25
28.5 - 29.0				10		10	1.9	189.5	28.75
29.0 - 29.5			5			5	1.0	206	29.25
29.5 - 30.0						0	0.0		29.75
30.0 - 30.5					5	5	1.0	201	30.25
TSN(10^6)	1183	9023	3214	144	5	13569			
TSB(10^3 t)	5.6	530.0	285.3	23.5	1.0		845.4		
Mean length (cm)	10.3	19.3	22.0	27.8	30.3	19.2			
Mean weight (g)	4.8	58.7	88.8	163.0	201.0	62.3			
						Target strength estimation based on formula: TS=20.0 log(L) - 71.9			

Table 5.2.2.2. Norwegian spring spawning herring. Acoustic estimates by age in autumn 1999-2015. 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	48759	716	986	31	51	2			49795	749
2000	14731	383	11499	560					26230	943
2001	525	12	10544	604	1714	160			12783	776
2002									0	0
2003	99786	3090	4336	220	2476	326			106597	3636
2004	14265	406	36495	2725	901	107			51717*	3252*
2005	46380	984	16167	1055	6973	795			69520	2833
2006	1618	34	5535	398	1620	211			8773	643
2007	3941	148	2595	218	6378	810	250	46	13164	1221
2008	30	1	1626	77	3987**	287**	3223**	373**	8866	738
2009	2	48	433	52	1807	287	1686	393	5577	815
2010	1047	35	215	34	234	37	428	104	2025	207
2011	95	3	1504	106	6	1			1605	109
2012	2031	36	1078	66	1285	195			4394	296
2013	7657	202	5029	322	92	13	57	9	12835	546
2014	4188	62	1822	126	6825	842	162	25	13011	1058
2015	1183	6	9023	530	3214	285	149	24	13569	845
Average	15390	385	6805	445	2398	291	455	100	21797	963

* Including older age groups (5 year old and more) not shown in the table
** including several Kanin herring (mix concentration in south-east area)

Number of 1-year-olds was estimated at 1.2 billion individuals, which is only about 25 % of the abundance of 1-year-olds in 2014, and well below the long-term average (15.3 billion individuals). No herring were determined to be 1-year-olds through age reading, the estimates are based on length distributions and age-length keys.

There was an estimated 9 billion 2-year-olds observed, and this yearclass dominated total herring abundance. This is the highest estimate of 2-year-olds since 2005. The average length of the 2-year group (19.3 cm) was a little lower than last year, and average weight of the fish was also lower (59.7 g in 2015 versus 75.7 g in 2014).

The abundance of 3-year-olds was lower than last year with a biomass of 285 000 tonnes, and 3.2 billion individuals. The average weight of the 3-year-olds (89 g) was lower than in 2014 (98.5 g) whereas average length had increased (22 cm compared to 20.9 cm).

It should be noted that in early October in the Kola Bay significant concentrations of juvenile herring were observed. At the same time marine mammals were feeding on the herring to the extent that it was impossible to carry out pelagic trawling in this area. From the acoustic recordings, it was possible to estimate the length of the young herring based on individual targets (figure 5.2.2.2), and the schools were estimated to consist mainly of fish in the length range 20-22 cm, most probably age groups 2+ or 3+. The biomass of herring within a limited area of Kola Bay was about 110-120 000 tonnes or 1.5 billion individuals. That is about 11% of the total number of herring estimated for the entire survey area. The findings suggest a large number of herring belonging to the 2012-2013 yearclasses.

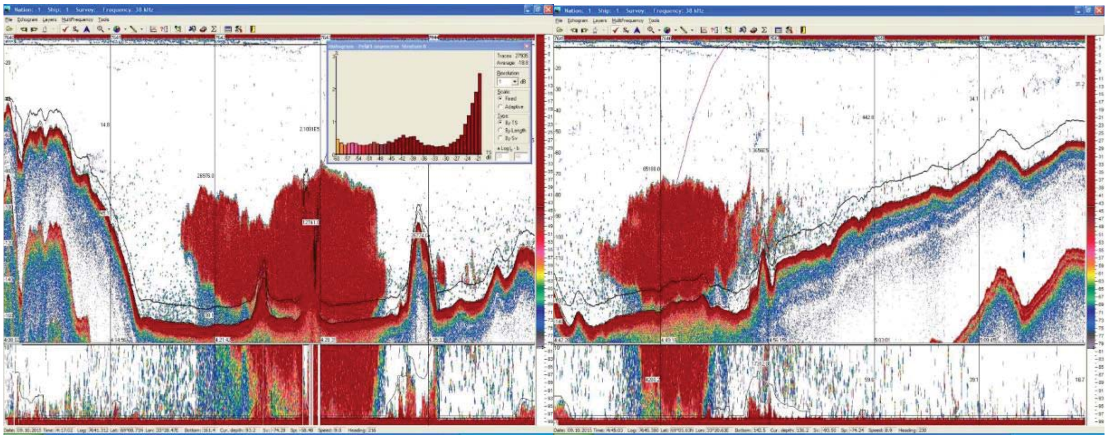

Figure 5.2.2.2. Echorecords of herring (size 20-22 cm) in the Kola Bay, 9 October 2015.

5.2.3 Blue whiting (*Micromesistius poutassou*)

The old target strength (TS) used for blue whiting during the BESS differ from the new TS value now used in the main blue whiting surveys west of the British Isles and in the Norwegian Sea. The time series in the Barents Sea needs to be recalculated using the new TS in the future. Consequently, the estimates should, to a greater extent than the other estimates, be considered as relative estimates.

Blue whiting is an important component of the Barents Sea ecosystem. Changes in the status of the stock of blue whiting in the Norwegian Sea are also observed in the Barents Sea.

Distribution

As in previous years, blue whiting was observed in the western part of the Barents Sea. In comparison with 2014, the distribution was more southerly along the western coast of Svalbard/Spitsbergen and further to the east in the central part of Barents Sea (Figure 5.2.3.1).

Abundance estimation

In 2004-2005 estimated biomass of blue whiting in the Barents Sea was higher than 1 million tonnes (Table 5.2.3.1). In 2008, the estimated biomass of blue whiting dropped abruptly, to only about 13% of the estimated biomass in the previous year, and since 2009 it has been lower than the 2004-2014 average. However, this year, blue whiting biomass was about 535 000 tonnes which is the highest since 2007 (Figure 5.2.3.2).

The number of 1-year olds (2014 year class) increased from previous years' 639 million individuals to an estimated 5835 million individuals and dominated both in terms of number and biomass (Table 5.2.3.2).

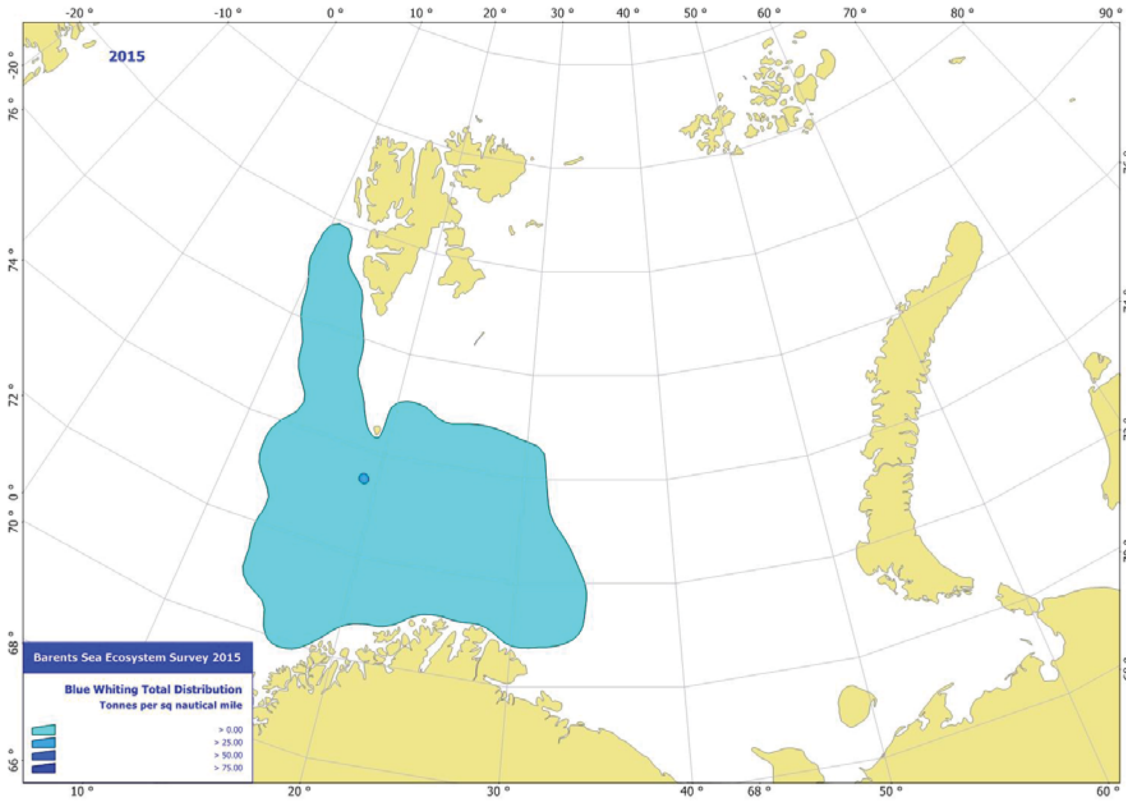

Figure 5.2.3.1. Estimated distribution of blue whiting (t/nautical mile^2) based on acoustic recordings, August-October 2015.

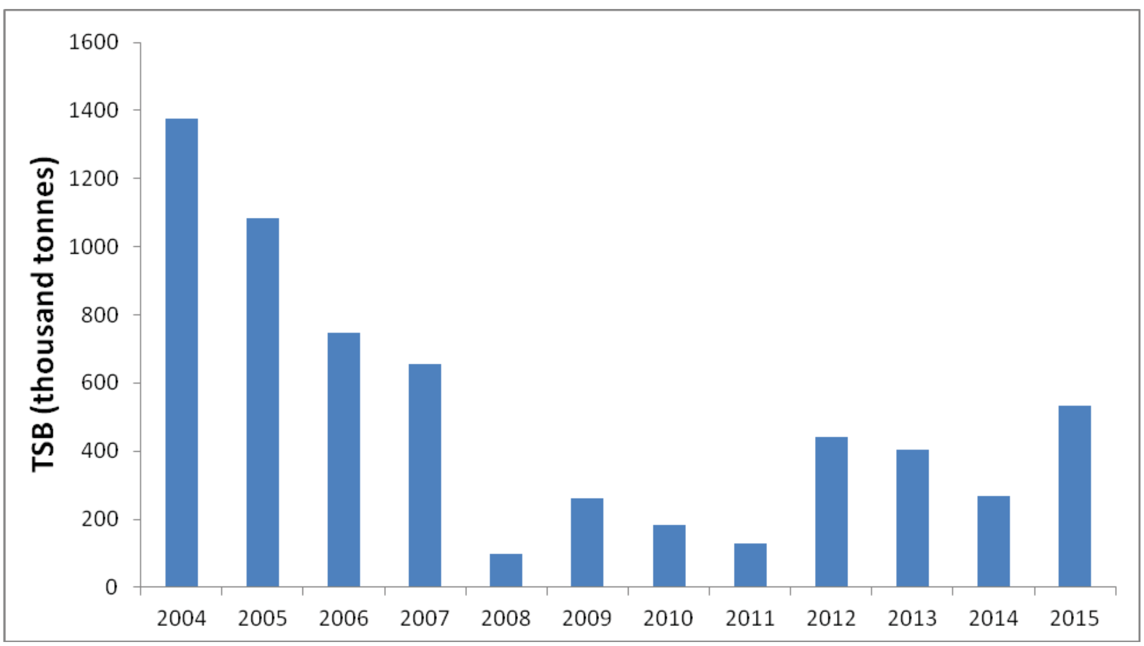

Figure 5.2.3.2 Total biomass of blue whiting in the Barents sea (BESS data).

Table 5.2.3.1. Blue whiting. Acoustic estimate in the Barents Sea in August-October 2015.

	Age/Yearclass														
	1	2	3	4	5	6	7	8	9	10	11	12	Sum	Biomass	Mean
Length (cm)	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	10^6	(10^3 t)	weigt(g)
15.0 - 15.5	15												15	0.2	16.1
15.5 - 16.0	12												12	0.2	17.1
16.0 - 16.5	54												54	1.0	19.3
16.5 - 17.0	127												127	2.8	22.3
17.0 - 17.5	265												265	6.4	24.3
17.5 - 18.0	462												462	12.8	27.6
18.0 - 18.5	860												860	26.7	31.1
18.5 - 19.0	621												621	20.8	33.5
19.0 - 19.5	822												822	30.8	37.5
19.5 - 20.0	691												691	27.9	40.4
20.0 - 20.5	626												626	27.5	43.9
20.5 - 21.0	402	51											453	21.7	47.8
21.0 - 21.5	378	8											386	19.9	51.5
21.5 - 22.0	182	3											185	11.2	60.3
22.0 - 22.5	143	28											171	11.3	65.9
22.5 - 23.0	56	121	16										193	13.5	69.7
23.0 - 23.5	89	25	33	3									150	11.2	74.5
23.5 - 24.0	31	136											167	12.9	77.1
24.0 - 24.5		202											202	16.8	83.2
24.5 - 25.0		167		13									180	16.0	89.0
25.0 - 25.5		222	9	0									231	21.8	94.5
25.5 - 26.0		85	75	33									193	19.6	101.5
26.0 - 26.5		23	223	0	21								267	28.9	108.1
26.5 - 27.0		49	13	97	4								163	18.6	114.4
27.0 - 27.5		39	127	11									177	21.4	120.8
27.5 - 28.0			12	106	13								131	16.8	128.6
28.0 - 28.5			10	101									111	14.6	131.9
28.5 - 29.0			1	69	24								94	13.2	140.7
29.0 - 29.5			34	38									72	10.5	145.3
29.5 - 30.0			24	0	23								47	7.6	160.7
30.0 - 30.5				45	20	1							66	10.7	161.7
30.5 - 31.0			19	18									37	6.2	166.6
31.0 - 31.5				7	10								17	3.1	181.2
31.5 - 32.0				3				13		5			21	4.0	191.0
32.0 - 32.5				9	11								20	4.2	207.6
32.5 - 33.0					9			2			7		18	3.5	196.3
33.0 - 33.5							5	7	14				26	5.7	220.3
33.5 - 34.0				4				2	17				23	5.0	217.8
34.0 - 34.5				12					0	2			14	3.2	226.9
34.5 - 35.0									5				5	1.1	218.3
35.0 - 35.5					2	1	3	4	2	4			16	3.9	243.2
35.5 - 36.0					1			4	0	3			8	2.0	255.4
36.0 - 36.5						1	2	11	2	8		1	25	6.7	268.2
36.5 - 37.0							8	8	0	2			18	4.3	237.1
37.0 - 37.5											6	1	7	1.8	256.4
37.5 - 38.0											3	1	4	1.1	282.2
38.0 - 38.5											5	1	6	1.7	279.1
38.5 - 39.0											2		2	0.6	295.4
39.0 - 39.5										2			2	0.6	320.6
TSN(10^6)	5836	1159	596	569	138	3	18	51	40	26	23	4	8463		
TSB(10^3 t)	229.3	99.7	67.9	76.9	21.3	0.7	4.3	11.7	8.9	6.4	5.7	1.1		534.0	
Mean length (cm)	19.4	24.4	26.7	28.3	29.5	33.9	35.5	34.4	33.9	35.3	36.3	37.4	21.7		
Mean weight (g)	39.3	86.1	114.0	135.2	154.4	224.4	236.9	229.3	222.5	246.5	249.8	271.5	63.1		
Target strength estimation based on formula: TS=21.8 log(L) - 72.7															

Table 5.2.3.2. Blue whiting. Acoustic estimates by age in autumn 2004-2015. 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	3801	286	2878	265	4780	607	17268	1377
2005	4871	132	2770	180	4205	363	3213	410	15058	1084
2006	371	21	2227	159	2665	238	2491	331	7754	749
2007	3	0	245	23	2934	292	2221	315	5666	658
2008	3	0	2	0	11	1	604	95	620	97
2009	2	0	2	0	2	0	1513	261	1519	261
2010	0	0	0	0	13	3	884	179	897	183
2011	30	2	16	2	79	15	462	109	587	129
2012	2685	125	355	43	158	26	1046	248	4244	441
2013	5	0	2364	188	609	62	676	155	3654	406
2014	639	28	83	8	932	104	575	126	2229	267
2015	5836	229	1159	100	596	68	872	137	8463	534
Average	1686.0	63.1	1085.3	82.4	1256.8	119.8	1611.4	247.8	5663.3	515.4

5.2.4 Polar cod (Boreogadus saida)

Distribution

Low abundances of polar cod were found in the traditional distribution area in the northern and the eastern Barents Sea, more specifically along the south coast of Novaya Zemlya and south of Franz Josef Land. The polar cod distribution area was wider than last year, and particularly stretched further to the west. No high density regions were recorded. The total geographical density distribution of polar cod inside the survey area is shown in Figure 5.2.4.1.

Abundance estimation

The stock abundance estimate by age, number, and weight was calculated using the same methods as for capelin. A detailed estimate is given in Table 5.2.4.1, and the time series of abundance estimates is summarized in Table 5.2.4.2. The main results of the abundance in 2015 are summarized in table 5.2.4.3.

In 2015 the numbers of all age groups except 1+ was significantly reduced compared to last year. The number of polar cod aged 1+ was higher than in 2014, but low compared to the long term level. It should be noted that the 2015 survey included more northerly areas than the 2014 survey, an area with much juvenile polar cod, and this could be the reason for the increased abundance of 1+ polar cod. No significant prespawning migration of polar cod was found in the traditional locations along Novaya Zemlya. Only small and scattered schools were recorded (Figure 5.2.4.2). In the northern part of the Barents Sea polar cod were dispersed in the bottom layer (Figure 5.2.4.2).

Thus the abundance of polar cod in the Barents Sea continues to decline. The total stock in 2015 amounted to only 148 thousand tons (Table 5.2.4.1). This is the lowest level of abundance during the last 25 years. Table 5.2.4.4 shows the "survey-mortality rates" of polar cod in the period 1985 to 2014 for each yearclass. Currently the polar cod fishery is negligible, so the total mortality is close to the natural mortality. The mortality estimates are very variable for the entire period, and for some years there are errors in the stock size estimation from year to year so impossible to estimate mortality. Since 2010, there has been an increase in natural mortality and a reduction in the polar cod stock size (Figure 5.2.4.3).

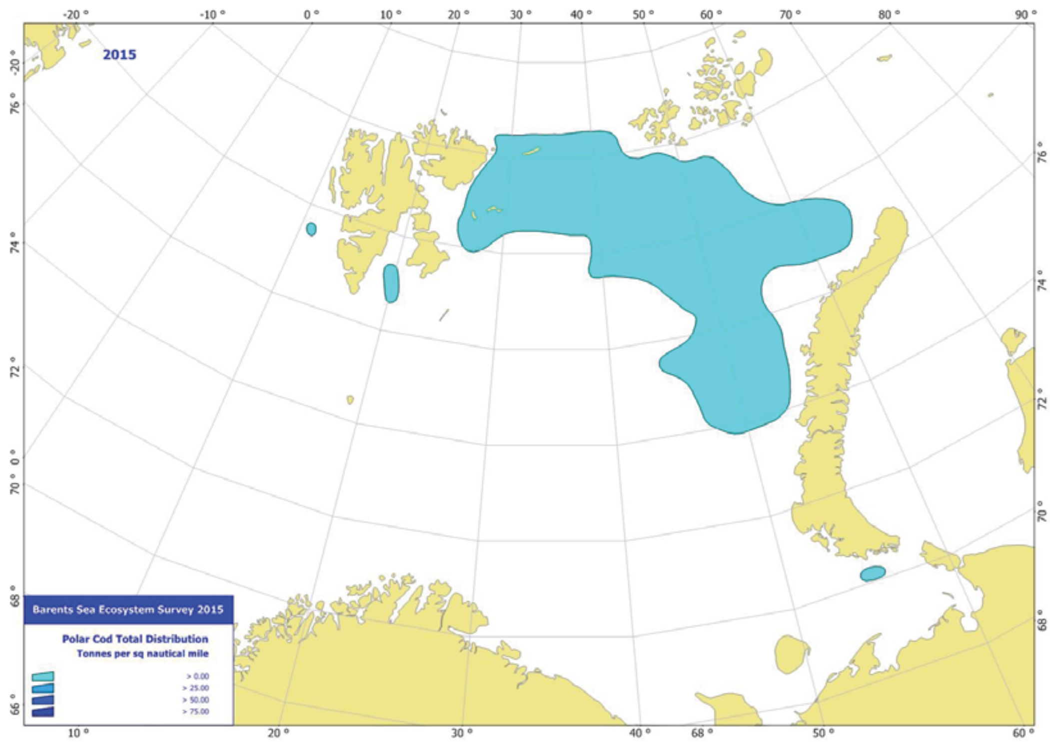

Figure 5.2.4.1. Estimated total density distribution of polar cod (t/sq nautical mile), August-October 2015.

Total mortality calculated from surveys

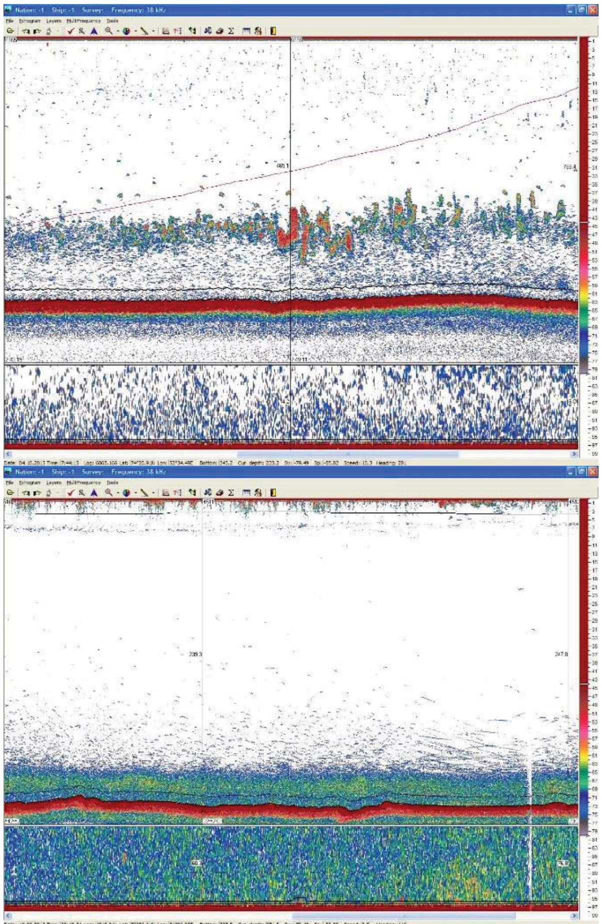

Figure 5.2.4.2. Echorecords of polar cod along western coast of Novaya Zemlya (above) and in the northern part of Barents Sea (below).

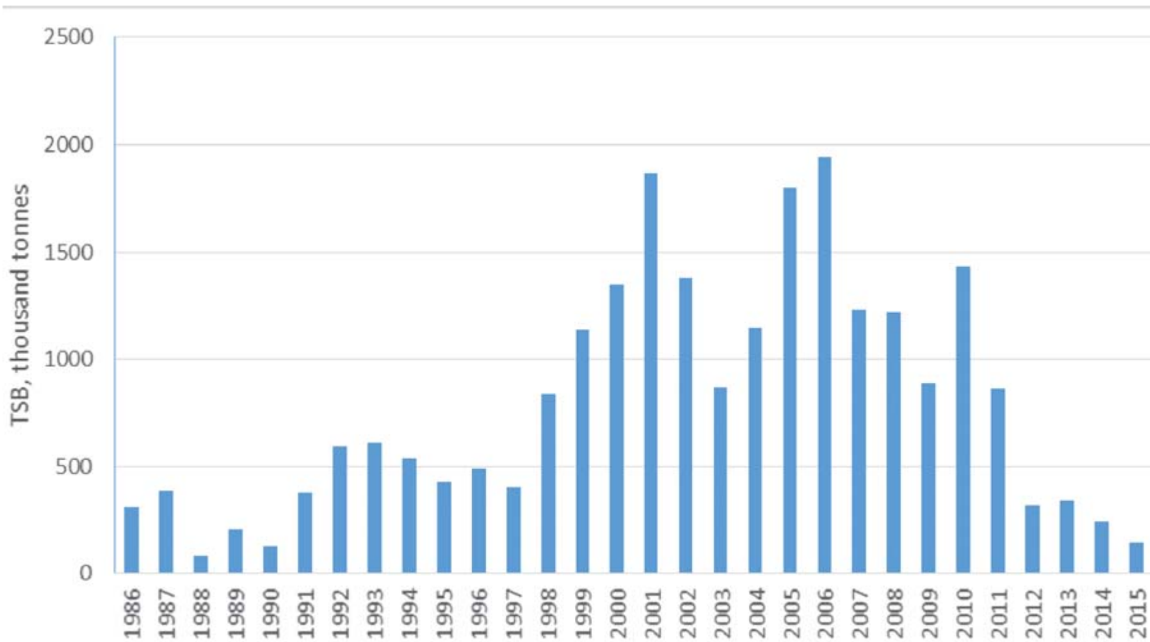

Figure 5.2.4.3. Total biomass of polar cod in the Barents sea.

Table 5.2.4.1. Barents Sea polar cod. Acoustic estimate in August-October 2015.

Length (cm)	Age/Year class						
	1	2	3	4	Sum	Biomass	Mean weight (g)
	2014	2013	2012	2011	(10^9)	(10^3 t)	
7.0 - 7.5	6				6	0.0	2.8
7.5 - 8.0	44				44	0.1	3.4
8.0 - 8.5	81				81	0.3	3.6
8.5 - 9.0	419				419	1.7	4.1
9.0 - 9.5	404				404	2.1	5.3
9.5 - 10.0	1776				1776	11.2	6.3
10.0 - 10.5	1452				1452	10.5	7.2
10.5 - 11.0	2427	7			2434	20.7	8.5
11.0 - 11.5	1347	16			1364	13.2	9.7
11.5 - 12.0	1322	9			1331	14.4	10.8
12.0 - 12.5	546	55			601	7.6	12.7
12.5 - 13.0	611	109			719	10.1	14.0
13.0 - 13.5	241	108			350	5.2	15.0
13.5 - 14.0	101	233	4		338	6.1	18.1
14.0 - 14.5	43	175	15		232	4.6	19.6
14.5 - 15.0		357	7		364	7.9	21.8
15.0 - 15.5	24	209	14		248	5.8	23.2
15.5 - 16.0	16	264	32		312	8.2	26.2
16.0 - 16.5		217	4		221	6.1	27.4
16.5 - 17.0	7	111	35		153	4.7	30.9
17.0 - 17.5		57	10	2	69	2.3	32.9
17.5 - 18.0		42	13		55	2.0	35.8
18.0 - 18.5		11	9		20	0.8	41.8
18.5 - 19.0		12	7		19	0.8	42.2
19.0 - 19.5		1	4		5	0.2	47.9
19.5 - 20.0			3	1	3	0.2	46.8
20.0 - 20.5			2		3	0.2	59.7
20.5 - 21.0			7	1	8	0.5	65.3
21.0 - 21.5				2	2	0.1	69.7
21.5 - 22.0						0.0	64.0
22.0 - 22.5				1	1	0.1	76.9
22.5 - 23.0						0.0	89.0
23.0 - 23.5						0.0	
23.5 - 24.0				1	1	0.1	84.1
24.0 - 24.5						0.0	
24.5 - 25.0						0.0	
25.0 - 25.5			1		1	0.1	83.0
TSN(10^6)	10866	1995	167	8	13036	.	.
TSB(10^3 t)	97.1	45.1	5.3	0.5	.	148.0	.
Mean length (cm)	10.8	14.9	16.7	20.3	.	.	11.5
Mean weight (g)	8.9	22.6	31.9	60.1	.	11.4	

Table 5.2.4.2. 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.

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*	32804	242.7	3255	59.9	15374	481.2	1739	87.6	53172	871.4
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
2012	13521	113.6	4696	104.3	2121	93.0	119	8.0	20457	318.9
2013	2216	18.1	4317	102.2	5243	210.3	180	9.9	11956	340.5
2014	687	6.5	4439	110	3196	121	80	5.3	8402	243.2
2015	10866	97.1	1995	45.1	167	5.3	8	0.5	13036	148.0
Average	28734.3	229.0	14488.9	331.8	4569.5	175.2	523.5	28.1	48350.8	766.0

Target strength estimation based on formula: TS = 21.8 log (L) - 72.7 dB

*-values are based on VPA runs due to survey failure

Table 5.2.4.3. Summary of stock size estimates for polar cod in 2014-2015.

Year class		Age	Number (10^9)		Mean weight (g)		Biomass (10^3 t)	
2014	2013	1	2.2	10.9	8.2	8.9	18.1	97.1
2013	2012	2	4.3	2.0	23.7	22.6	102.2	45.1
2012	2011	3	5.2	0.2	40.1	31.9	210.3	5.3
2011	2010	4	0.2	0.01	54.9	60.1	9.9	0.5
Total stock in								
2015	2014	1-4	12.0	13.0	28.5	11.4	340.5	148.0
Target strength estimation based on formula: TS = 21.8 log (L) – 72.7, corresponding to $\sigma = 6.7 \cdot 10^7 \cdot L^{2.18}$								

Table 5.2.4.4. Barents Sea polar cod. Survey mortalities (%) for age 1 and age 2

Year class	In age 1	In age 2	Year class	In age 1	In age 2
1985	58	93	2001	61	19
1986	90	84	2002	31	84
1987	59	63	2003	43	79
1988	84	13	2004	37	93
1989	-	80	2005	-	77
1990	41	79	2006	39	54
1991	17	73	2007	47	42
1992	43	83	2008	-	74
1993	76	49	2009	47	85
1994	67	69	2010	86	-
1995	60	49	2011	68	26
1996	52	-	2012	-	96
1997	75	36	2013	-	
1998	66	38	2014		
1999	54	60	2015		
2000	55	56	**Mean**	**56**	**61**

5.2.5 Lumpfish (*Cyclopterus lumpus*)

Text by C.Durif and E.Eriksen

Spatial distribution in 2015

Small lumpfish (<20 cm) were widely distributed in thewestern southern and central Barents Sea in 2015 (Figure 5.2.5.1). Larger lumpfish (>20 cm) were located mostly in the northern part relative to the smaller fish, however a few captures were taken along the coast and south of Svalbard.

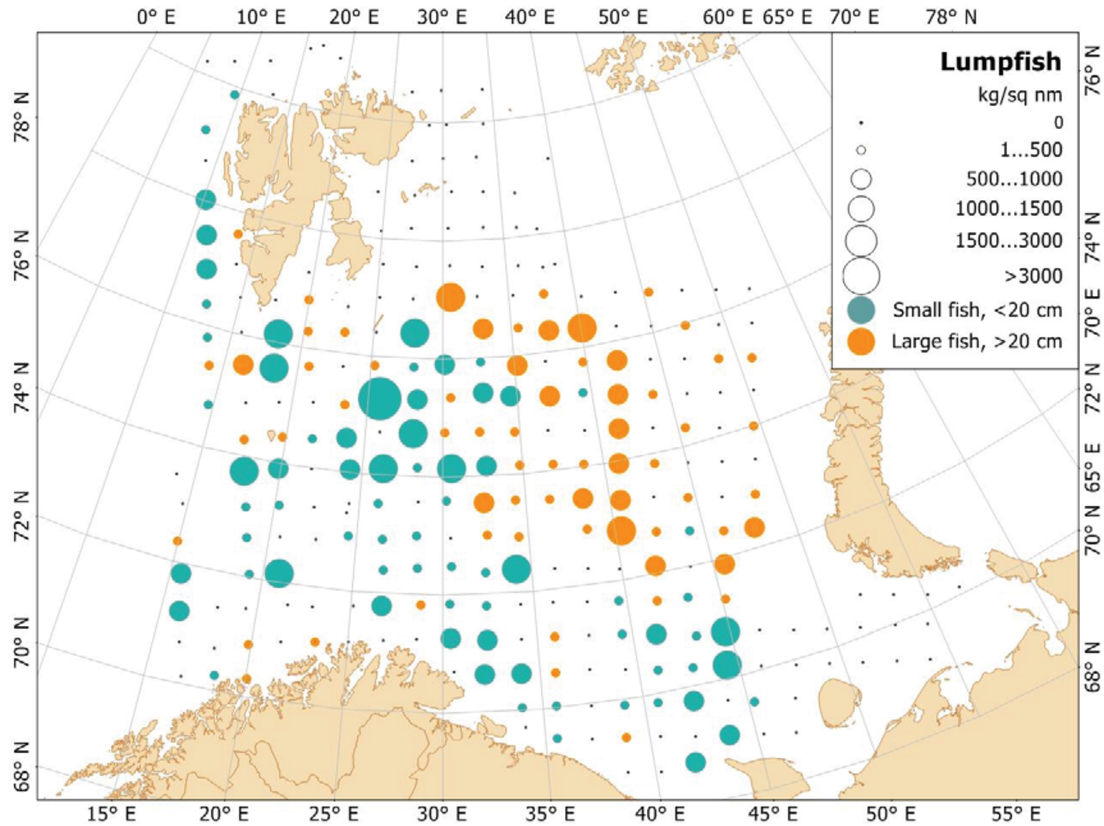

Figure 5.2.5.1. Estimated total density distribution of lumpfish (kg per sq nm), August-October 2015.

Biomass and abundance estimation

Lumpfish biomass has been increasing since the early 1990s and reached a peak of 143 thousand tonnes in 2007 (Figure 5.2.5.2). For the past 3 years lumpfish biomass has been a decreasing, and in 2015 it is half of what it was in 2007. However, it remains above the average annual level of 53 thousand tonnes (1980-2015). Fluctuations in biomass are closely related to changes in temperature (Figure 5.2.5.3). Increased temperatures are soon after followed by a proportional increase in lumpfish biomass.

In 2013-2015, the abundance of lumpfish also decreased. The number of juveniles (fish<20 cm) decreased from 70 to 33 million individuals and larger adult fish from 98 to 58 million individuals. Lumpfish stock in the Barents Sea is dominated by small fish, and during the last few years their proportion has increased from 58% (2010-2013) to 64% (2015). In 2015, the proportion of large fish has been the lowest since 2010, and this most likely reflects a similar decrease in the spawning stock.

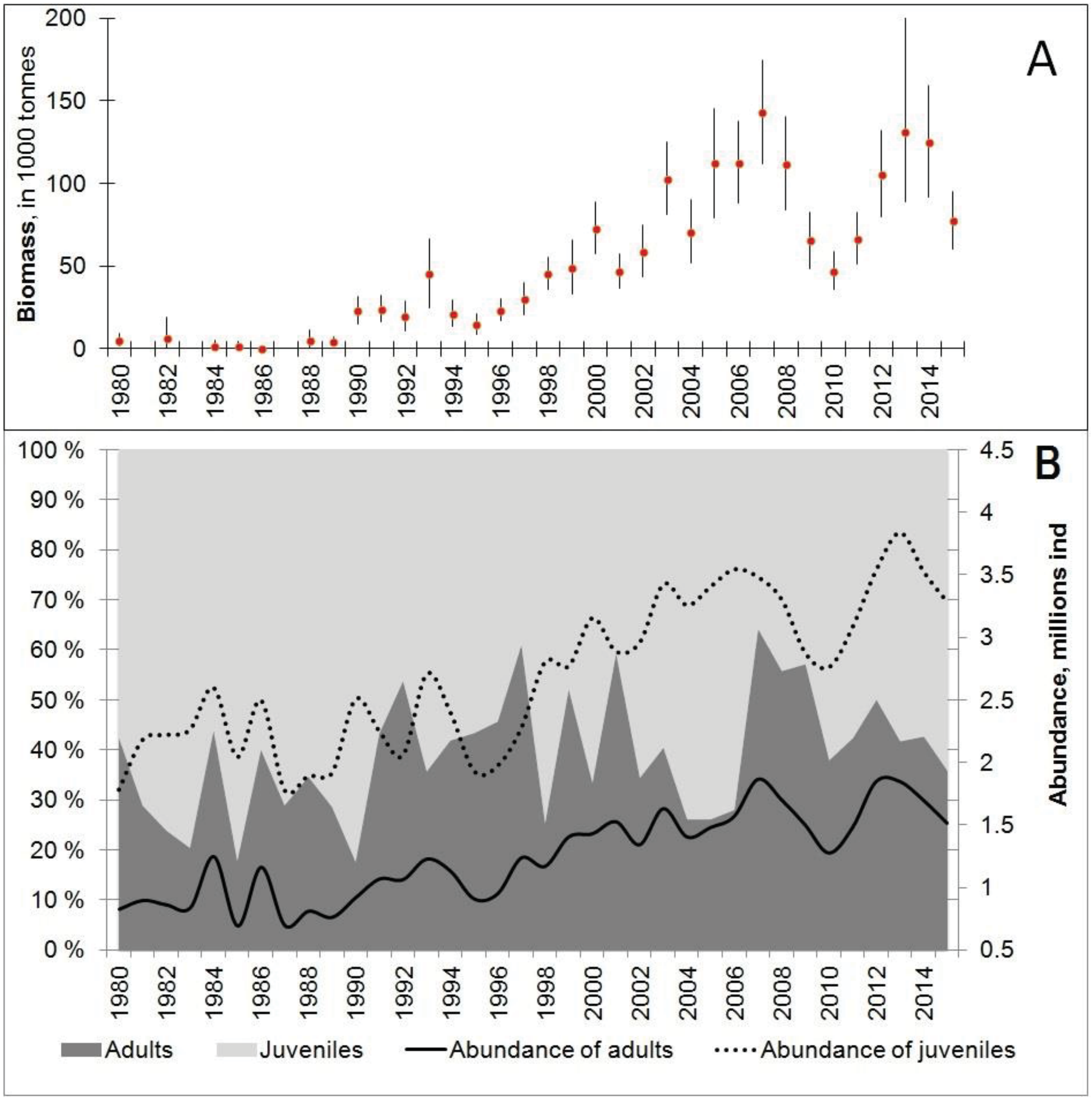

Figure 5.2.5.2. Estimated biomass (A, in 1000 tonnes) and abundance (B, in million individuals) of small (spotted line) and larger (black line) lumpfish, August-October 2015. Light grey (small fish, <20 cm) and dark grey (larger fish, >20 cm) areas showed composition of the stock.

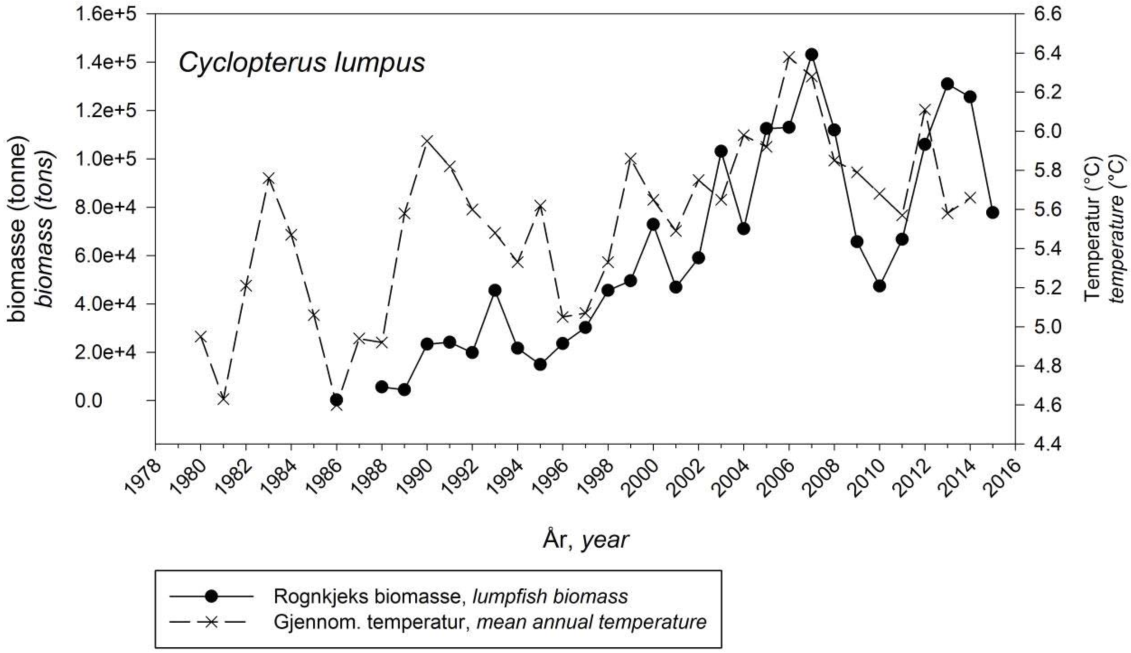

Figure 5.2.5.3. Biomass of lumpfish caught during the 0-group and ecosystem surveys between 1980 and 2015 and mean annual temperature in the Barents Sea (average temperatures between 50 and 200 m for the Fugløya-Bjørnøya section until 2014) .

6 Monitoring the demersal community

6.1 Fish community

Text by A. Russkikh and J.A. Godiksen
Figures by P. Krivosheya

In the Barents Sea bottom catches were dominated cod, long rough dab and haddock. In the areas along the Norwegian and Russian coast Norway pout and plaice were numerous. Figures 6.1.1.1 - 6.1.1.11 show the distribution of demersal fish. The numbers of fish sampled during the survey are presented in Appendix 2.

6.1.1 Cod (*Gadus morhua*)

At this time of the year, towards the end of the feeding period, the distribution of cod is wide, and cod was found over most of the survey area. In 2014, large ice cover reduced the survey area in the north, and the largest concentrations were found in areas close to the ice border. This year, however, it was possible to trawl further north, and the largest distributions of cod were found in the same areas as in the previous year, and in the same areas as capelin were found this year (Fig. 6.1.1.1, 6.1.1.2). In previous years the distribution of cod has been further north than seen in 2014 and 2015. Therefore, it is possible that the 2014 survey covered the distribution of cod and that the stock size index was adequate. There is no significant error. The biomass and abundance of cod in 2015 is slightly higher than in 2014 (Table 6.1.1), but still lower than in the years before. The distribution of cod in the covered area of 2015 was similar to that in the two previous years, however, cod was found further south than seen in previous years. Except for the north-east survey area, were the zero-line of the cod distribution was not reached, and in the Loophole, were demersal trawl hauls were missing (see Background), the coverage of the 2015 survey was generally reasonably well.

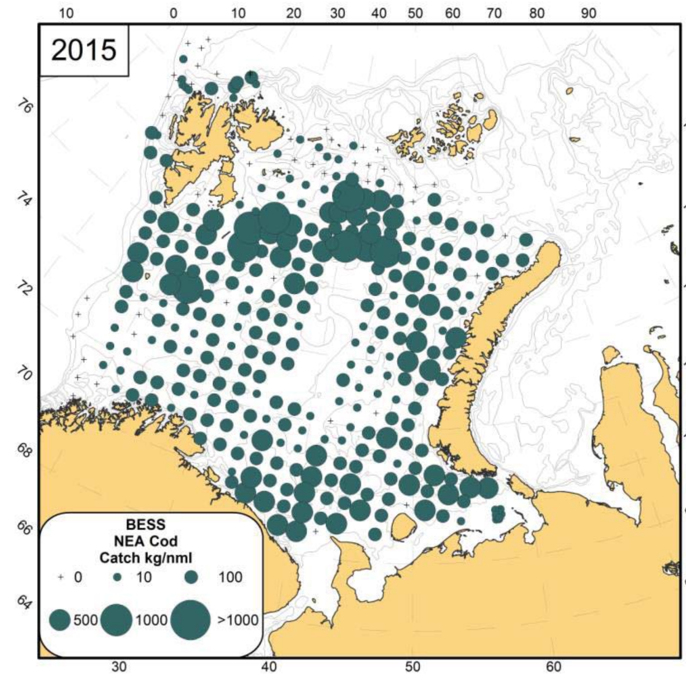

Figure 6.1.1.1. Distribution of cod (*Gadus morhua*), August-October 2015.

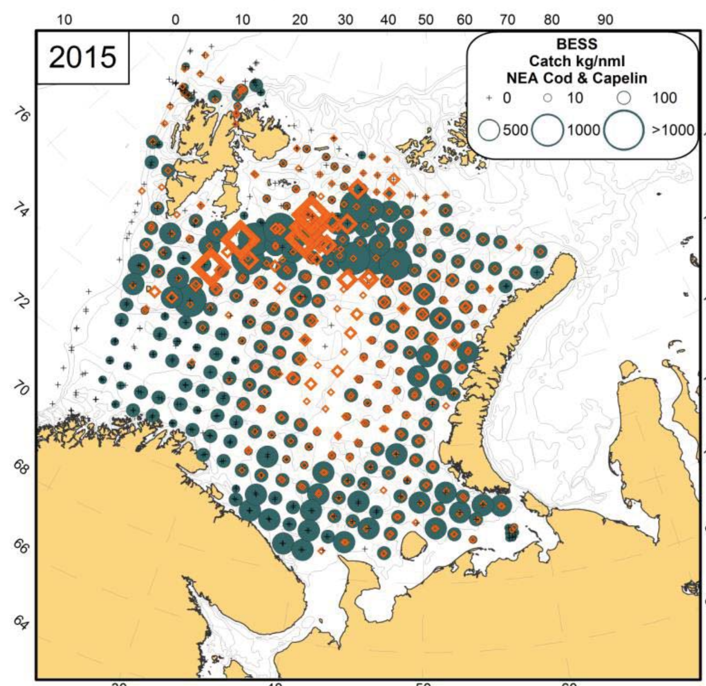

Figure 6.1.1.2. Distribution of cod (from demersal trawl hauls) and capelin (from both demersal and pelagic trawl hauls), August-October 2015.

Table 6.1.1. Abundance (N, million individuals) and biomass (B, thousand tonnes) of the main demersal fish species in the Barents Sea (not including 0-group). * – incomplete coverage of area due to ice

6.1.2 Haddock (*Melanogrammus aeglefinus*)

Due to the small amount of haddock captured in the border areas of survey, it is believed that the distribution of haddock was more or less completely covered. Less haddock than usual was observed in the shallow areas (depths as shallow as 15m) in the south-eastern Barents Sea. The main concentrations of haddock were found in the southeastern Barents Sea, and though relatively high concentrations were also found between Bear Island and Hopen Island, there were less than in the previous year. Haddock will mainly be distributed in areas with temperatures higher than 2°C, see Figure 3.1.2.7. Compared to 2014, the biomass slightly decreased while the abundance was stable (Table 6.1.1).

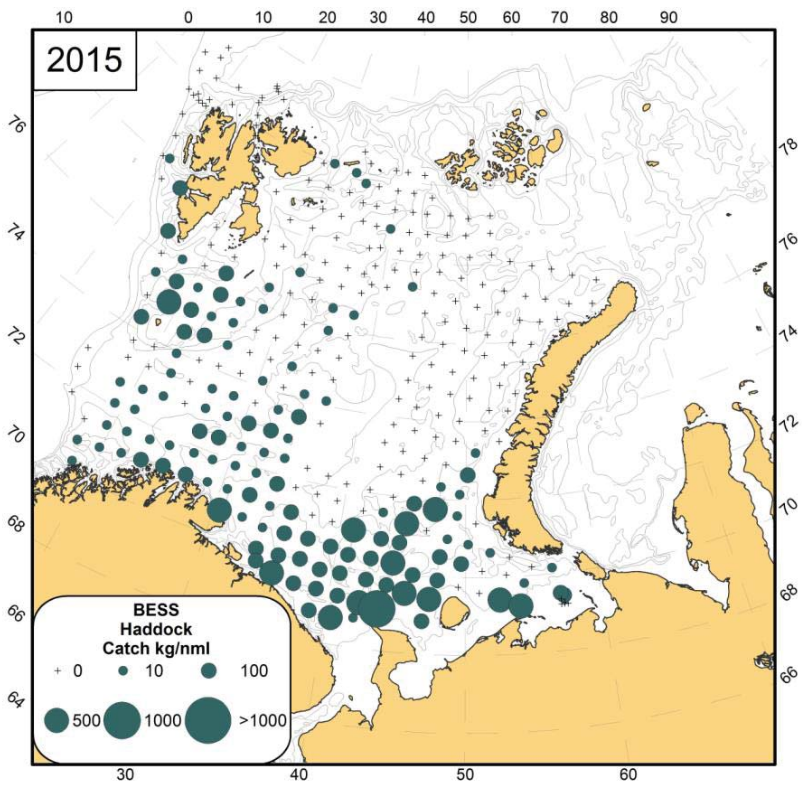

Figure 6.1.2.1. Distribution of haddock *(Melanogrammus aeglefinus)*, August-October 2015.

6.1.3 Saithe (*Pollachius virens*)

The survey covered only part of saithe distribution along the coast of Norway (Figure 6.1.3.1). Saithe are mainly distributed inside the fjords and further south along the Norwegian coast. The occupation area of saithe has increased somewhat eastwards along the coast of Finnmark over the last couple of years. This year only small amounts of saithe were found east of 30°E. The biomass and abundance of saithe was the highest observed in the time series (Table 6.1.1).

6.1.4 Greenland halibut (*Reinhardtius hippoglossoides*)

The distribution of Greenland halibut has been wide over the last five years, and specimens were captured in 41% of the bottom trawl hauls in 2015. Greenland halibut were distributed along the shelf slope in the western Barents Sea and north of Svalbard/Spitsbergen, and high numbers of small individuals were found between Svalbard and Franz Joseph land, which was not trawled in 2014 due to ice cover (Figure 6.1.4.1). BESS mainly reflect a recruitment of halibut. The total biomass on Greenland halibut within the coverage area was the lowest since 2005, and mainly young age groups of Greenland halibut were observed. The adult part of the stock was, as usual, distributed outside the survey area. On the other hand, in recent years an increasing number of large halibut has been captured in the deep-water surveyed area.

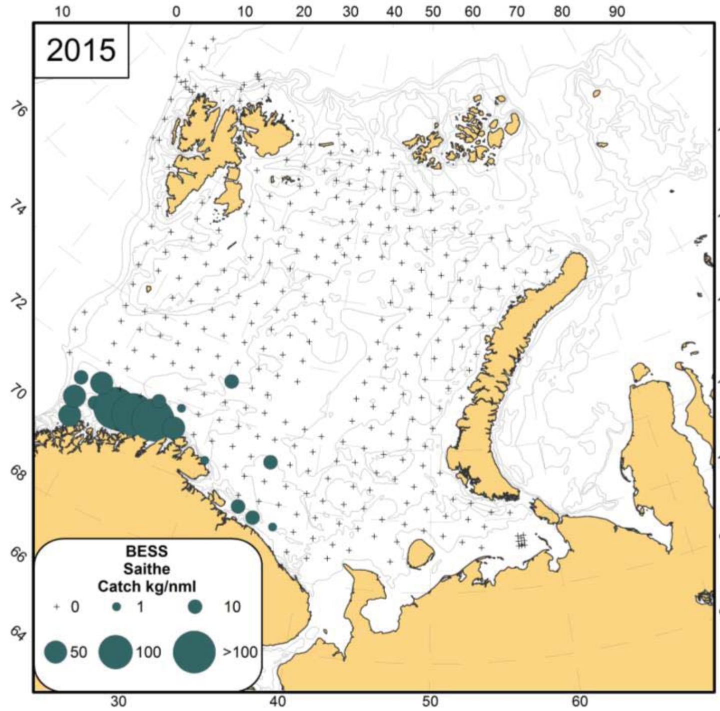

Figure 6.1.3.1. Distribution of saithe *(Pollachius virens)*, August-October 2015.

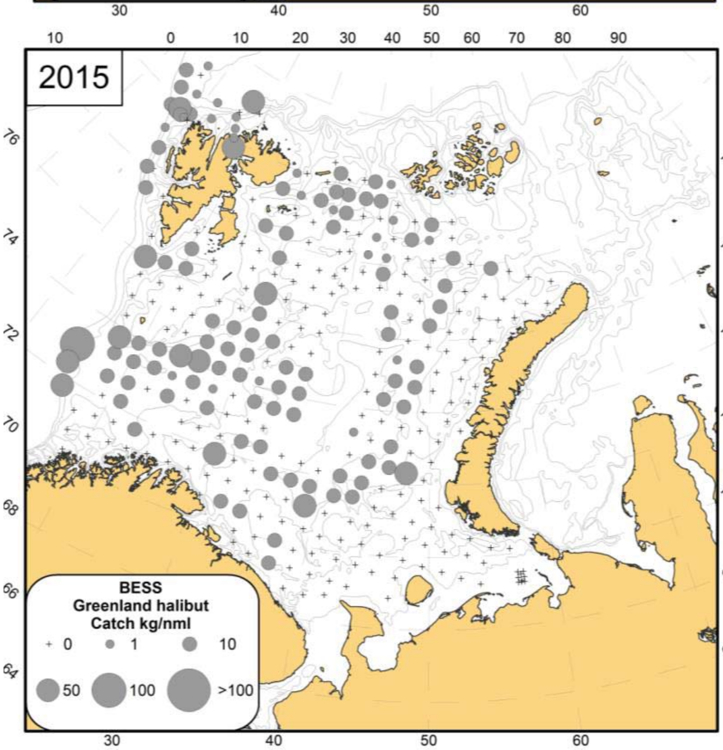

Figure 6.1.4.1. Distribution of Greenland halibut (*Reinhardtius hippoglossoides*), August- October 2015.

6.1.5 Golden redfish (*Sebastes norvegicus*)

Over the last, at least, five years, golden redfish was observed along the shelf slope north and west of Svalbard/Spitsbergen, and occupation area in the southern Barents Sea has increased in recent years (Figure 6.1.5.1). The abundance and biomass of golden redfish within the surveyed area decreased from 2014, and are the lowest observed in the time series (Table 6.1.1).

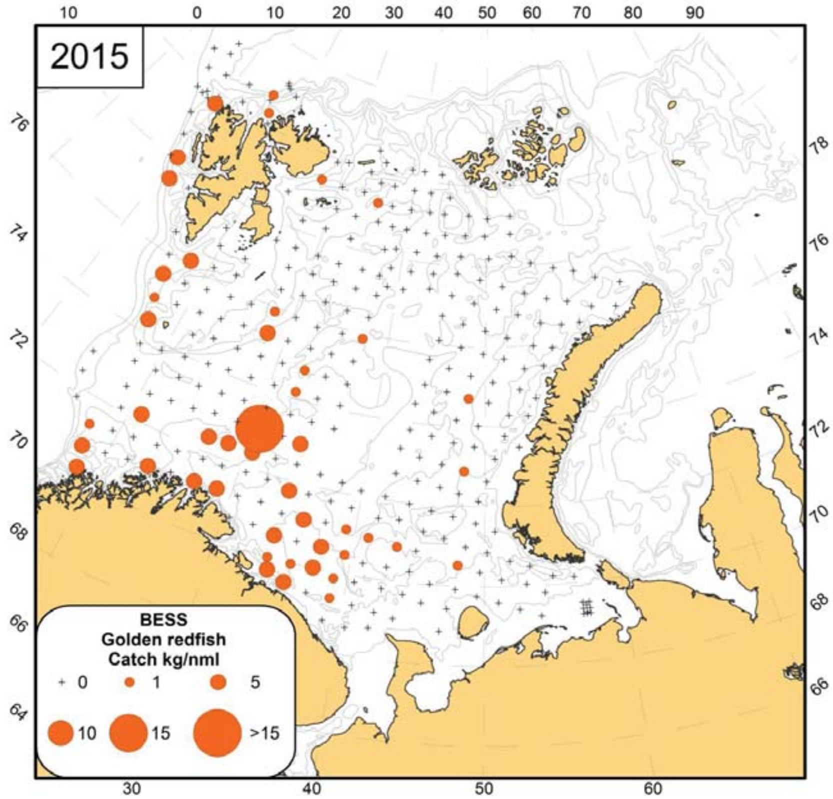

Figure 6.1.5.1. Distribution of golden redfish (*Sebastes marinus)*, August-October 2015.

6.1.6 Deep-water redfish (*Sebastes mentella*)

Deep-water redfish were widely distributed in the Barents Sea. Main concentrations of deep-water redfish were found, as usual, in the western and north-western parts of the Barents Sea. West and east of Svaldard/Spitsbergen abundances of younger individuals are high, which is similar to what is found in previous years. The biomass of deep-water redfish in the Barents Sea decreased somewhat from 2013 to 2014, which was thought to be partly explained by limited coverage in the northern and northeastern Barents Sea, but the level in 2015 increased only slightly despite an increased coverage (Table 6.1.1.).

6.1.7 Norway redfish (*Sebastes viviparus*)

Norway redfish were distributed in the southwestern Barents Sea (Figure 6.1.7.1), as in the previous years. The biomass was the lowest since 2010.

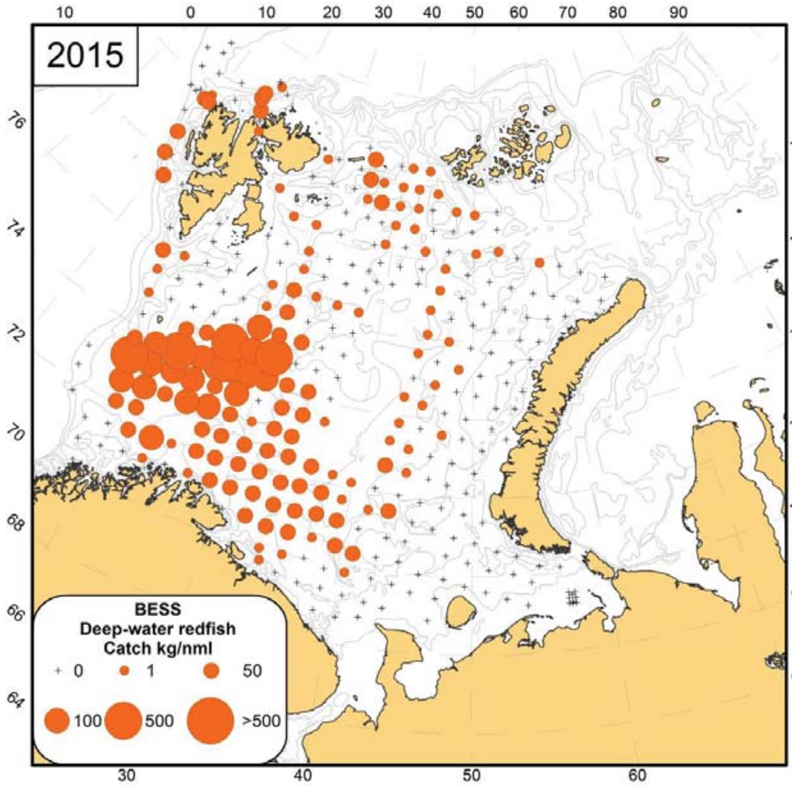

Figure 6.1.6.1. Distribution of deep-water redfish *(Sebastes mentella)*, August-October 2015.

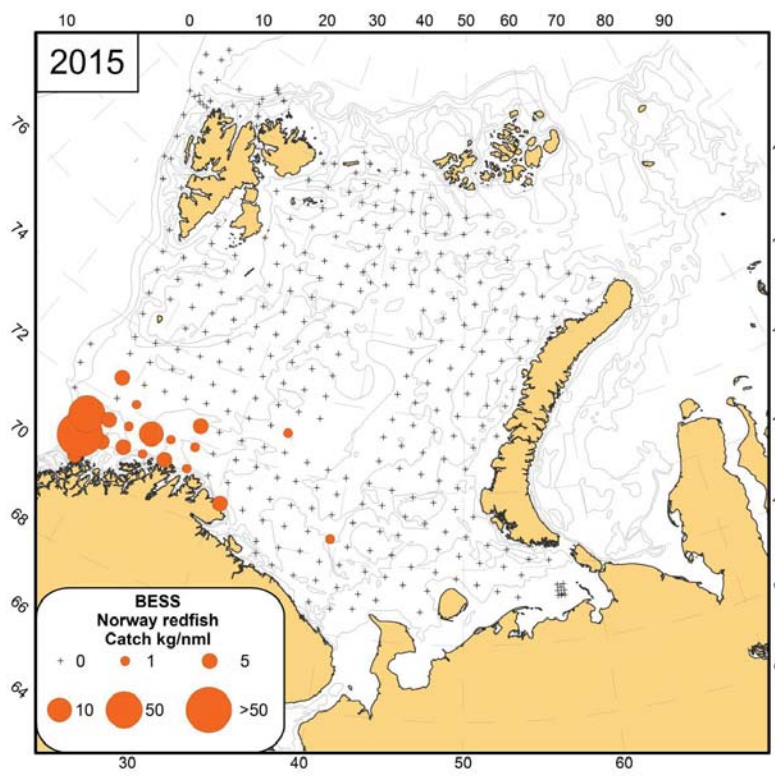

Figure 6.1.7.1. Distribution of Norway redfish (*Sebastes viviparus*), August-October 2015.

6.1.8 Long rough dab (*Hippoglossoides platessoides*)

As in the previous years, long rough dab were widely distributed in the Barents Sea, and denser concentrations of long rough dab were observed in the central-northern and eastern areas (Figure 6.1.8.1). Long rough dab, as in the previous years, were dominant by numbers in bottom trawl catches. In 2015, long rough dab had increased slightly in abundance compared to previous year (Table 6.1.1). Many small fish were observed in trawl catches especially in the eastern areas.

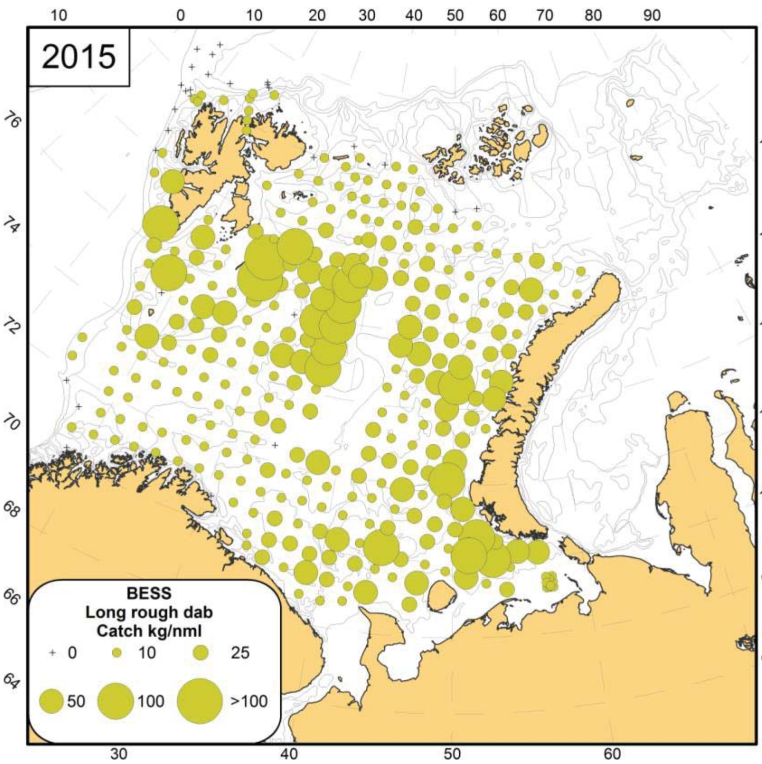

Figure 6.1.8.1. Distribution of long rough dab (*Hippoglossoides platessoides)*, August-October 2015.

6.1.9 Wolffishes (*Anarhichas* sp.)

Atlantic wolffish (*Anarhichas lupus*), spotted wolffish (*Anarhichas minor*) and Northern wolffish (*Anarhichas denticulatus*) were observed in the Barents Sea.

The distribution of Atlantic wolffish was similar to that in recent years, where there has been abundance in the central area. The highest catches of Atlantic wolffish were observed in shallow southern Barents Sea, along the continental shelf, west of Svalbard/Spitsbergen and near Bear Island, which is similar to catches in the previous, at least, five years. However, south of Bear Island, where the abundance was high in 2014, few individuals were captured (Figure 6.1.9.1). This is similar to years prior to 2014. Compared to the previous year, abundance and biomass of Atlantic wolffish increased in 2015, and the highest biomass in the time series was observed this year (Table 6.1.1).

The area in the Loop hole in the central Barents Sea which had catches of spotted wolfish in 2014 was not covered in the 2015 survey. However, the areas which were covered showed a similar distribution area in 2015 as seen in previous years. The biomass of spotted wolffish increased from 2014, and was at the same level as in 2012 and 2013 (Table 6.1.1).

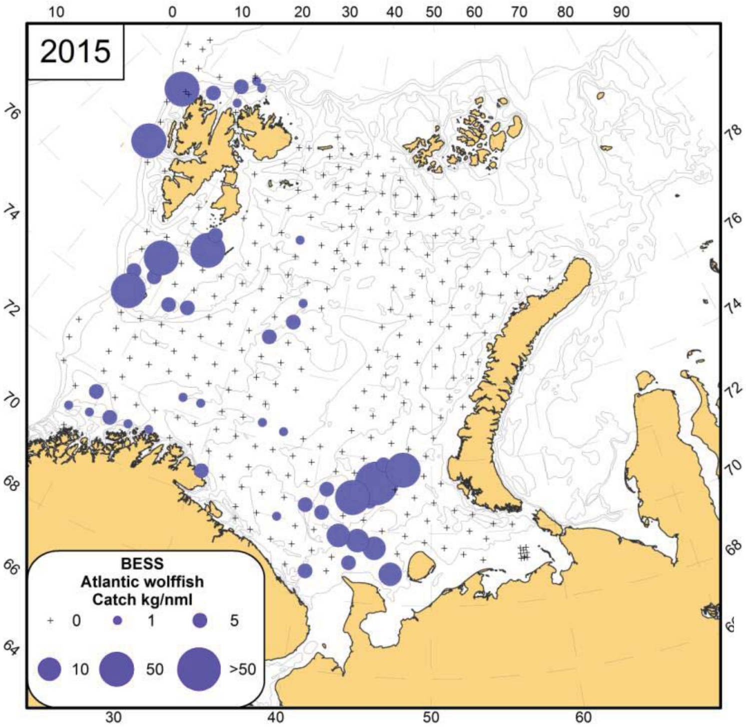

Figure 6.1.9.1. Distribution of Atlantic wolffish (*Anarhichas lupus*), August-October 2015.

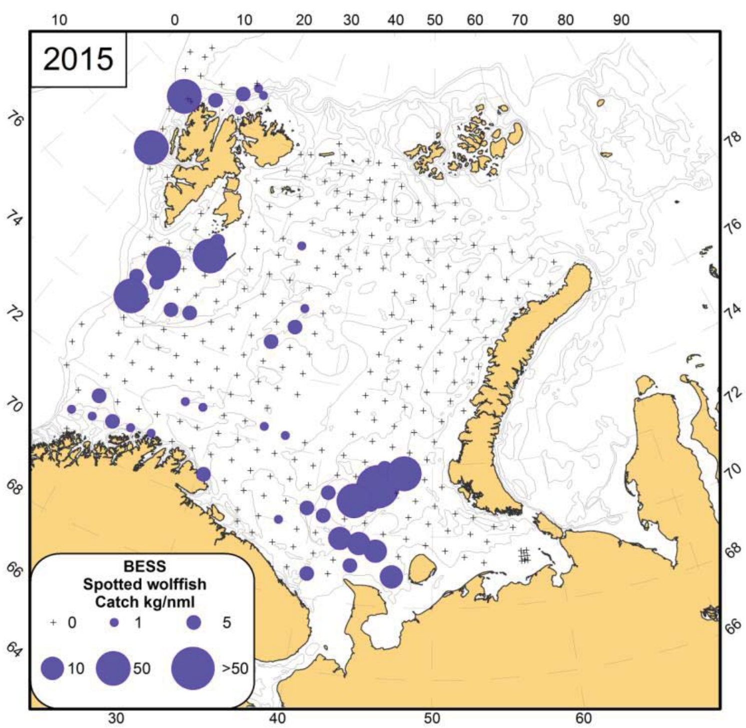

Figure 6.1.9.2. Distribution of spotted wolffish (*Anarhichas minor*), August-October 2015.

In 2015, Northern wolfish were distributed similar to that in previous years (Fig. 6.1.9.3). As in previous years, there were no catches in the north-eastern areas. Biomass of Northern wolffish was the highest since 2015 and abundance was one of the highest in the time series as well (Table 6.1.1).

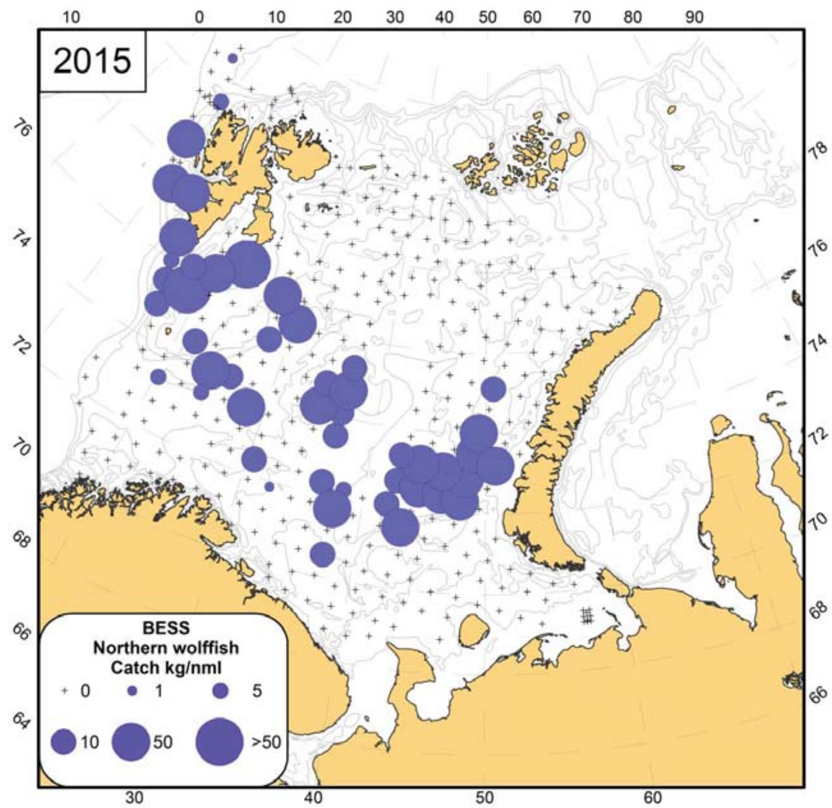

Figure 6.1.9.3. Distribution of Northern wolffish (*Anarhichas denticulatus*), August-October 2015.

6.1.10 Plaice (*Pleuronectes platessa*)

Plaice were distributed mainly in the southern Barents Sea, which is similar to the distribution seen in the past, at least, five years (Fig. 6.1.10.1). In 2014 plaice catches, as well as abundance and biomass, was record high. In 2015 abundance and biomass had decreased, but both were still high compared to years before 2014 (Table 6.1.1).

6.1.11 Norway pout (*Trisopterus esmarkii*)

The main concentrations of Norway pout were observed in the southwestern Barents Sea (Figure 6.1.11.1). Very few individuals of Norway pout were found west of Spitsbergen, which is similar to what was found in 2014. Compared to years before 2014, distribution area of Norway pout was reduced and main concentrations were located further west along the coast of Norway. In 2014, abundance and biomass were also lower than in the previous year, and this down-going trend continued in 2015 (Table 6.1.1).

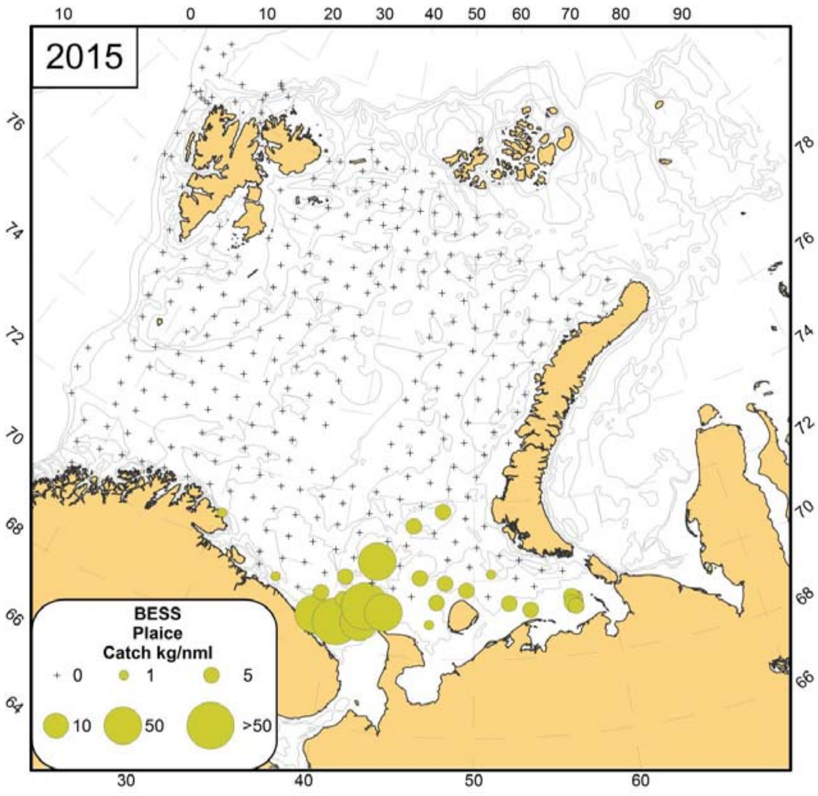

Figure 6.1.10.1. Distribution of plaice (*Pleuronectes platessa*), August-October 2015.

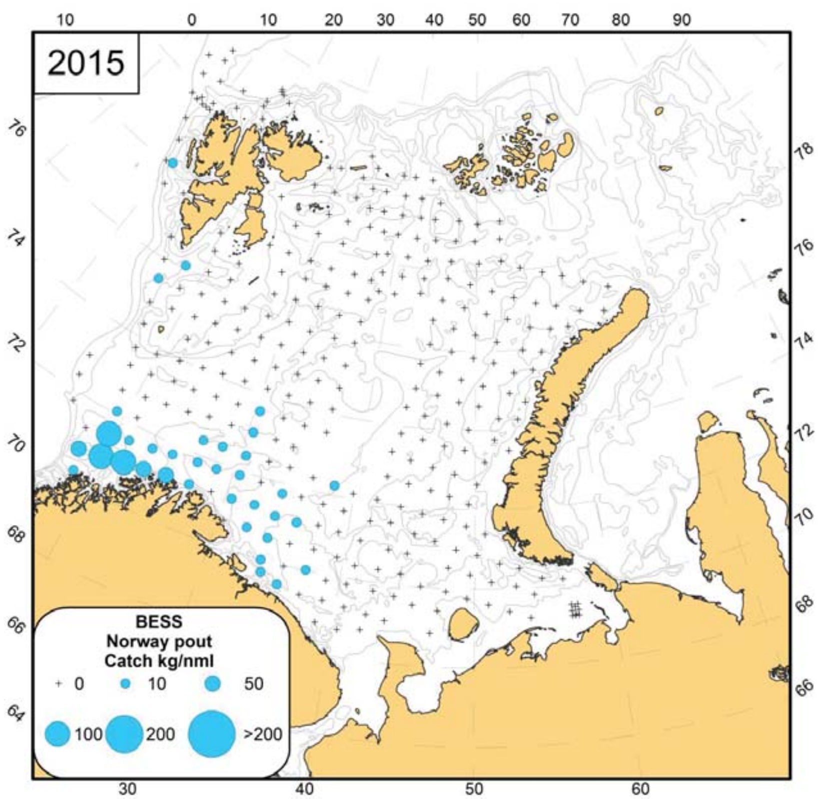

Figure 6.1.11.1. Distribution of Norway pout (*Trisopterus esmarkii*), August-October 2015 .

6.1.12 Abundance and biomass estimation of demersal fish

Preliminary estimates of the abundance and biomass of demersal fish were made at the end of the survey and presented in Table 6.1.1. Final estimates by age/length group for cod, haddock, redfish and Greenland halibut will be presented in the ICES AFWG report in 2016.

In 2014, the abundance and biomass of all species except haddock and plaice decreased compared to 2013. Part of the reason for this is the incomplete area coverage in 2014. In 2015 the abundance and biomass increased again for most species, however, despite a much better coverage, the levels are in many cases still lower than in 2013.

Table 6.1.1. Abundance (N, million individuals) and biomass (B, thousand tonnes) of the main demersal fish species in the Barents Sea (not including 0-group).

Species		Year										
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Atlantic wolfish	N	15	26	42	25	20	17	20	22	27	12*	↑33
	B	6	11	11	14	8	17	13	9	30	12*	↑37
Spotted wolfish	N	11	12	12	13	9	7	9	13	13	8*	↑12
	B	92	46	42	51	47	37	47	83	84	51*	↑86
Northern wolfish	N	3	2	3	3	3	3	6	8	12	6*	↑9
	B	26	19	25	22	31	25	42	45	52	34*	↑63
Long rough dab	N	2910	3705	5327	3942	2600	2520	2507	4563	4932	3046*	↑3624
	B	280	378	505	477	299	356	322	584	565	413*	↑438
Plaice	N	19	36	120	57	21	34	36	21	36	170	↓107
	B	11	19	55	29	13	21	26	13	29	121	↓79
Norway redfish	N	110	219	64	24	17	26	83	114	233	105	↑168
	B	15	19	10	4	2	2	9	12	25	6	↑20
Golden redfish	N	23	16	20	42	12	22	14	32	75	45	↓9
	B	11	16	11	17	11	4	5	8	20	13	↓5
Deep water redfish	N	336	526	796	864	1003	1076	1271	1587	1608	927	↓894
	B	143	219	183	96	213	112	105	196	256	208	↑214
Greenland halibut	N	358	430	296	153	191	186	175	209	160	43*	↑79
	B	53	77	86	76	90	150	88	86	94	53*	↓52
Haddock	N	1211	3518	4307	3263	1883	2222	1068	1193	734	1110	↑1135
	B	342	659	1156	1246	1075	1457	890	697	570	630	↓505
Saithe	N	31	28	70	3	33	5	9	14	18	3	↑105
	B	26	49	98	7	29	9	10	13	33	6	↑153
Cod	N	1012	1539	1724	1857	1593	1651	1658	2576	2379	1373*	↑1694
	B	499	810	882	1536	1345	2801	2205	1837	2132	1146*	↑1425
Norway pout	N	1026	1838	2065	3579	3841	3530	5976	3089	2267	1254	↓943
	B	14	32	61	97	131	103	68	105	40	37	↓33

* – incomplete coverage of area due to ice

As seen in Table 6.1.1, numbers and biomass of demersal fish species varies annually. These changes are significant for some species and negligible for others. Nevertheless, abundance indices allow for investigations of total fish quantity dynamics in the Barents Sea. Some non-commercial species can be indicators of the ecosystem state since their numbers are changing for natural reasons only. Fluctuation in abundance numbers for different fish species indicates not only stock changes, but also changes in ecosystem conditions.

6.2 Benthos community

6.2.1 Monitoring the Northern shrimp (*Pandalus borealis*)

Text by D. Zakharov
Figures by D. Zakharov and P. Krivosheya

During the survey in 2015 334 trawls were made. Northern shrimp was found in the catches of 245 trawls. The biomass of shrimp varied from several grams to 72.9 kg per nautical mile with an average catch of 7.4±0.6 kg/nml. The densest concentrations of the shrimp were registered in the central part of the Barents Sea and south-east of Spitsbergen (Fig. 6.2.1.1). In 2015, the calculated index (method of squares) of the Northern shrimp stock was 375.2 thousand tons, which is 18 % higher than 2014, and 7 % higher than the average index value of the stock. A decrease of the stock in 2014 was observed in the southern and western part of the sea, this result might be affected by the underestimation of shrimp due to difficult ice conditions in the Northern part of the Barents Sea in August-September 2014.

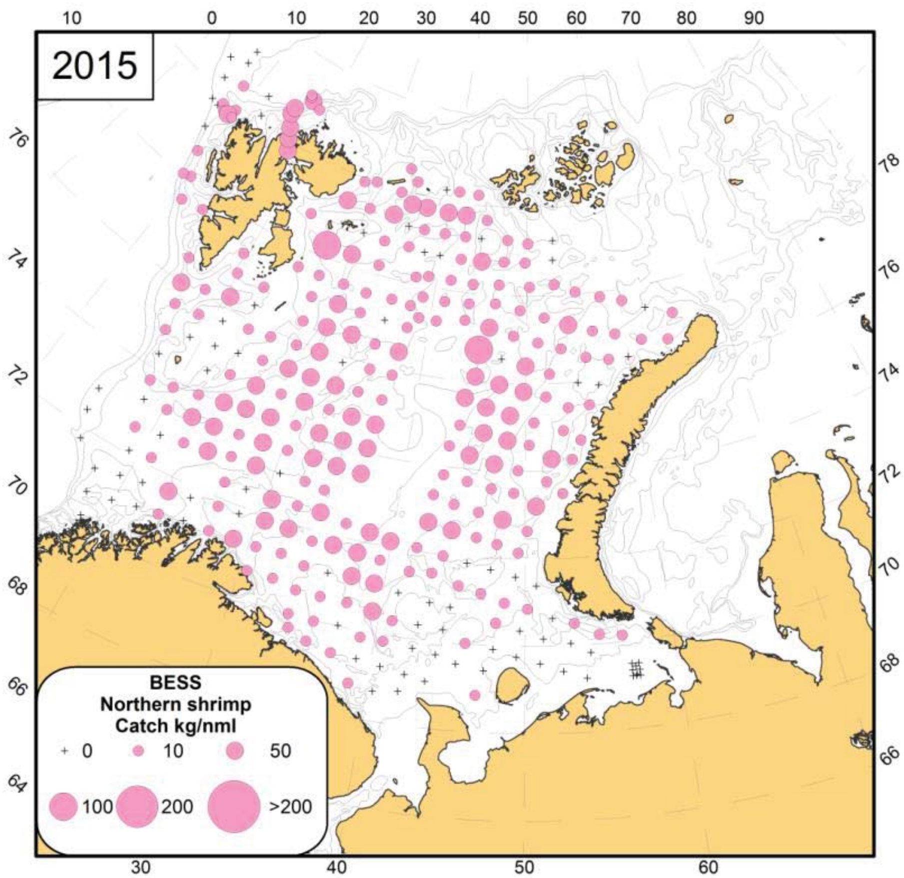

Figure 6.2.1.1 Distribution and the biomass (kg/nml) of the Northern shrimp in the BESS 2015.

Biological analysis of the northern shrimp stock was conducted in 2015 by Russian scientists in the eastern part of the survey area. Likewise in the previous year the main bulk of the

Barents Sea shrimp population was made up of individuals of smaller age groups – males with carapace length of 8-28 mm and females with carapace length of 16-34 mm (Fig. 6.2.1.2).

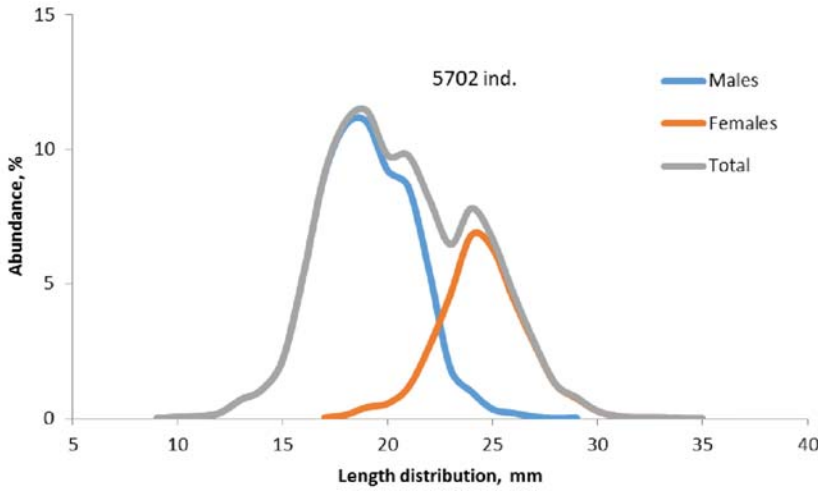

Figure 6.2.1.2 Size and sex structure of catches of the Northern shrimp in the eastern Barents Sea in 2015.

6.2.2 Monitoring of Red King crab (*Paralithodes camtschaticus*)
Text by N. Anisimova, L. Lindal Jørgensen
Figures by P. Krivosheya

The Red King crab were recorded in 14 of 335 trawl catches and were distributed in the southern part of the Barents Sea between 25 and 57° E (11 catches in REZ and 3 catches in NEZ) (fig. 6.2.2.1).

The biomass of Red King crab varied from 1.08 to 142.94 kg/haul (0.9-168.1 kg/nml). The average biomass is 36.92±12.64[1] kg/haul (44.42±15.22 kg/nml). The abundance of crab ranged from 1 to 95 ind./haul (0.57-111.76 ind./nml). The average abundance of crabs accounted for 18.21±7.78 ind./haul (21.96±9.39 ind./nml).

The densest concentration of crab was observed in the eastern part of the Murman Rise and in the Kanin Bank (Table 6.2.2.1). The most eastern catch of the Red King crab was recorded at 23 m depth in the Pechora Sea about 57° E (see fig. 6.2.2.1). It was mature female with a clutch on the pleopods, carapace width of 145 mm and weight of 1.505 kg.

The total catch of crab in 2015, compared with the previous year, increased by 1.5 times (table 6.2.2.1). Compared with last year average catch of crabs in the REZ this showed an increase from 19.0 to 27.6 ind./nml.

[1] the average value is reported with standard error

6.2.3 Monitoring of Snow crab (*Chionoecetes opilio*)

Text by N. Anisimova, L. Lindal Jørgensen
Figures by P. Krivosheya and N. Anisimova

In 2015 the Snow crab were recorded in 89 of 335 trawl catches and were distributed more wide to the west (till 30°11' E) that in previous years (till 36°28' E). The highest catches of crab were taken in the southern part of the Barents Sea in the region of South Novaya Zemlya Trough (fig. 6.2.3.1).

The biomass of Snow crab in 2015 varied from 1 g to 29.84 kg/haul (0.001-35.53 kg/nml). The average biomass is 3.05±0.58 kg/haul (3.69±0.71 kg/nml). The abundance ranged from 1 to 1246 ind./haul (0.6-1483.3 ind./nml). The average abundance of crabs accounted for was 35.11±14.11 ind./haul (42.03±16.80 ind./nml).

Despite the fact that in 2015, the area of Snow crab distribution in the Barents Sea increased compared with the previous year, all quantitative parameters indicated a reduction of the Snow crab population to half of the size compared to previous years.

The most abundant group of Snow crab was the 2-3-year old juveniles with a mean carapace width of 20-40 mm (fig. 6.2.3.2)

Table 6.2.2.1. The total catch of Red King crab during ecosystem surveys of 2004-2015.

Year	Total numbers, ind.	Total biomass, kg
2004	385	1293
2005	106	309
2006	1243	3350
2007	1521	3869
2008	127	93
2009	15	25
2010	12	25
2011	40	22
2012	126	308
2013	272	437
2014	168	403
2015	255	517

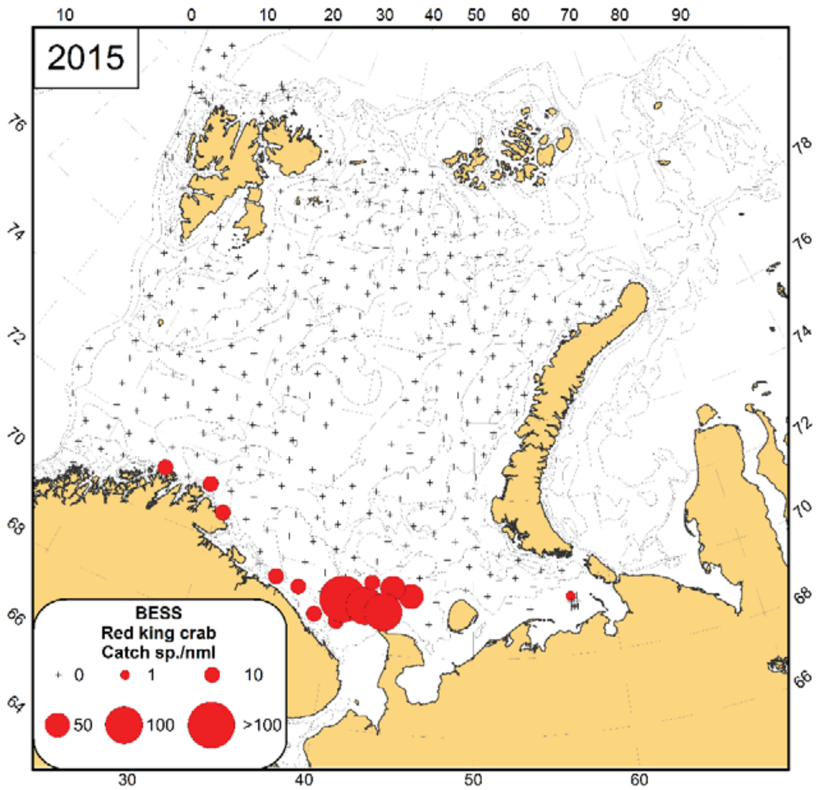

Figure 6.2.2.1. The distribution and number of individuals per nm of the Red King crab in the Barents Sea in August-October 2014.

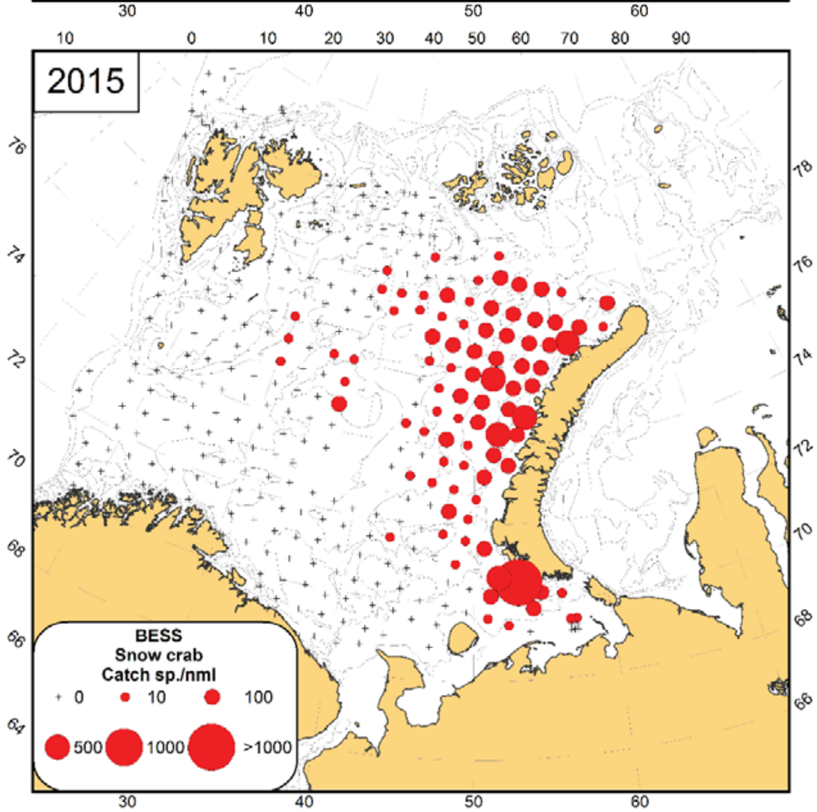

Figure 6.2.3.1. Distribution and numbers of the snow crabs per one nm in the Barents Sea during the ecosystem survey 2014.

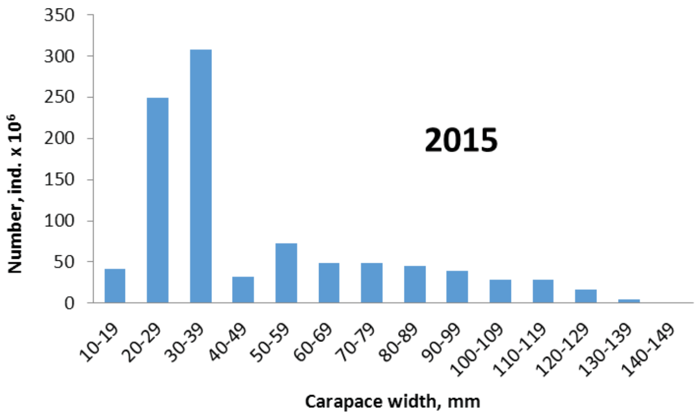

Figure 6.2.3.2. Size structure of the Snow crab population in the Barents Sea in 2015.

6.2.4 Monitoring of Scallop (*Chlamys islandica*)

Text by I. Manushin

Figures by P. Krivosheya and I. Manushin

In 2015 the scallop *Chlamys islandica* were recorded in 103 of 335 trawl catches. Survey showed a broad distribution of Scallops around the Barents Sea, but the most abundant catches were recorded in the south-eastern shallow banks, in the coastal water of the northern tip of Novaya Zemlya archipelago and in Spitsbergen Bank (fig. 6.2.4.1).

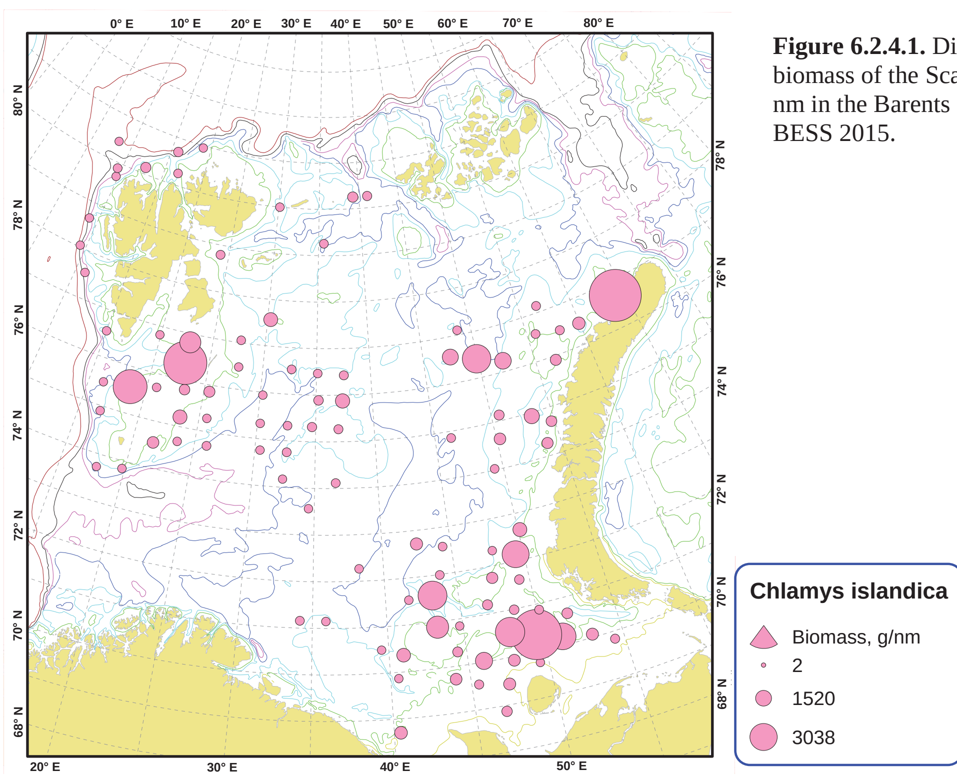

Figure 6.2.4.1. Distribution and biomass of the Scallops per one nm in the Barents Sea during the BESS 2015.

The biomass of Scallops in 2015 varied from 1 g to 2.28 kg/haul (0.002-3.04 kg/nml). The average biomass is 209.8±42.4 g/haul (278.3±55.8 g/nml). The abundance ranged from 1 to 130 ind./haul (0.4-173.3 ind./nml). The average abundance of scallops accounted for 9.8±1.7 ind./haul (13.1±2.3 ind./nml).

7 Monitoring of interactions by diet study

Text and figure by I. Prokopchuk

7.1 Sampling of capelin and polar cod stomachs by PINRO in 2015

In total 600 capelin and 750 polar cod stomachs were collected on board RV Vilnyus in the BESS 2015. Stomach stations location is shown on the figure 7.1.

Stomachs were preserved in 10 %-formalin and delivered at PINRO for latter trophology analysis. Capelin and polar cod stomach will be processed during 2016 and Report chapter will updated.

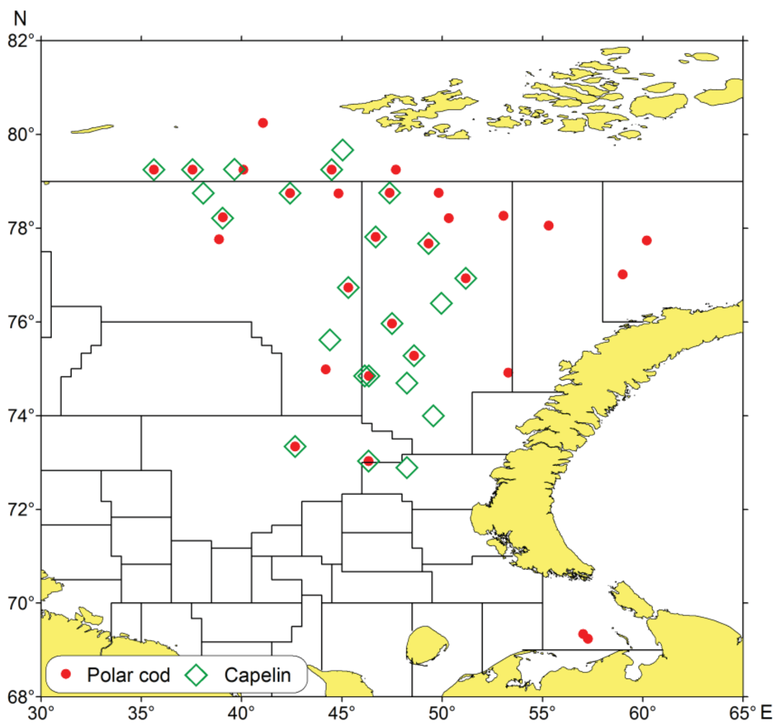

Figure 7.1. Location of capelin and polar cod stomachs sampling in BESS 2015 taken by R/V Vilnyus.

8 Monitoring of biodiversity

8.1 Plankton biodiversity

No results available. Take contact with responsible scientific group at IMR and PINRO.

8.2 Invertebrate biodiversity

8.2.1 Megabenthos bycatch in bottom trawls

Text by D. Zakharov, L. Lindal Jørgensen
Figures by D. Zakharov

In 2015, recording of megabenthos in 334 bottom trawls were made. This included all four participating research vessels of the Ecosystem Survey. This resulted in 647 taxa of benthic invertebrates, of which 422 taxa were identified to species level (table 8.2.1).

Table 8.2.1 Amount of megabenthic taxa identified in the ecosystem survey 2015

Taxa	RV Vilnus	RV G.O. Sars	RV Helmer Hansen	RV Johan Hjort
N travling	178	37	26	93
Phylum	13	13	11	14
Class	26	24	24	33
Order	80	70	61	107
Family	140	130	107	221
Genus	190	163	141	331
Species	151	153	113	333
Total taxa:	257	204	162	480

Mollusca had the greatest number of taxa (148 taxa) (fig. 8.2.1). The second greatest group was Arthropoda (110 taxa), the third Echinodermata (93 taxa). The lowest number of taxa was represented by the phylum Nemertini (1 taxon). The most widespread species and taxa in 2015 were: *Pandalus borealis* (identified in 73 % of trawl-catches), *Ctenodiscus crispatus* (73 % of catches) and *Sabinea septemcarinata* (68 % of catches).

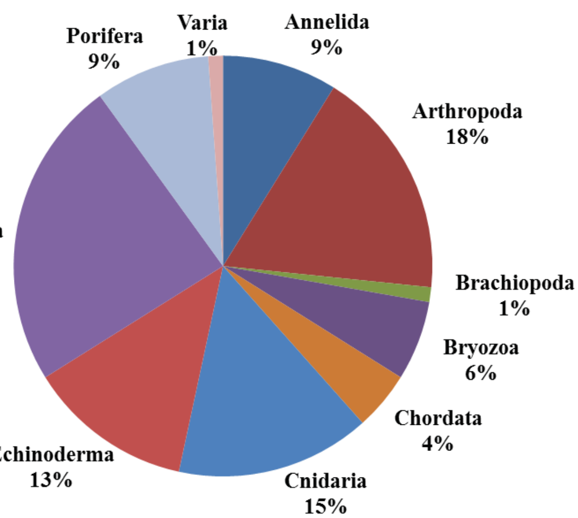

Figure 8.2.1.1. The mean distribution of taxa per invertebrate group (%) in the bottom trawl catch of the ecosystem survey in 2015.

8.2.2 Biodiversity (number of taxa)

The number of taxa in the trawl catches ranged from 4 to 89 with average of 29±1 taxon's per trawl-catch. The highest taxonomic diversity was observed south and east of the Spitsbergen archipelago (more than 89 taxa) (RV "Johan Hjort") (fig. 8.2.2). In the Russian economic zone the taxonomic diversity ranged from 5 to 36 taxa per trawling with an average number of 17±1 taxa per trawling. As a result, a reduction of the taxonomic diversity was observed in a North-East direction, with the lowest values recorded in the area of the Kola Peninsula.

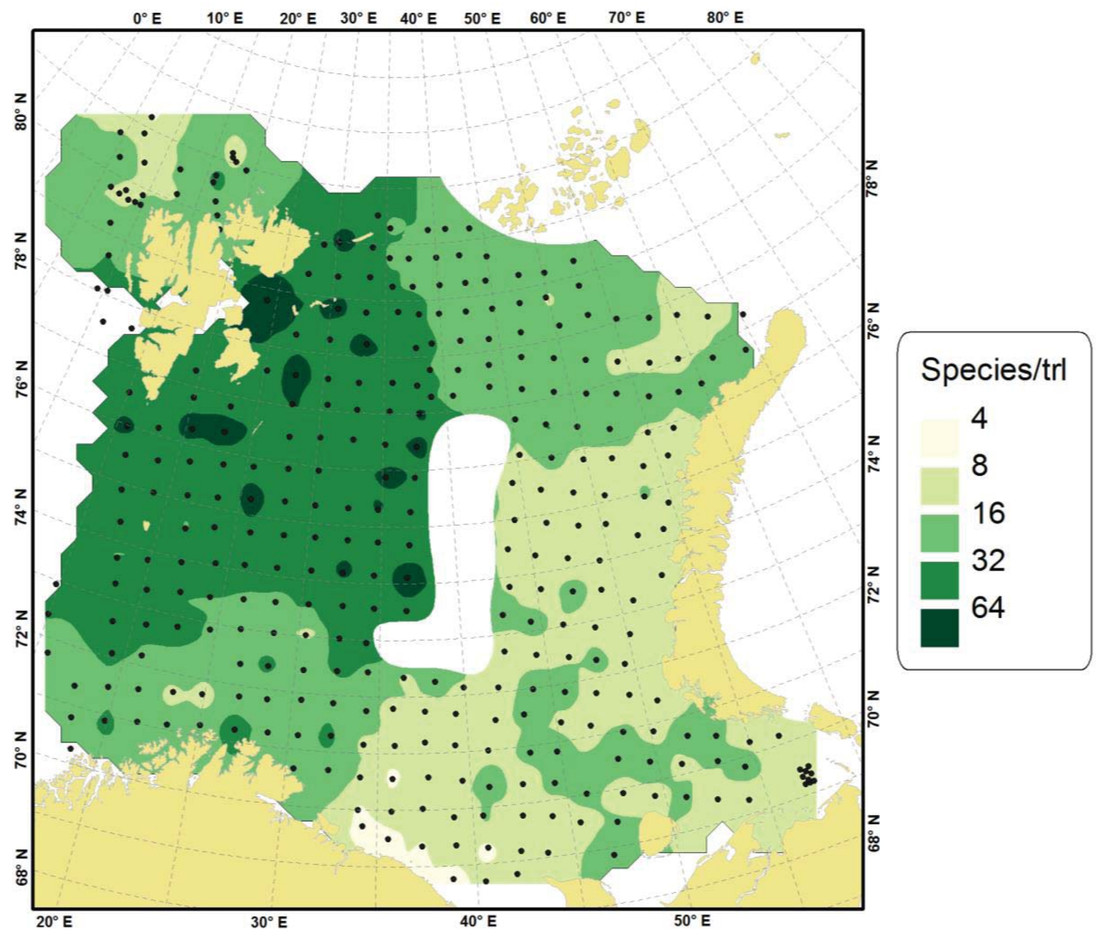

Figure 8.2.2.1. The extrapolated number of taxa per trawl-catch in the Barents Sea from the BESS 2015.

8.2.3 Abundance (number of individuals)

The average number of megabenthos encountered in the trawl catches was 1821±501 specimens/nml (fig. 8.2.3.1). The lowest catch was recorded southwest of the Barents Sea ("G.O. Sars") with 4 individuals per mile trawling. The maximum number of specimens was observed near to Bear Island ("Johan Hjort") and this catch was represented by one species of ascidia – *Eugyra pedunculata* (160 thousand individuals/nml trawling). In the southern and south-eastern regions there is a decrease in the number of megabenthos (maximum 1000 individuals per mile of trawling).

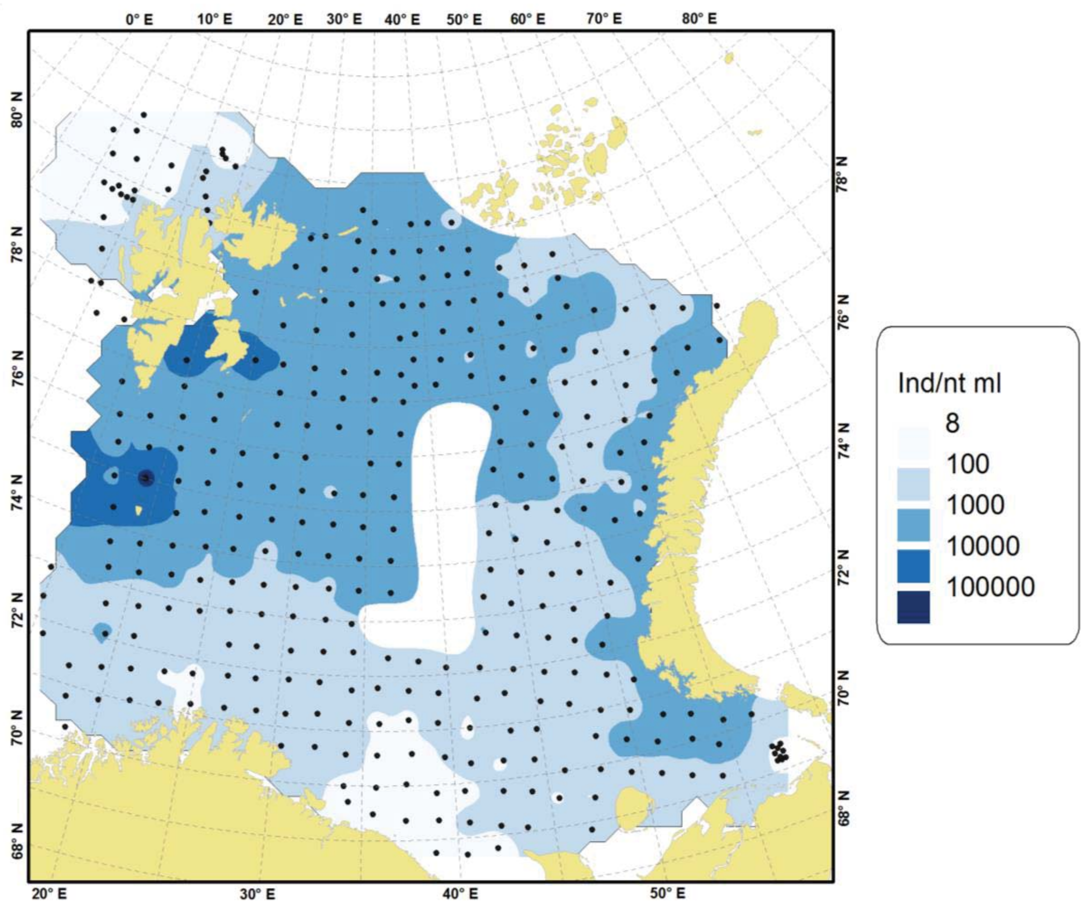

Figure 8.2.3.1 The extrapolated number of individuals of megabenthos in the Barents Sea from the BESS 2015.

8.2.4 Biomass

The maximum bycatch of benthos (487 kg) was observed in the southern part of the study area at a depth of 87 (Figure 8.2.4.1). The sponge *Myxilla incrustans* (317 kg) and the crab *Paralithodes camtschaticus* (171 kg) were dominating there. Lowest catch (76 g) were taken in the northwest of Spitsbergen, at a depth of 539 m. In average, the biomass of benthos was 36 ± 5 kg per mile.

Compared to the ecosystem survey in 2013, as well as the results of the previous years, there are an increasing trend of dominance of echinoderms (Echinodermata) of the total by-catch-biomass from southwest to northeast (Figure 8.2.4.2). At the same time, there has been a significant increase of crustaceans caused by the spreading and the high abundances of large *Chionoecetes opilio* specimens (snow crab). Large colonies of sponges were recorded in the southern part of the Barents Sea and in the area of the continental slope to the northwest of Spitsbergen,.

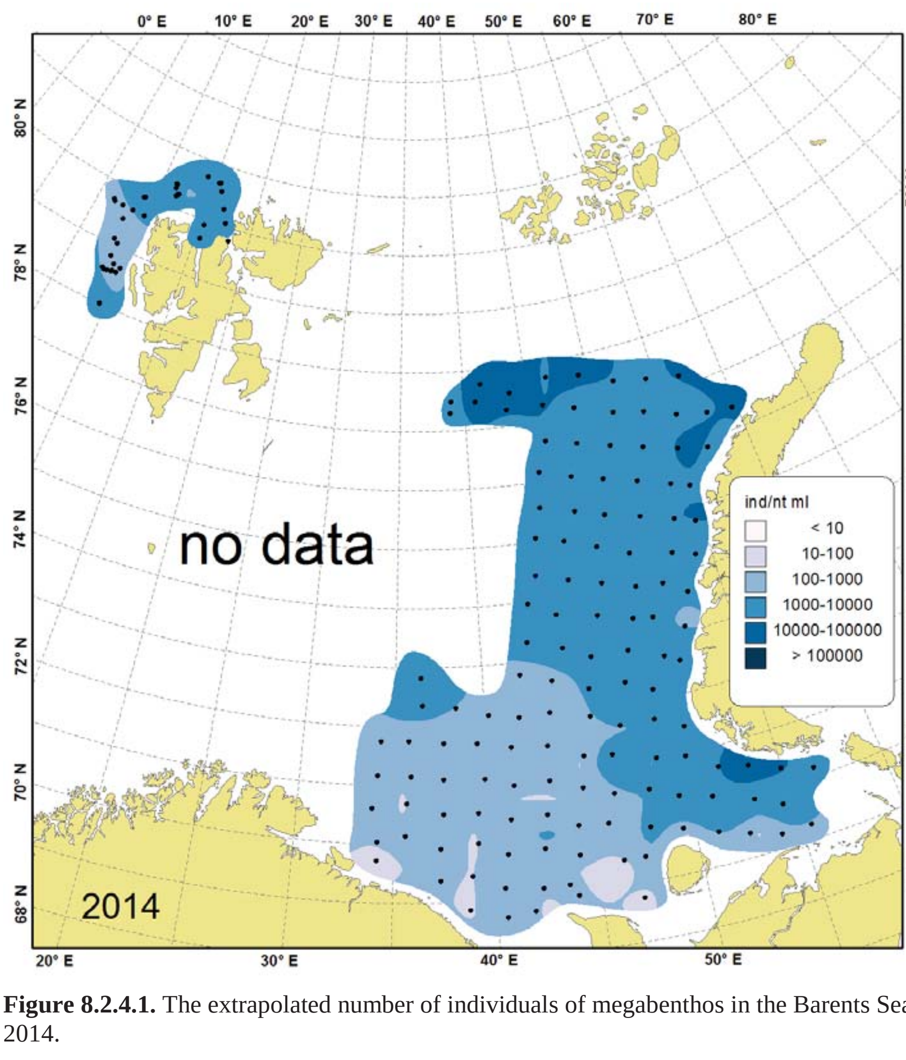

Figure 8.2.4.1. The extrapolated number of individuals of megabenthos in the Barents Sea in August-October 2014.

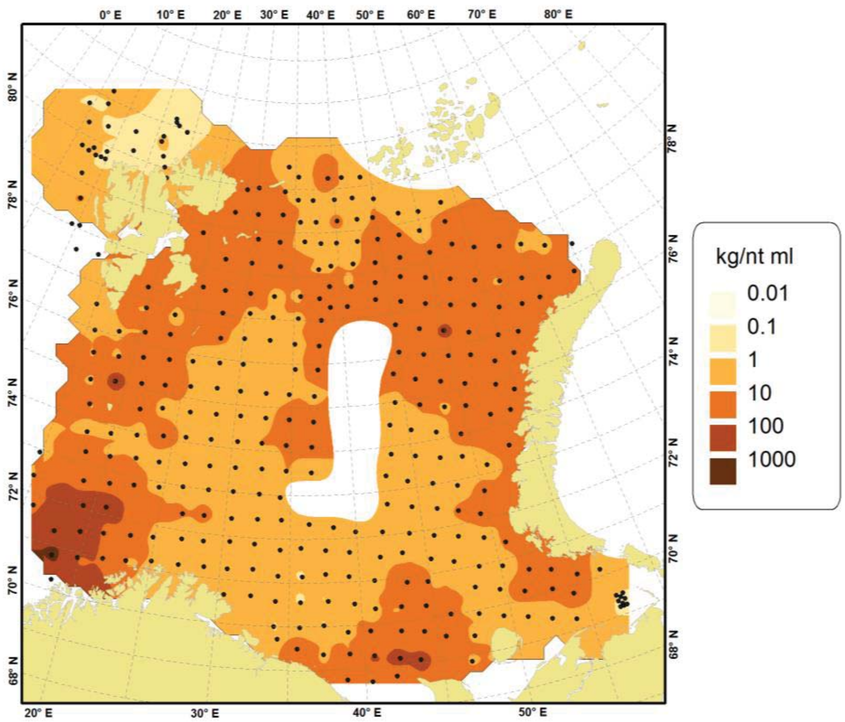

Figure 8.2.4.2. The extrapolated biomass distribution of megabenthos in the Barents Sea in the BESS 2015.

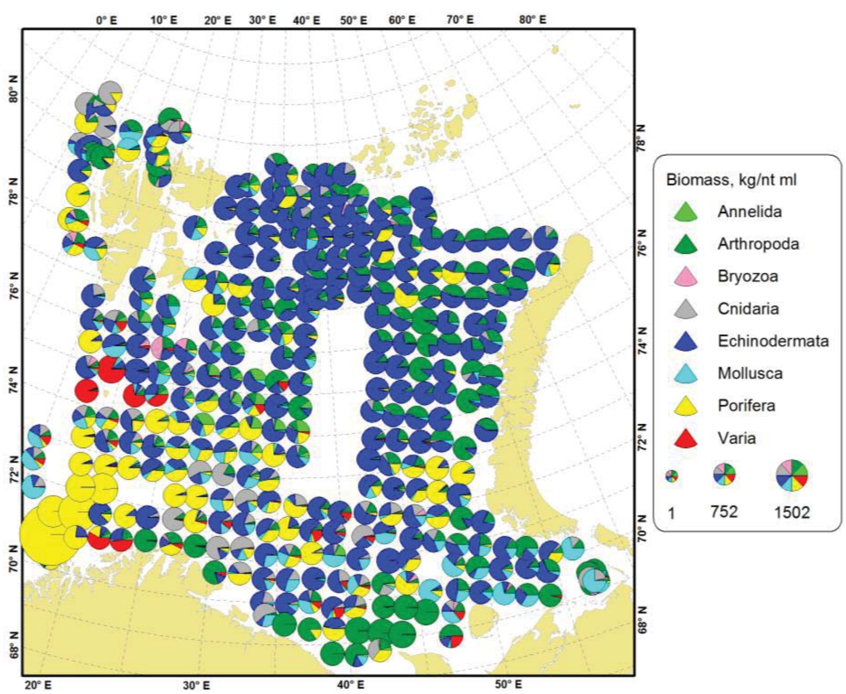

Figure 8.2.4.3. Distribution of the main megabenthic taxonomic groups in the Barents Sea during the BESS 2015.

8.2.5 Distribution and amount of Gonatus fabricii

No results available. Take contact with responsible scientific group at IMR and PINRO.

8.3 Fish biodiversity

8.3.1 Small non-target fish species

No results available. Take contact with responsible scientific group at IMR and PINRO.

8.3.2 Species-indicators

by T. Prokhorova, E. Johannesen, A. Dolgov and R. Wienerroither
Figures by P. Krivosheya

Thorny skate (*Amblyraja radiata*) and Arctic skate (*Amblyraja hyperborea*) were selected as indicator species to study how fishes from different zoogeographic groups respond to changes of their environment. Thorny skate belongs to the boreal zoogeographic group and are widely distributed in the Barents Sea except the most north-eastern areas, while Arctic skate belongs to the arctic zoogeographic group and are distributed in the coldwater northern area.

As in previous years thorny skate are distributed in the wide area from the southwest to the northwest where warm Atlantic and Coastal Water have influenced (Figure 8.3.2.1, see Figure 3.1.2.7 in the section 3.1 “Hydrography”). Thorny skate was found at the same area as in 2014. This species was observed in the 33.7 % of the bottom stations. Thorny skate are distributed within a depth of 46-946 m, and the highest biomass was at depth 50-150 m (46.4 % of total biomass). The mean catch (1.0 kg per nautical mile and 1.1 individuals per nautical mile) was some less than in 2014 (1.2 kg per nautical mile and 1.4 individuals per nautical mile). The estimated total biomass of thorny skate in 2015 (30.5 thousand tonnes) was approximately the same as in 2014 (30.0 thousand tonnes), but estimated total abundance in 2015 (31.8 million individuals) was less than in 2014 (34.4 million individuals). The reason of this is larger mean weight of this species in 2015 (0.97 kg) than in 2014 (0.82 kg).

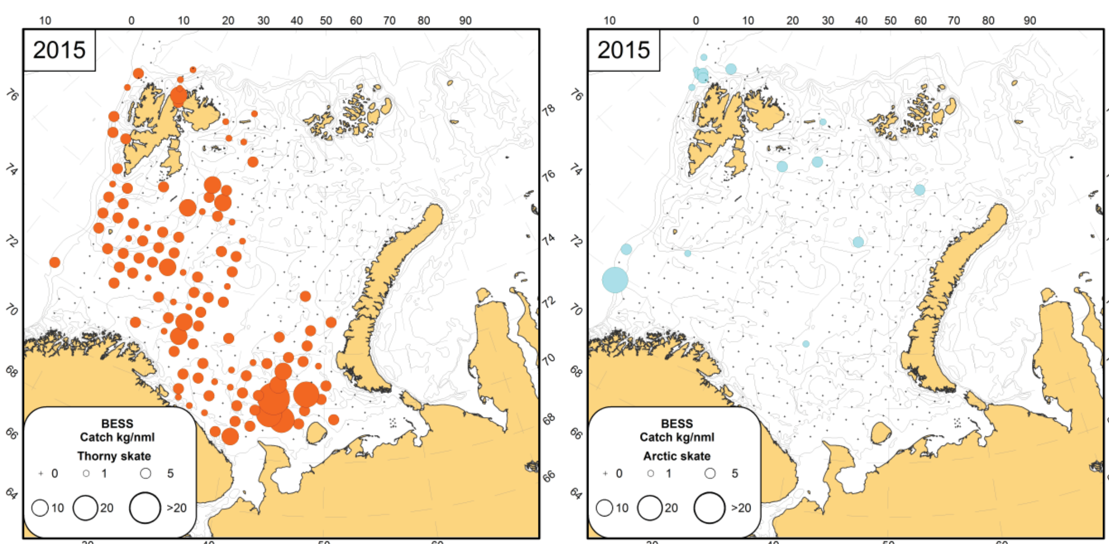

Figure 8.3.2.1. Distribution of thorny skate (*Amblyraja radiata*) and arctic skate (*Amblyraja hyperborea*), August-October 2015.

Arctic skate was mainly found in deep trenches at sub-zero temperatures in the northwest, southwest and central Barents Sea (Figure 8.3.2.1, see also Figure 3.1.2.7 in the section 3.1 “Hydrography”). Compared to 2014 this species was found in the southwest Barents Sea. Arctic skate was found in the 4.8 % of the bottom stations only. This species was distributed within a depth 202-1025 m and the highest biomass was observed at 650-750 m (37.8 %). The mean catch of arctic skate in 2015 (0.1 kg per nautical mile and 0.07 individuals per nautical mile) was less than in 2014 (0.3 kg per nautical mile and 0.2 individuals per nautical mile) and the same as in 2013. The estimated total biomass and abundance of arctic skate in 2015 (1.9 thousand tonnes and 1.6 million individuals) was less than in 2014 (6.7 thousand tons and 3.7 million individuals). Mean weight of this species in 2015 (1.44 kg) was also less than in 2014 (1.66 kg).

8.3.3 Zoogeographic groups

by T. Prokhorova, E. Johannesen, A. Dolgov and R. Wienerroither
Figures by P. Krivosheya

During the 2015 ecosystem survey 91 fish species from 29 families were recorded in the catches, and 14 species were identified up to the level higher than species (genus or family level) (Appendix 2). All recorded species belonged to the 7 zoogeographic groups: **widely distributed**, **south boreal**, **boreal**, **mainly boreal**, **arctic-boreal**, **mainly arctic** and **arctic** according to the Andriashev and Chernova (1994) and Mecklenburg et al. (2010). Table 8.2.3.1 represents average and maximum catches of species from different zoogeographic groups in the survey. Only bottom trawl data were used. Only non-commercial species were included into the analysis. Both demersal (including bentho-pelagic) and pelagic (neritopelagic, epipelagic, bethyalpelagic) species were reviewed (Andriashev and Chernova, 1994, Parin, 1968, 1988).

Widely distributed (only ribbon barracudina *Arctozenus risso* represents this group), **south boreal** (e.g. whiting *Merlangius merlangus*, silvery pout *Gadiculus argenteus*, grey gurnard *Eutrigla gurnardus*) and **boreal** (e.g. moustache sculpin *Triglops murrayi*, fourbeard rockling *Enchelyopus cimbrius*) species were mostly distributed over the south western and western part of the survey area where warm Atlantic and Coastal Water have influenced (Figure 8.2.3.1). The maximum catch of this group (660 individuals per nautical mile) was higher than in 2014 (479 individuals per nautical mile) (Table 8.3.3.1).

Mainly boreal species (e.g. lumpfish *Cyclopterus lumpus*, sandeel *Ammodytes marinus*) were widely distributed over the entire survey area as usual (Figure 8.3.3.1). The south boreal, boreal and mainly boreal species were widely distributed due to positive temperature anomalies near the bottom throughout the Barents Sea in 2015 as in 2014 and 2013. The average catch of species from the mainly boreal group in 2015 (68.5 individuals per nautical mile) was 2.1 times higher than in in 2014 (33.0 individuals per nautical mile), but the maximum catch in 2015 (1587.1 individuals per nautical mile) was 2.4 times less than in 2014 (3841.4 individuals per nautical mile) (Table 8.3.3.1).

Arctic-boreal (e.g. ribbed sculpin *Triglops pingelii*, atlantic poacher *Leptagonus decagonus*), **mainly arctic** (e.g. atlantic spiny lumpsucker *Eumicrotremus spinosus*, arctic flounder *Liopsetta glacialis*, variegated snailfish *Liparis bathyarcticus*) and **arctic** (e.g. Arctic cod *Arctogadus glacialis*, threadfin seasnail *Rhodichthys regina*, black seasnail *Paraliparis bathybius*) species were distributed west and north off Svalbard/ Spitsbergen, west off Novaya Zemlya Archipelago, and in the northern part of the survey area (Figure 8.3.3.1). Species of these groups mostly occur in areas influenced by cold Arctic Water, Spitsbergen Bank Water, Novaya Zemlya Coastal Water and Pechora Coastal Water. These species were wider distributed then in 2014 due to lack of coverage north area during the survey in 2014. So catches of species from these groups was in many times higher than in 2014 (Table 8.3.3.1).

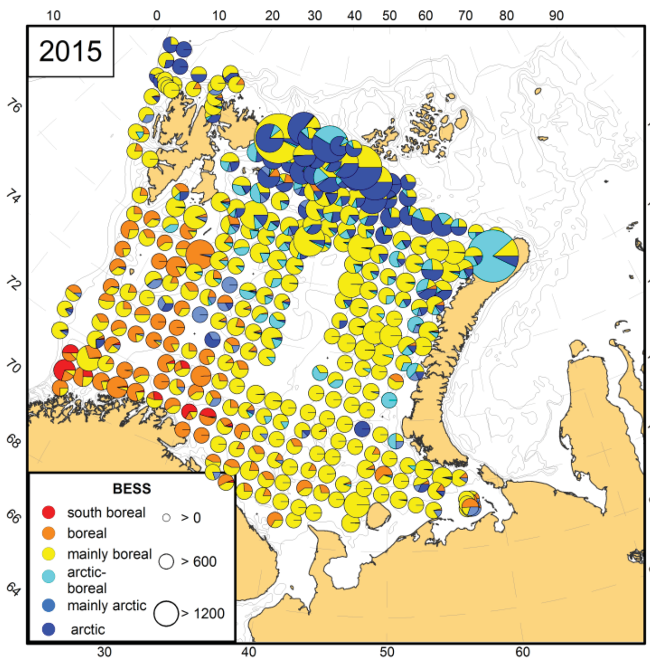

Figure 8.3.3.1. Distribution of non-commercial fish species from different zoogeographic groups during the ecosystem survey 2015. Size of circle corresponds to abundance (thousand individuals per nautical mile, only bottom trawl were used, both pelagic and demersal species are included).

Table 8.3.3.1. Average and maximum catch (individuals per nautical mile) of non-commercial fish from different zoogeographic groups (only bottom trawl data were used, both pelagic and demersal species are included).

Zoogeographic group	Average catch			Maximum catch		
	2013	2014*	2015	2013	2014*	2015
Widely distributed	0.2	0.1	0.09	45.0	4.3	10.0
South boreal	0.5	0.9	1.2	171.4	105.7	216.3
Boreal	5.95	10.6	10.6	258.6	478.6	660.0
Mainly boreal	38.5	33.0	68.5	6282.7	3841.4	1587.1
Arctic-boreal	14.2	8.6	14.0	3326.9	371.6	1502.4
Mainly arctic	5.9	1.7	1.9	656.3	60.9	53.8
Arctic	52.2	7.2	31.4	3822.7	385.2	832.2

* – Coverage in the northern Barents Sea was highly restricted

8.3.4 Rarely found species

by T. Prokhorova, E. Johannesen, A. Dolgov and R. Wienerroither
Figures by P. Krivosheya

Some uncommon species were observed in the Barents Sea during the ecosystem survey in 2015 (Figure 8.3.4.1). Most of these species usually occur in adjacent areas of the Barents Sea and therefore occurred mainly along the border of the surveyed area (e.g. black seasnail *Paraliparis bathybius* and Arctic cod *Arctodagus glacialis*, which are distributed in the Arctic polar basin, sea lamprey *Petromyzon marinus* and witch flounder *Glyptocephalus cynoglossus*, which are distributed southwest from the Barents Sea).

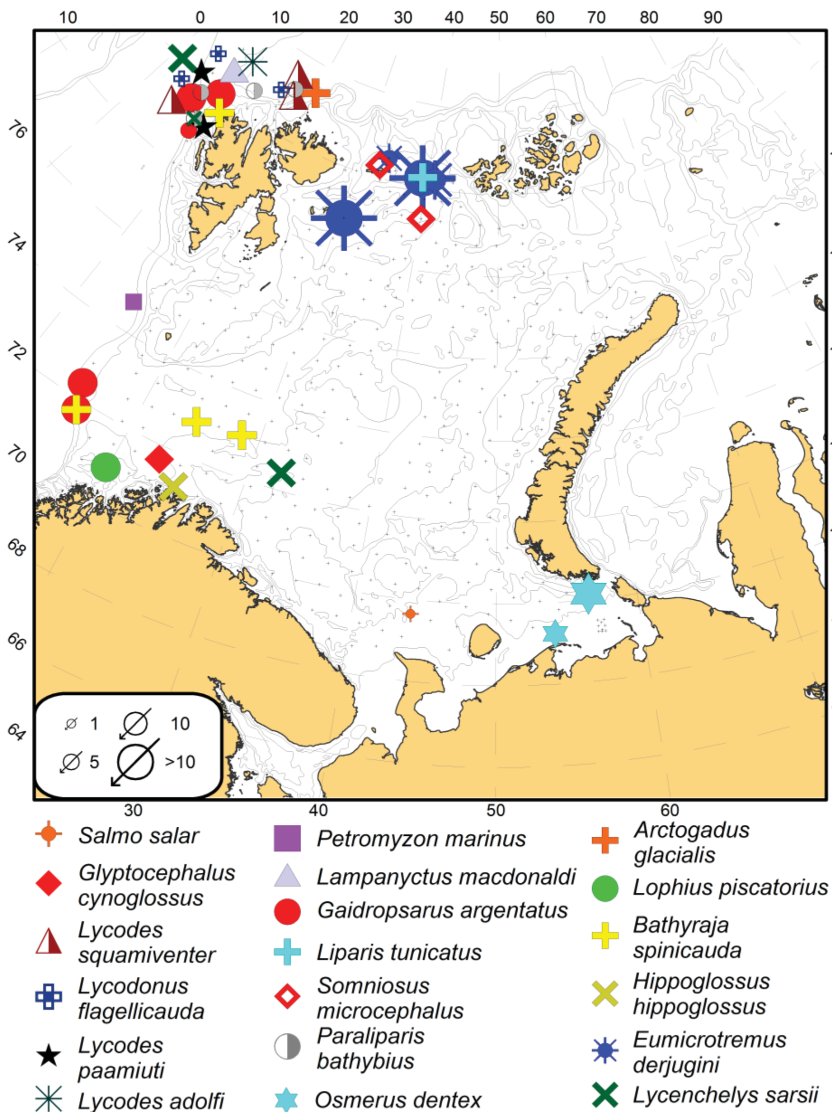

Figure 8.3.4.1. Distribution of species that are rare in the Barents that were found in the survey area in 2015. Size of circle corresponds to abundance (individuals per nautical mile, both bottom and pelagic trawls were used).

9 Marine mammals and seabird monitoring

9.1 Marine mammals

Text by R. Klepikovskiy and N. Øien
Figures by R. Klepikovskiy

In total 2028 individuals of 11 identified species of marine mammals in August-October 2015 were observed (42 individuals in total was not identified). The results of observations are presented in Table 9.1.1 and Figure 9.1.1-9.1.2.

As in previous years, the most often observed species was white-beaked dolphin (*Lagenorhynchus albirostris*) (some more than 60% of all registrations). This species has a wide distribution in research area. The most meetings of this dolphin closely capelin, herring, polar cod and other cod with different densities were recorded, and it was in western, central and eastern parts of the Barents Sea between 72º-78º N. The largest groups of these animals (25-35 individuals) in the western regions, and the New Land (Novaya Zemlya) Archipelago were recorded. Numbers of white-beaked dolphin meetings in comparison with 2012-2013 was increased.

Table 9.1.1. Number of marine mammals individuals observed from the R/V “Johan Hjort”, “Helmer Hansen”, “G.O. Sars”, “Vilnyus” during the ecosystem survey in 2015.

Order / suborder	Name of species (english)	Johan Hjort	G.O.Sars	Helmer Hansen	Vilnyus	Total	%
Cetacea/ Baleen whales	Blue whale	-	-	7	-	7	0.3
	Fin whale	65	45	14	9	133	6.6
	Humpback whale	457	-	1	26	484	23.9
	Minke whale	53	5	2	24	84	4.1
	Sei whale	1	-	-	-	1	0.05
	Unidentified whale	14	-	20	1	35	1.7
Cetacea/ Toothed whales	Sperm whale	1	5	-	-	6	0.3
	White-beaked dolphin	363	427	12	429	1231	60.7
	Harbour porpoise	2	-	-	11	13	0.6
	Killer whale	-	6	2	5	13	0.6
	Unidentified dolphin	2	-	-	-	2	0.1
Pinnipedia	Unidentified seal	-	1	4	-	5	0.2
	Bearded seal	-	-	1	-	1	0.05
	Walrus	2	-	11	-	13	0.6
Total sum		960	489	74	505	2028	100

Besides white-beaked dolphin among toothed whales sperm whale (*Physeter macrocephalus*), harbour porpoise (*Phocoena phocoena*), and killer whale (*Orcinus orca*) were observed. Sperm whale met in the western part of research area at deep waters. For this species also far stopping at place as in previous years was recorded, animals far than 25º E was met. The harbor porpoise mainly in couples in the south-eastern regions to 73º30'N was observed. These animals on the herring, capelin and juvenile cod aggregations were recorded. Killer whale this year was met in the west part of research area is likely to herring and in the northwest of the Svalbard Archipelago and in the area of the Victoria Island - in the field of possible concentrations of pinnipeds.

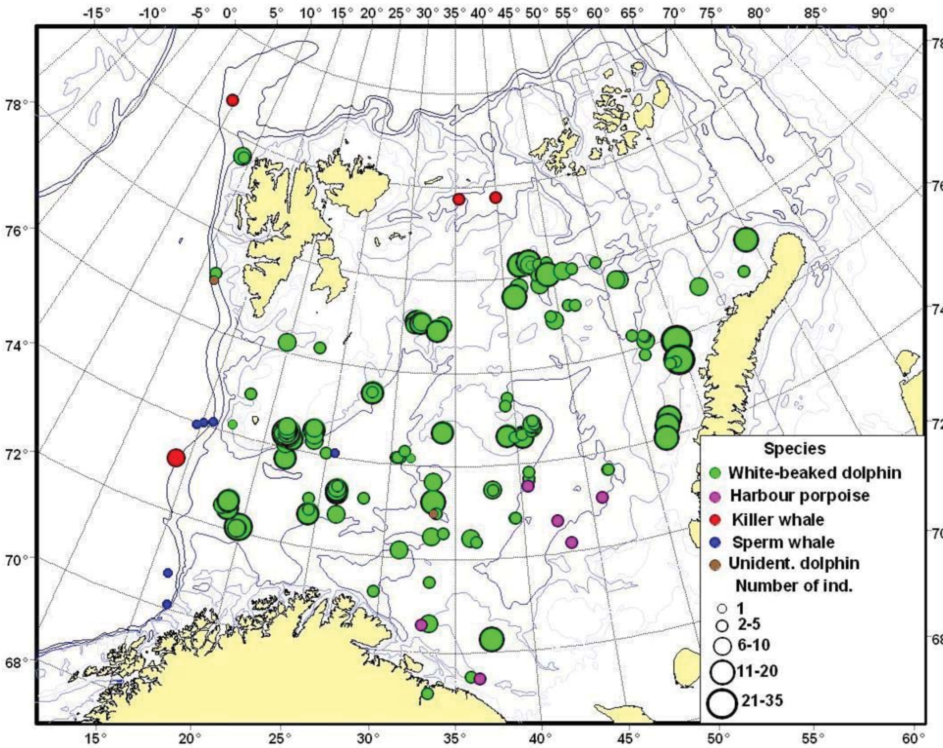

Figure 9.1.1. Distribution of toothed whales observed in August-October 2015.

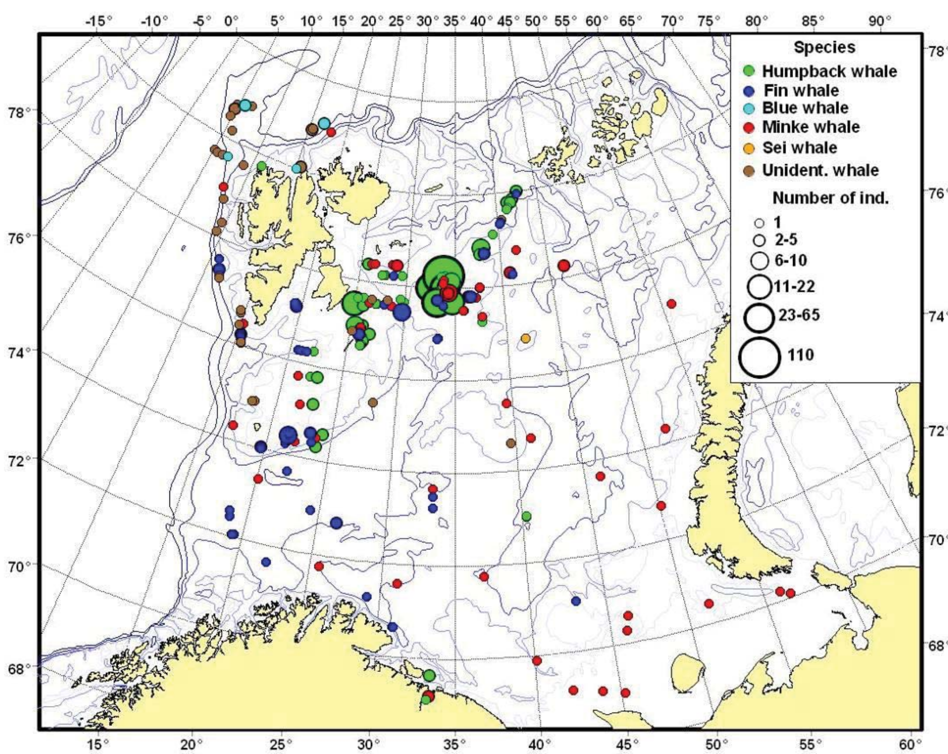

Figure 9.1.2. Distribution of baleen whales in August - October 2015.

Among baleen whales, the most observed were minke (*Balaenoptera acutorostrata*), humpback (*Megaptera novaeangliae*) and fin (*Balaenoptera physalus*) whales (with about 35% of all the animals). Minke whale in research area was widely distributed. The most dense concentrations of this species in area of the Hope Island and the Great Bank on capelin aggregations were recorded. In southern part of the Barents Sea minke whale on herring, juveniles capelin, cod, sand lance and other fish aggregations was met.

Increasing numbers of humpback whale in comparison with 2011-2013 was recorded this year. The most meetings of these animals in the area of the Hope Island, the Great Bank and the Franz Josef Land were recorded. Here, together with minke whale and fin whale as single individuals and groups are actively feeding on capelin humpback whales, numbering up to 110 individuals were recorded.

Fin whale observations this survey was increased. The most observations this species closely the Svalbard Archipelago, the Bear Island, and the Great Bank were recorded. Here these animals with minke whale and humpback whale were fed. In areas northward of the Svalbard Archipelago blue whale traditionally was observed. The Norwegian observers recorded sei whale on the Great Bank who was not observed early.

From pinnipeds during research period only walrus (*Odobenus rosmarus*) and bearded seal (*Erignathus barbatus*) were observed. This year the harp seal (*Phoca groenlandica*) summer-autumn concentrations were not recorded. It was caused by this year poor ice condition in the Barents Sea. Ice edge far in the northern are was located. Walrus closely the West Spitsbergen Island, the White Island, and northward of the Svalbard Archipelago was recorded. Bearded seal northward of the Svalbard Archipelago was met. Also due to the remove of ice edge far to northern part of research area polar bears (*Ursus maritimus*) were not observed.

9.2 Seabird observations

Text by P. Fauchald and R. Klepikovsky
Figures by P. Fauchald

Seabird observations were carried out by standardized strip transect methodology. Birds were counted from the vessel's bridge while the ship was steaming at a constant speed of ca. 10 knots. All birds seen within an arc of 300 m from directly ahead to 90° to one side of the ship were counted. On the vessels Helmer Hansen, GO Sars and Johan Hjort, birds following the ship i.e. "ship-followers", were counted as point observations within the sector every ten minutes. Ship-followers included the most common gull species and Northern fulmar. The ship-followers are attracted to the ship from surrounding areas and individual birds are likely to be counted several times. The numbers of ship-followers are therefore probably grossly over-estimated.

Total transect length covered by the Norwegian vessels (Helmer Hansen, GO Sars and Johan Hjort) was 5736 km. Total transect length covered by Vilnus was 5056 km. A total of 58141 birds belonging to 39 different species were counted (Table 9.2.1). The highest density of seabirds was found north of the polar front. These areas were dominated by Brünnich's guillemots (*Uria lomvia*), little auk (*Alle alle*), kittiwake (*Rissa tridactyla*) and Northern fulmar (*Fulmarus glacialis*) (Fig. 9.2.1).

Broadly, the distribution of the different species was similar to the distribution in the 2014 survey (Figure 9.2.1). Alcids were observed throughout the study area but the abundance and species distribution varied geographically. Little auks were found in the northern area, Brünnich's guillemots were found in the central and northern area, Atlantic puffins (*Fratercula arctica*) were found in the western part and common guillemots (*Uria aalge*) were found in the south. Among the ship-followers, black-backed gulls (*Larus marinus*) and herring gull (*Larus argentatus*) were found in the south, close to the coast. Glaucous gull (*Larus hyperboreus*) was found in small numbers in the south-eastern area, kittiwakes were found in high density in the central and northern area, while Northern fulmars were encountered in highest numbers in the west and south.

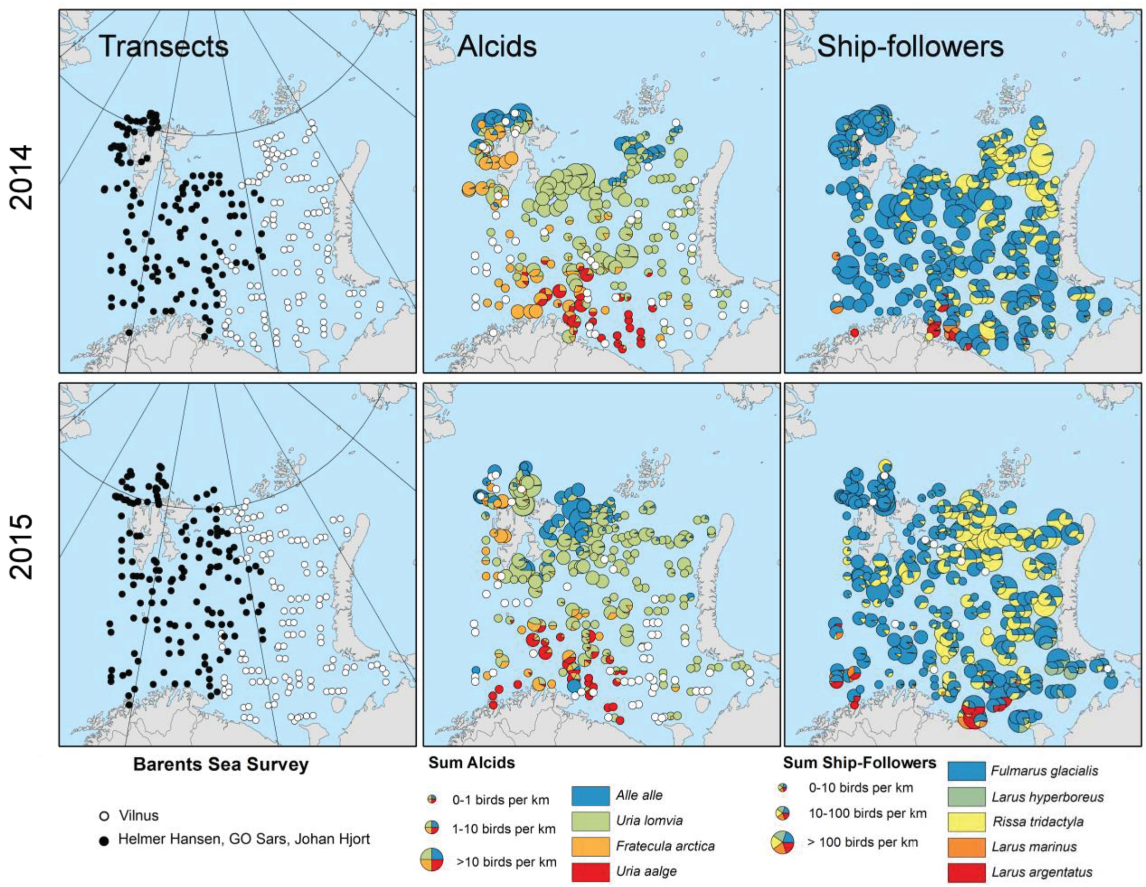

Figure 9.2.1 Seabird observations in 2014 (top) and 2015 (bottom). Left panel; positions of transects, middle panel; distribution of auks, right panel; distribution of ship-followers (gulls and fulmar).

Table 9.2.1. List of species encountered during the survey in 2015. Note that ship-followers were counted differently on the Norwegian and Russian vessels.

English name	Scientific name	Norwegian vessels	Russian vessel
Razorbill	*Alca torda*	4	0
Little Auk	*Alle alle*	1395	720
Pink-footed goose	*Anser brachyrhynchus*	160	0
Meadow pipit	*Anthus pratensis*	1	0
Ruddy turnstone	*Arenaria interpres*	1	0
Purple sandpiper	*Calidris maritima*	0	31
Black guillemot	*Cephus grylle*	36	0
Puffin	*Fratercula arctica*	493	13
*Northern fulmar	*Fulmarus glacialis*	33697	2448
Yellow-billed loon	*Gavia adamsii*	0	1
Black-throated loon	*Gavia arctica*	0	6
Great northern loon	*Gavia immer*	2	0
Red-throated loon	*Gavia stellata*	2	0
*Herring gull	*Larus argentatus*	1020	116
*Mew gull	*Larus canus*	4	0
*Lesser black-backed gull	*Larus fuscus*	8	0
*Heuglin's gull	*Larus heuglini*	0	49
*Glaucous gull	*Larus hyperboreus*	594	217
*Great black-backed gull	*Larus marinus*	932	69
Sabine's gull	*Larus sabini*	1	0
Northern gannet	*Morus bassanus*	17	7
Northern wheatear	*Oenanthe oenanthe*	1	0
Ivory gull	*Pagophila eburnea*	21	0
Unident. Sparrow	*Passeridae spp.*	1	0
European shag	*Phalacrocorax aristotelis*	3	0
Great cormorant	*Phalacrocorax carbo*	5	0
Snow bunting	*Plectrophenax nivalis*	3	7
European goldenplover	*Pluvialis apricaria*	5	0
Sooty shearwater	*Puffinus griseus*	13	2
Goldcrest	*Regulus regulus*	1	0
*Kittiwake	*Rissa tridactyla*	6467	2738
Common eider	*Somateria mollissima*	4	0
King eider	*Somateria spectabilis*	0	70
Long-tailed skua	*Stercorarius longicaudus*	13	0
Arctic skua	*Stercorarius parasiticus*	71	55
Pomarine skua	*Stercorarius pomarinus*	208	471
Great skua	*Stercorarius skua*	14	0
Unident. Skua	*Stercorarius spp.*	12	0
Arctic tern	*Sterna paradisaea*	39	2
Common guillemot	*Uria aalge*	174	76
Brünnich's guillemot	*Uria lomvia*	3319	2163
Unspec. guillemot	*Uria spp.*	127	12
Total		48868	9273

*Ship-followers

10 Special investigations

10.1 Investigation of trophic interaction

Text by E. Eriksen

Background and aim

The trophic investigations under the BESS survey is part of an ongoing activity aiming at improve our understanding of the trophic interactions, food web structure and function, and energy flow in the Barents Sea ecosystem. TIBIA (Trophic interactions in the Barents Sea-steps towards an Integrated Ecosystem Assessment) is a strategic institutes program. The aim of these investigations has been to examine how the benthic and pelagic systems are coupled by analyzing fish stomach analyses.

Samplings procedure

Biological samples (fish) were taken with a pelagic trawl with “Harstad” trawl with opening 20*20m opening and bottom “Campelen 1800” trawl with 15m horisontal and 4 m vertical trawl opening.

Length (down to nearest ½ cm), weight (down to nearest 1 g) and sex were recorded for maximum 30 individuals of all fish species from each trawl sample. In addition individual measures of age, special maturation stadium, stomach was taken from 10 selected individuals. Stomach content of fish larger than 10 cm were analyzed onboard, smaller fish was frozen for diet analyses, which will take place at the institute later. Stomach content was weighed, analysed to highest possible taxonomic level and percentage of each prey was given. Stomach of 62 fish species were collected and analysed on board from 144 stations (Figure 10.1.1).

Results

Sixtitwo fish species from 11 families were taken by pelagic and bottom trawl and analysed on board during the survey (Table 10.1.1.).

Table 10.1.1. Fish stomach content was analysed onboard during the BESS survey 2015.

English name	Norwegian name	Order	Family	Scientific name	Author
Ribbed sculpin	ARKTISK KNURRULKE	Scorpaeniformes	Cottidae	Triglops pingelii	Reinhardt, 1937
Slender eelblenny	ARKTISK LANGEBARN	Perciformes	Stichaeidae	Lumpenus fabricii	Reinhardt, 1836
Pale eelpout	BLEK ÅLEBROSME	Perciformes	Zoarcidae	Lycodes pallidus	Collett, 1878
Greenland halibut	BLÅKVEITE	Pleuronectiformes	Pleuronectidae	*Reinhardtius hippoglossoides*	(Walbaum, 1792)
Northern wolffish	BLÅSTEINBIT	Perciformes	Anarhichadidae	*Anarhichas denticulatus*	Kröyer, 1845
Anglerfish	BREIFLABB	Lophiiformes	Lophiidae	Lophius piscatorius	Linnaeus, 1758
Tusk	BROSME	Gadiformes	Lotidae	Brosme brosme	(Ascanius, 1772)
Fourbeard rockling	FIRETRÅDET TANGBROSME	Gadiformes	Lotidae	Enchelyopus cimbrius	(Linnaeus, 1766)
Spotted wolffish	FLEKKSTEINBIT	Perciformes	Anarhichadidae	*Anarhichas minor*	Olafsen, 1772
Long rough dab	GAPEFLYNDRE	Pleuronectiformes	Pleuronectidae	*Hippoglossoides platessoides*	(Fabricius, 1780)
Spinetail ray	GRÅSKATE	Rajiformes	Rajidae	Bathyraja spinicauda	(Jensen, 1914)
Atlantic wolffish	GRÅSTEINBIT	Perciformes	Anarhichadidae	*Anarhichas lupus*	Linnaeus, 1758
Bigeye sculpin	GRØNLANDSKNURR ULKE	Scorpaeniformes	Cottidae	Triglops nybelini	Jensen, 1944
Fish doctor	HALVNAKEN ÅLEBROSME	Perciformes	Zoarcidae	Gymnelus viridis	(Fabricius, 1780)
Lesser sandeel	HAVSIL	Perciformes	Ammodytidae	Ammodytes marinus	Raitt, 1934
Whiting	HVITTING	Gadiformes	Gadidae	*Merlangius merlangus*	(Linnaeus, 1758)
Haddock	HYSE	Gadiformes	Gadidae	*Melanogrammus aeglefinus*	(Linnaeus, 1758)
Rough-head grenadier (ICES), onion-eye grenadier (Fish-base)	ISGALT	Gadiformes	Macrouridae	*Macrourus berglax*	
Arctic skate	ISSKATE	Rajiformes	Rajidae	Amblyraja hyperborea	(Collett, 1879)
Thorny skate	KLOSKATE	Rajiformes	Rajidae	*Amblyraja radiata*	(Donovan, 1808)
Grey gurnard	KNURR	Scorpaeniformes	Triglidae	Eutrigla gurnardus	(Linnaeus, 1758)
Blue whiting	KOLMULE	Gadiformes	Gadidae	*Micromesistius poutassou*	(Risso, 1826)
Atlantic hookear sculpin	KROKULKE	Scorpaeniformes	Cottidae	*Artediellus atlanticus*	Jordan & Evermann, 1898
Pearlsides	LAKSESILD	Stomiiformes	Sternoptychidae	*Maurolicus muelleri*	(Gmelin, 1789)
Snakeblenny	LANGHALET LAGEBARN	Perciformes	Stichaeidae	*Lumpenus lampretaeformis*	(Walbaum, 1792)
White barracudina	LITEN LAKSETOBIS	Aulopiformes	Paralepididae	*Arctozenus risso*	(Bonaparte, 1840)
Capelin	LODDE	Osmeriformes	Osmeridae	*Mallotus villosus*	(Müller, 1776)
Lemon sole	LOMRE	Pleuronectiformes	Pleuronectidae	Microstomus kitt	(Walbaum, 1792)
Norway redfish	LUSUER	Scorpaeniformes	Sebastidae	Sebastes viviparus	Kröyer, 1844
Arctic eelpout	NETTÅLEBROSME	Perciformes	Zoarcidae	Lycodes reticulatus	Reinhardt, 1935
Moustache sculpin	NORDLIG KNURRULKE	Scorpaeniformes	Cottidae	Triglops murrayi	Günther, 1888
Moustache sculpin	NORDLIG KNUR	Scorpaeniformes	Cottidae	*Triglops murrayi*	Günther, 1888
Glacier lanternfish	NORDLIG LYSPIKFISK	Myctophiformes	Myctophidae	*Benthosema glaciale*	(Reinhardt, 1837)
Threespot eelpout	NORDLIG ÅLEBRÅSME	Perciformes	Zoarcidae	*Lycodes rossi*	Malmgren, 1864
Polar sculpin	PADDEULKE	Scorpaeniformes	Psychrolutidae	*Cottunculus microps*	Collett, 1875
Gelantinous snailfish	POLARRINGBUK	Scorpaeniformes	Liparidae	*Liparis fabricii*	Kröyer, 1847
Polar cod	POLARTORSK	Gadiformes	Gadidae	*Boreogadus saida*	
Lumpsucker	ROGNKJEKS	Scorpaeniformes	Cyclopteridae	*Cyclopterus lumpus*	Linnaeus, 1758
Stout eelblenny	RUNDHALET LANGEBARN	Perciformes	Stichaeidae	*Anisarchus medius*	
Round ray	RUNDSKATE	Rajiformes	Rajidae	Rajella fyllae	(Lütken, 1888)

Table 10.1.1. cont.

English name	**Norwegian name**	**Order**	**Family**	**Scientific name**	**Author**
Saithe	SEI	Gadiformes	Gadidae	*Pollachius virens*	(Linnaeus, 1758)
Witch	SMØRFLYNDRE	Pleuronectiformes	Pleuronectidae	Glyptocephalus cynoglossus	(Linnaeus, 1758)
Herring	SILD'G03	Clupeiformes	Clupeidae	*Clupea harengus*	Lumpsucker
Deepwater redfish	SNABELUER	Scorpaeniformes	Sebastidae	*Sebastes mentella*	Travin 1951
Snailfish	SNOTTFISH	Scorpaeniformes	Liparidae	The genus under revisions	
Aurora unernak	SPITSBERGENナLEBR OSME	Perciformes	Zoarcidae	Gymnelus retrodorsalis	Le Danois, 1913
Argentine	STRリMSILD	Osmeriformes	Argentinidae	Argentina sphyraena	Linnaeus, 1758
Leatherfin lumpsucker	SVARTKJEKS	Scorpaeniformes	Cyclopteridae	Eumicrotremus derjugini	Popov, 1926
Arctic rockling	SリLVTANGBROSME	Gadiformes	Lotidae	Gaidropsarus argentatus	(Reinhardt, 1838)
Silvery pout	SØLVTORSK	Gadiformes	Gadidae	*Gadiculus argenteus*	Guichenot, 1850
Atlantic poacher	TISKJEGG	Scorpaeniformes	Agonidae	*Leptagonus decagonus*	(Bloch & Schneider, 1801)
Twohorn sculpin	TORNULKE	Scorpaeniformes	Cottidae	*Icelus bicornis*	(Reinhardt, 1840)
Atlantic cod	TORSK	Gadiformes	Gadidae	*Gadus morhua*	Linnaeus, 1758
Daubed shanny	TVERRHALET LANGEBARN	Perciformes	Stichaeidae	*Leptoclinus maculatus*	(Fries, 1838)
Redfishes	UERSLEKTEN	Scorpaeniformes	Sebastidae		
Greater eelpout	ULVEFISK	Perciformes	Zoarcidae	*Lycodes esmarkii*	Collett, 1875
Golden Redfish	VANLIG UER	Scorpaeniformes	Sebastidae	*Sebastes marinus*	(Linnaeus, 1758)
Shorthorn sculpin	VANLIG ULKE	Scorpaeniformes	Cottidae	*Myoxocephalus scorpius*	(Linnaeus, 1758)
	VANLIG ÅLEBRÅSME	Perciformes	Zoarcidae	*Lycodes gracilis*	Sars, 1867
Greater argentine	VASSILD	Osmeriformes	Argentinidae	*Argentina silus*	(Ascanius, 1775)
Atlantic spiny lumpsucker	VORTEKJEKS	Scorpaeniformes	Cyclopteridae	Eumicrotremus spinosus	(Fabricius, 1776)
Norway pout	ØYEPÅL	Gadiformes	Gadidae	*Trisopterus esmarkii*	(Nilsson, 1855)

Diet of the collected fish species will be presented later in the TIBIA report.

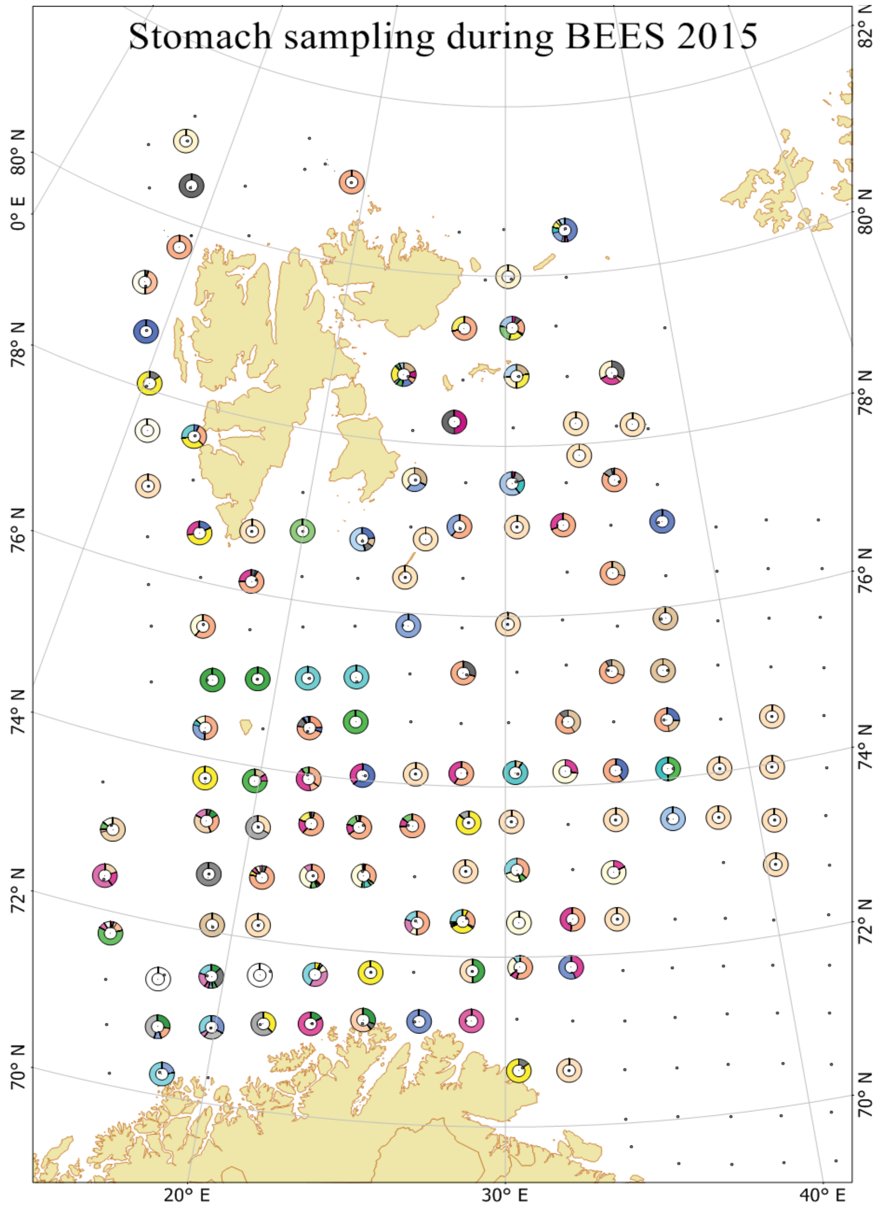

Figure 10.1.1. Stations were stomach samples were collected and analysed on board during the joint Norwegian-Russian Barents Sea Survey (BESS), August-October 2015. Fish species shown by different colours.

10.2 Krill sampling by plankton net attched to the bottom trawl

by A. Benzik and A.Dolgov

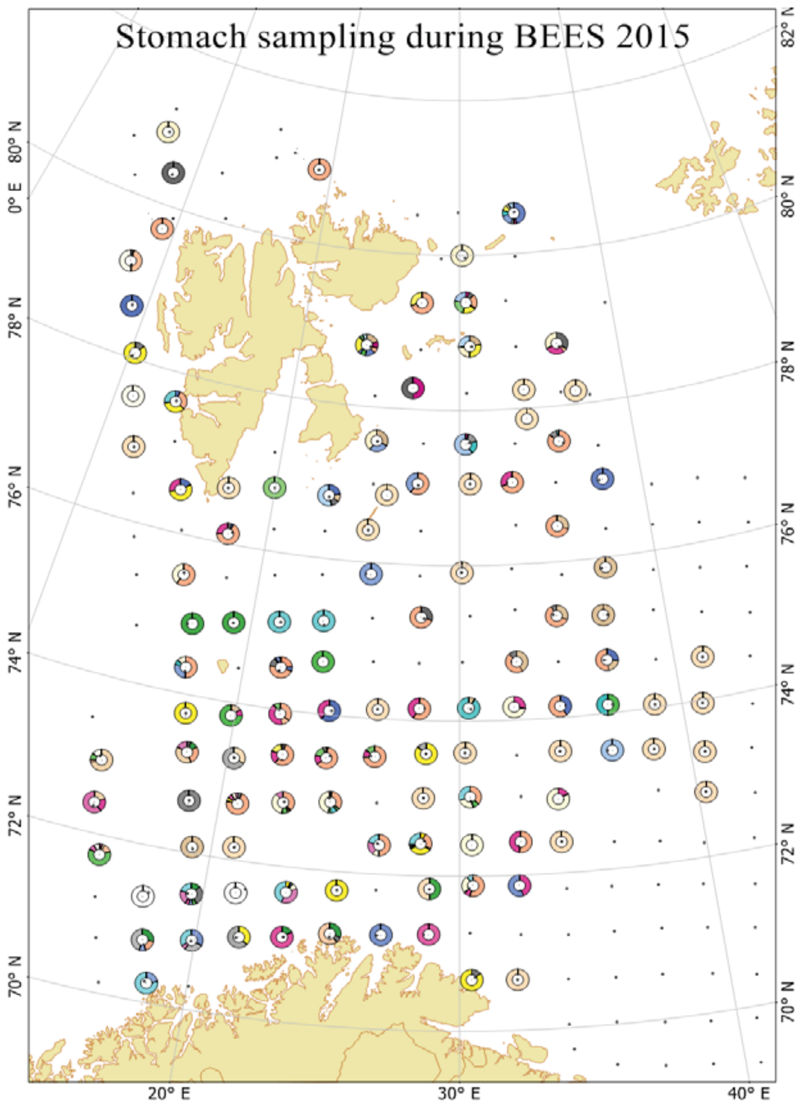

Figure 10.2.1. Stations were stomach samples were collected and analysed on board during the joint Norwegian-Russian Barents Sea Survey (BESS), August-October 2015. Fish species shown by different colours.

Results

Sixtytwo fish species from 11 families were taken by pelagic and bottom trawl and analysed on board during the survey (Table 10.1.1.).

Background and aim of investigations

Euphausiids are an abundant group of planktonic invertebrates, which play important role in trophic chains in the Barents Sea ecosystem (Drobysheva, 1994; Anon., 1996).

Since 1950s PINRO have conducted annual survey of euphausiids in the Barents Sea during Russian autumn-winter survey in October-December. Distribution, abundance, species and length compositions of euphausiids are annually estimated by PINRO. Based on these data, a review of their populations state and a forecast for the next year are conducted to evaluate feeding conditions for commercially important fishes in the Barents Sea.

To evaluate the possibility to estimate euphausiids stocks in different seasons, at the March meeting 2014 PINRO and IMR have agreed to conduct the joint investigations of euphausiids in the ecosystem survey (August-September 2014), Russian autumn-winter survey (October-December 2014) and in the Joint Norwegian-Russian winter survey (February-March 2015) onboard Russian and Norwegian vessels by standard sampling gear (the plankton net attached to the bottom trawl net).

10.3 Methods

According these agreements, euphausiids sampling were conducted in the ecosystem survey 2014. PINRO scientists Aleksander Benzik and Tatiana Prokhorova provided methodical help in using of the trawl net and collection of samples onboard Norwegian research vessels (G.O.Sars and J.Hjort).

Euphausiid (macro plankton) sampling was conducted according traditional methods used in PINRO (Anon., 2004). The trawl net (net size № 40, diameter of net opening - 50 cm) was used as sampling gear. The plankton net was attached to mid of the head line of bottom or pelagic trawl (Figure 10.3.1, 10.3.2 and 10.3.3).

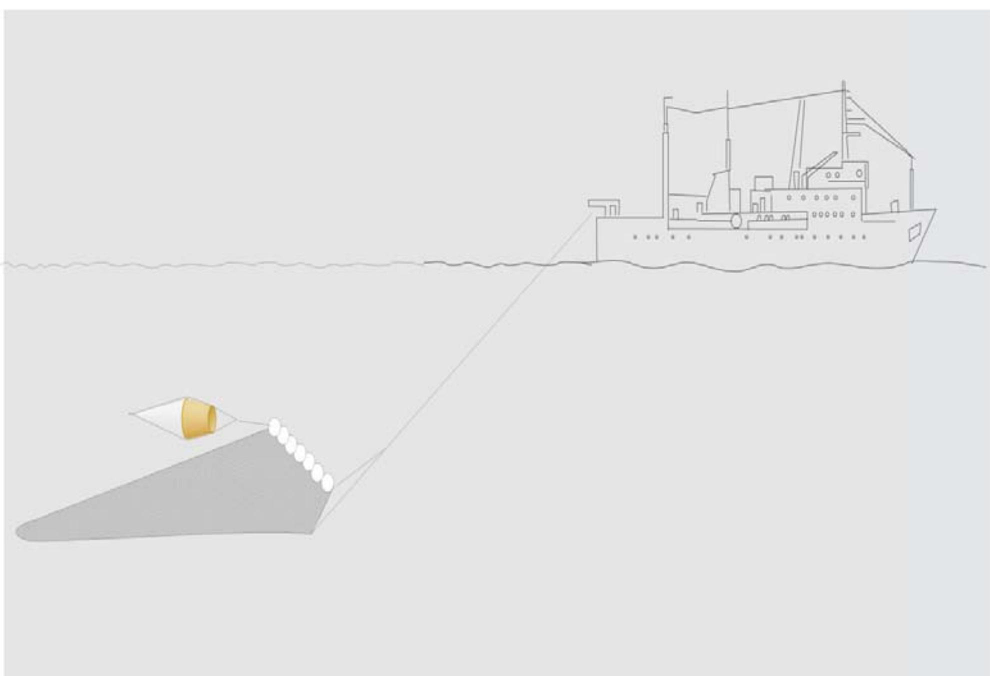

Figure 10.3.1. The plankton net attached to the bottom trawl.

Figure 10.3.2. Plankton net attached to the bottom trawl.

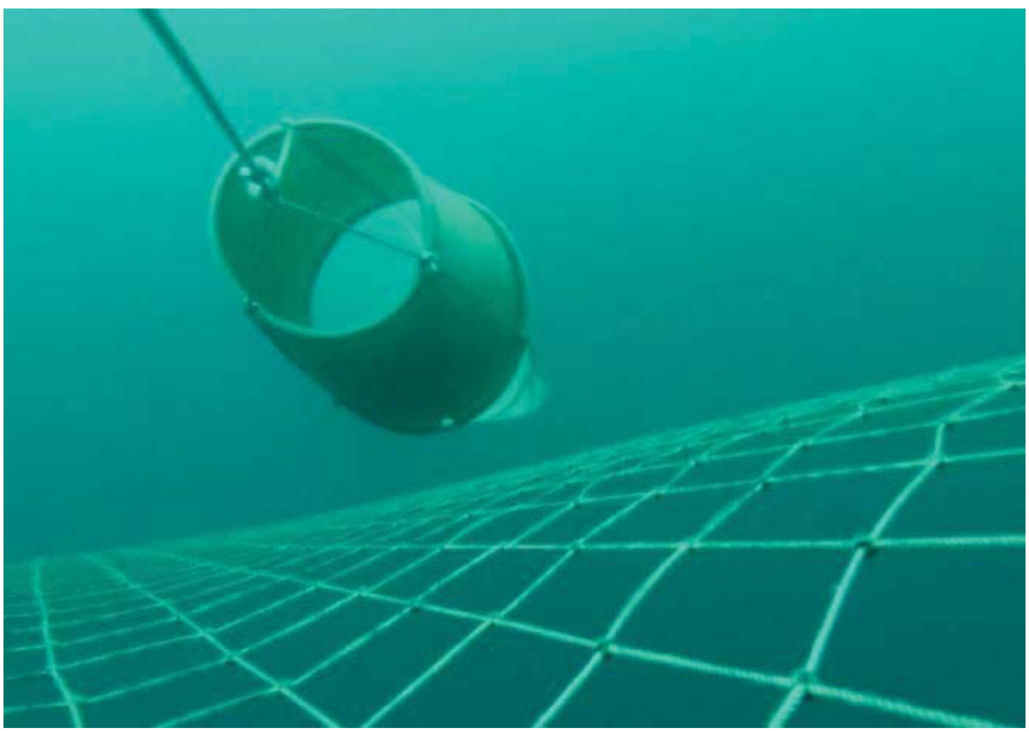

Figure 10.3.3. Underwater picture of plankton net attached to the pelagic trawl

During work on R/V G.O.Sars underwater video observations were conducted to evaluate possible effect of pelagic trawl geometry. Underwater records have shown that plankton net attached to the pelagic trawl not affected trawl geometry.

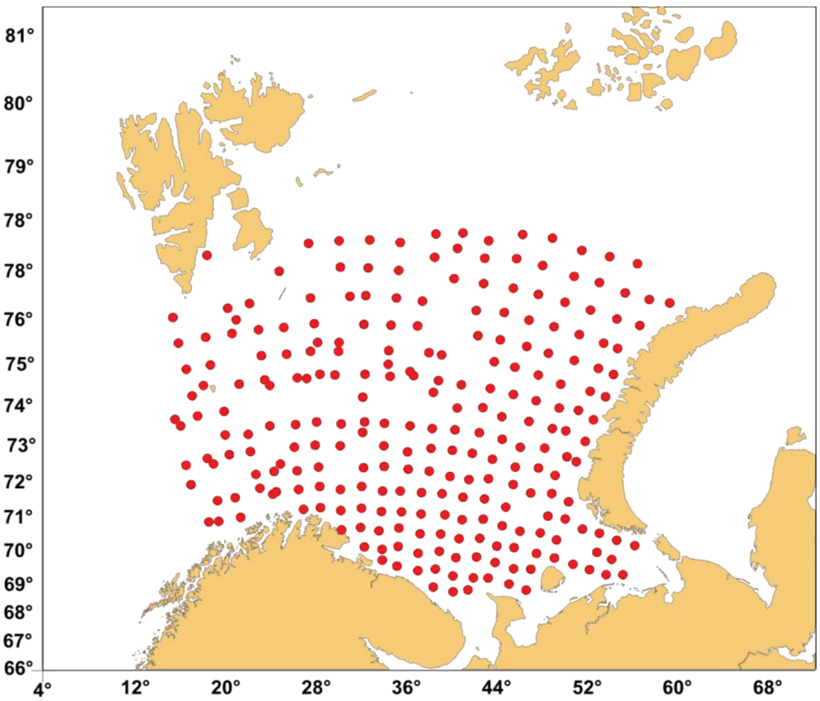

Figure 10.3.4. Macro plankton samples collected by plankton net attached to the bottom trawl.

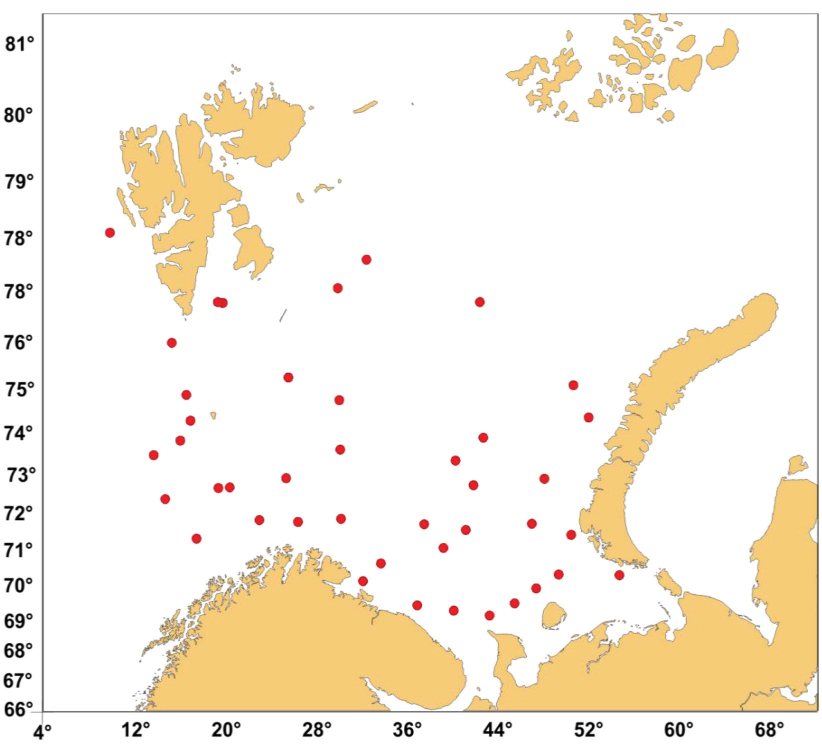

Figure 10.3.5. Macro plankton samples collected by plankton net attached to the pelagic trawl.

10.4 References

Anon. 1996. Annual distribution of euphausiid crustaceans – prey of commercially important fishes of the Barents Sea (1981-1995) (reference materials). Murmansk, PINRO Press. 27 pp. (in Russian).

Anon., 2004. Investigations of fisheries water ecosystems, sampling and processing of data on water biological resources, technics and technology of their catch and production. Vol. 1. Instructions and methodic recommendations on sampling and processing of biological information in the seas of the European North and North Atlantic / PINRO. 2nd edition, corrected and expanded. – Moscow, VNIRO Press. 299 pp. (in Russian).

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11 Instruments and fishing gear used

11.1 Instruments

The Simrad ER-60/18, 38, 120, 200 and 330 kHz scientific sounder was run during the survey for fish observation and bottom detection.

The details of the settings of the 38 kHz echo sounder where as follows:

Reference Target:			
TS	-33.60 dB	Min. Distance	21.00 m
TS Deviation	5.0 dB	Max. Distance	27.00 m
Transducer: ES38B Serial No.			
Frequency	38000 Hz	Beamtype	Split
Gain	25.51 dB	Two Way Beam Angle	-20.8 dB
Athw. Angle Sens.	21.90	Along. Angle Sens.	21.90
Athw. Beam Angle	6.85 deg	Along. Beam Angle	6.84 deg
Athw. Offset Angle	-0.08 deg	Along. Offset Angl	0.15 deg
SaCorrection	-0.65 dB	Depth	6.00 m
Transceiver: GPT 38 kHz 009072034687 2-1 ES38B			
Pulse Duration	1.024 ms	Sample Interval	0.190 m
Power	2000 W	Receiver Bandwidth	2.43 kHz
Sounder Type:			
EK60 Version 2.4.2			
TS Detection:			
Min. Value	-50.0 dB	Min. Spacing	100 %
Max. Beam Comp.	6.0 dB	Min. Echolength	80 %
Max. Phase Dev.	8.0	Max. Echolength	180 %
Environment:			
Absorption Coeff.	9.4 dB/km	Sound Velocity	1485.0 m/s
Beam Model results:			
Transducer Gain =	25.37 dB	SaCorrection =	-0.60 dB
Athw. Beam Angle =	7.18 deg	Along. Beam Angle =	7.17 deg
Athw. Offset Angle =	-0.08 deg	Along. Offset Angle=	-0.13 deg

Data deviation from beam model:
RMS = 0.16 dB
Max = 1.56 dB No. = 221 Athw. = 4.5 deg Along = -1.1 deg
Min = -0.54 dB No. = 44 Athw. = -4.9 deg Along = -0.2 deg

Data deviation from polynomial model:
RMS = 0.13 dB
Max = 1.65 dB No. = 221 Athw. = 4.5 deg Along = -1.1 deg
Min = -0.38 dB No. = 275 Athw. = 4.5 deg Along = -1.9 deg

Standard sphere calibrations were carried out in Malangen fjord, Spilderbukta (79°25’N and 18°31’E) 05-06.09.2014 by using a 60 mm diameter copper sphere for 38kHz. Due to high fish densities only 38kHz was calibrated. Other frequencies were examined by running the appropriate calibration sphere through the echosounder beam in order to manually check that signal levels were normal. Thus eliminating the possibility of a faulty echo sounder.

11.2 Fishing gear

All vessels have pelagic”Harstad” and bottom ”Campelen” trawls. Additionally, the Norwegian vessels equipped with mactoplankton trawl. Trawls were used for monitoring of pelagic and demersal community and identification of acoustic targets.

The bottom trawl has a headline of 31 m, footrope 47 m and 20 mm mesh size in the cod end with an inner net of 10 mm mesh size. The trawl height was about 4.5 m and distance between wings during towing about 21 m. The sweeps are 40 m long. The trawl is equipped with a 12" rubber bobbins gear. New doors are 'Thyborøn' combi type, 7.41 m2, 1720 kg.

The SCANMAR system was used on all trawl hauls. This equipment consists of sensors, a hydrophone, a receiver, a display unit and a battery charger. Communication between sensors and ship is based on acoustic transmission. The doors are fitted with sensors to provide information on their distance, and the trawl was equipped with a trawl eye that provides information about the trawl opening. A catch sensor on the cod-end indicated the size of the catch.

Acknowlegements

Preparing and conducting of ecosystem survey requires an enormous effort and knowledge. Every year in survey a large number of people involved. We thank all of them for the work.

Special thanks to crew of research vessels “Helmer Hanssen”, “Johan Hjort”, “G.O.Sars” and “Vilnyus” for ensuring the investigation and good work.

We are thankful to the scientific staffs both in Norway and Russia that have organized and participated in the surveys and those in Institutes who have analysed the samples.

We also thank The Barents Sea Program at the IMR and PINRO for funding.

Appendices

Appendix 1. Vessels and participants of the Ecosystem survey 2015

Prepared by P. Krivosheya, T.Wenneck and K. Sunnanå

Research vessel	Participants
”Vilnyus” (19.8–9.10)	P. Krivosheya (cruise leader), A. Amelkin, A. Velikzhanin, M. Kalashnikova, R. Klepikovsky, I. Malkov, S. Liutyi, S. Kharlin, T. Tankovskaya, N. Pankova, V. Pavlov, E. Eveseeva, D. Dragonov
”G. O. Sars” (11.9 – 27.9)	L. L. Jørgensen (cruise leader), B. Kvinge, B. Krafft, H. Senneset, I.M. Beck, J. de Lange, J. Skadal, J. Døvle Jojansen, M. Kalsund, M. Strand, M. Martinussen, O. Dyping, R. Olssøn, R..A. Johansen, T. Haugland, T. Iversen, J. Ford, B. Aleksander, O. Zimina, H. Haanes, J. Gwynn, C.D. Lasson, E.R. Davidson, K. Sunnanå, L.S. Charbit, M-K. Kiepert, R.H. Krapp, T.P. Egli
”Johan Hjort” (13.8-4.10)	Part 1 (13.8-26.8) G.O. Johansen (cruise leader), A. Rey, A. Voronkov, A. Storaker, A. Kristiansen, B.E. Grøsvik, E. Odland, G. Nesje, H. Gabrielsen, I. henriksen, J. Alvares, J.D. Johansen, J. Erices, L. Drivenes, M. Mjanger, S. Wennerqvist, S-R. Birkely, Y. Hunt, P. Dutt, N. Lauretan, D. Clarke Part 2 (26.8-9.9) S. Mehl (cruise leader), A. Rey, a. Sæverud, A. Voronkov, A. Kristiansen, E. Odland, H.E. Heldal, H. Mjanger, J. Erices, L. Solbaken, M. Mjanger, M.M. Nilsen, O.S. Fossheim, S. Kolbeinson, Y. Hunt, Ø. Sørensen, A. Iglikovska, J Ford, N. Lauretan, T. Prokhorova, H.K. Skjerdal Part 3 (10.9-4.10) G. Skaret (cruise leader), A. Voronkov, A. Staby, E. Hermansen, E. Holm, G. McCallum, J. Alvarez, J.E. Nygård, J. Kristiansen, J. Vedholm, J. Rønning, J. Røttinen, J. Erices, T.H.Thangstad, Y. Hunt, J. Przytaska, S. Murray, N. Lauretan, T. Prohorova
“Helmer Hanssen” (17.8-7.9)	R. Ingvaldsen (cruise leader), J. Bortolzzi, E. Ona, G. Langhelle, G. Lien G. Richardsen, H. Gjøsæter, L-J. Naustvoll, L.L. Jørgensen, . Chierici, R. Pedersen, S.E. Sem, S. Vindenes, T. Wenneck, T. Knutsen, T. Haugen, V.H. Lund, S. Iglesias, S. Murray, V. Syomin, A. Hosia, J. Nielsen, A. Buclin, P. Wiebe

Appendix 2. Sampling of fish in ecosystem survey 2015

Prepared by T. Prokhorova, R. Wienerroither and I. Malkov

Species are divided into **boreal (includes widely distributed, south boreal, boreal and mainly boreal zoogeographic groups)**, **arctic (includes arctic and mainly arctic zoogeographic groups)** and **arctic-boreal**. Black genus name (Genus sp.) means that fish was identified only to the genus level and species of this genus belong to different zoogeographic groups. Length measurements present samples from bottom and pelagic trawl catches.

Family	Latin name/ English name	Norwegian vessels	Russian vessel	Total	Length, cm mean (min-max)
Agonidae	***Aspidophoroides olrikii*/ Arctic alligatorfish**				6.3 (3-8)
	No of stations with samples	-	20	20	
	Nos. length measured	-	331	331	
	Nos. aged	-	-	-	
Agonidae	***Leptagonus decagonus*/ Atlantic poacher**				11.6 (2-20)
	No of stations with samples	97	104	201	
	Nos. length measured	831	620	1451	
	Nos. aged	76	-	76	
Ammodytidae	***Ammodytes marinus*/ Lesser sandeel**				8.2 (3-22)
	No of stations with samples	53	36	89	
	Nos. length measured	380	901	1281	
	Nos. aged	19	-	19	
Anarhichadidae	***Anarhichas* sp./ Wolffish**				
	No of stations with samples	1	-	1	4.0
	Nos. length measured	1	-	1	
	Nos. aged	-	-	-	
Anarhichadidae	***Anarhichas denticulatus*/ Northern wolffish**				80.0 (8-116)
	No of stations with samples	30	20	50	
	Nos. length measured	57	28	85	
	Nos. aged	24	2	26	
Anarhichadidae	***Anarhichas lupus*/ Atlantic wolffish**				14.6 (2-124)
	No of stations with samples	79	20	99	
	Nos. length measured	309	75	384	
	Nos. aged	32	1	33	
Anarhichadidae	***Anarhichas minor*/ Spotted wolffish**				61.0 (4-127)
	No of stations with samples	51	21	72	
	Nos. length measured	95	35	130	
	Nos. aged	27	-	27	
Argentinidae	***Argentina silus*/ Greater argentine**				21.3 (2-48)
	No of stations with samples	31	3	33	
	Nos. length measured	387	3	389	
	Nos. aged	59	-	58	
Arhynchobatidae	***Bathyraja spinicauda*/ Spinetail ray**				86.6 (45-145)
	No of stations with samples	4	-	4	
	Nos. length measured	5	-	5	
	Nos. aged	-	-	-	
Clupeidae	***Clupea harengus harengus*/ Atlantic herring**				11.9 (3-37)
	No of stations with samples	91	28	119	
	Nos. length measured	1764	97	1861	
	Nos. aged	295	39	334	
Clupeidae	***Clupea pallasii suworowi*/ Kanin herring**				18.1 (8-23)
	No of stations with samples	-	8	8	
	Nos. length measured	-	140	140	
	Nos. aged	-	35	35	
Cottidae	***Artediellus atlanticus*/ Atlantic hookear sculpin**				7.4 (2-15)
	No of stations with samples	109	103	212	
	Nos. length measured	1552	1112	2664	
	Nos. aged	182	-	182	
Cottidae	**Cottidae g.sp./ Bullheads and Sculpins**				3.0
	No of stations with samples	1	1	2	
	Nos. length measured	1	1	2	
	Nos. aged	-	-	-	

Cottidae	***Gymnocanthus tricuspis*/ Arctic staghorn sculpin**				10.2 (2-20)
	No of stations with samples	1	22	23	
	Nos. length measured	1	100	101	
	Nos. aged	-	-	-	
Cottidae	***Icelus bicornis*/ Twohorn sculpin**				5.8 (3-8)
	No of stations with samples	16	1	17	
	Nos. length measured	92	1	93	
	Nos. aged	20	-	20	
Cottidae	***Icelus spatula*/ Spatulate sculpin**				6.8 (3-12)
	No of stations with samples	-	38	38	
	Nos. length measured	-	158	158	
	Nos. aged	-	-	-	
Cottidae	***Myoxocephalus scorpius*/ Shorthorn sculpin**				3.0 (2-5)
	No of stations with samples	23	-	23	
	Nos. length measured	132	-	132	
	Nos. aged	-	-	-	
Cottidae	***Triglops murrayi*/ Moustache sculpin**				8.5 (2-17)
	No of stations with samples	49	25	74	
	Nos. length measured	384	183	567	
	Nos. aged	73	-	73	
Cottidae	***Triglops nybelini*/ Bigeye sculpin**				6.8 (2-15)
	No of stations with samples	44	52	96	
	Nos. length measured	772	1433	2205	
	Nos. aged	36	-	36	
Cottidae	***Triglops pingelii*/ Ribbed sculpin**				11.7 (2-18)
	No of stations with samples	11	25	36	
	Nos. length measured	132	412	544	
	Nos. aged	28	-	28	
Cottidae	***Triglops* sp./**				4.8 (2-5)
	No of stations with samples	6	4	5	
	Nos. length measured	20	10	11	
	Nos. aged	-	-	-	
Cyclopteridae	***Cyclopterus lumpus*/ Lumpsucker**				22.4 (4-53)
	No of stations with samples	99	56	155	
	Nos. length measured	299	104	403	
	Nos. aged	95	-	95	
Cyclopteridae	***Eumicrotremus derjugini*/ Leatherfin lumpsucker**				4.0 (3-11)
	No of stations with samples	2	2	4	
	Nos. length measured	25	63	88	
	Nos. aged	11	-	11	
Cyclopteridae	***Eumicrotremus spinosus*/ Atlantic spiny lumpsucker**				6.9 (3-12)
	No of stations with samples	12	3	15	
	Nos. length measured	81	13	94	
	Nos. aged	24	-	24	
Gadidae	***Arctogadus glacialis*/ Arctic cod**				13.0
	No of stations with samples	1	-	1	
	Nos. length measured	1	-	1	
	Nos. aged	-	-	-	
Gadidae	***Boreogadus saida*/ Polar cod**				9.3 (2-25)
	No of stations with samples	134	150	284	
	Nos. length measured	3829	14858	18687	
	Nos. aged	1003	650	1653	
Gadidae	***Eleginus nawaga*/ Atlantic navaga**				17.7 (5-27)
	No of stations with samples	-	10	10	
	Nos. length measured	-	1991	1991	
	Nos. aged	-	175	175	
Gadidae	**Gadidae g.sp./ Codfishes**				2.1 (1-3)
	No of stations with samples	1	-	1	
	Nos. length measured	68	-	68	
	Nos. aged	-	-	-	
Gadidae	***Enchelyopus cimbrius*/ Fourbeard rockling**				7.7 (1-26)

	No of stations with samples	12	1	13	
	Nos. length measured	22	2	24	
	Nos. aged	4	-	4	
Gadidae	***Gadiculus argenteus*/ Silvery pout**				12.3 (8-16)
	No of stations with samples	15	2	17	
	Nos. length measured	172	3	175	
	Nos. aged	22	-	22	
Gadidae	***Gaidropsarus argentatus*/ Arctic threebearded rockling**				24.4 (11-39)
	No of stations with samples	5	-	5	
	Nos. length measured	10	-	10	
	Nos. aged	4	-	4	
Gadidae	***Gadus morhua*/ Atlantic cod**				17.8 (2-138)
	No of stations with samples	281	267	548	
	Nos. length measured	7981	10254	18235	
	Nos. aged	973	1381	2354	
Gadidae	***Melanogrammus aeglefinus*/ Haddock**				15.3 (2-74)
	No of stations with samples	129	102	231	
	Nos. length measured	2787	4153	6940	
	Nos. aged	520	437	957	
Gadidae	***Merlangius merlangus*/ Whiting**				5.5 (5-6)
	No of stations with samples	1	-	1	
	Nos. length measured	2	-	2	
	Nos. aged	-	-	-	
Gadidae	***Micromesistius poutassou*/ Blue whiting**				20.7 (14-40)
	No of stations with samples	76	5	81	
	Nos. length measured	4253	6	4259	
	Nos. aged	352	-	352	
Gadidae	***Molva molva*/ Ling**				85.1 (71-118)
	No of stations with samples	1	-	1	
	Nos. length measured	19	-	19	
	Nos. aged	-	-	-	
Gadidae	**Phycinae g.sp./ Phycine hakes**				2.0
	No of stations with samples	2	-	2	
	Nos. length measured	3	-	3	
	Nos. aged	-	-	-	
Gadidae	***Pollachius virens*/ Saithe**				44.9 (1-94)
	No of stations with samples	29	4	33	
	Nos. length measured	405	6	411	
	Nos. aged	15	6	21	
Gadidae	***Trisopterus esmarkii*/ Norway pout**				16.2 (2-23)
	No of stations with samples	35	10	45	
	Nos. length measured	454	54	508	
	Nos. aged	71	-	71	
Gasterosteidae	***Gasterosteus aculeatus*/ Threespine stickleback**				5.6 (4-8)
	No of stations with samples	-	22	22	
	Nos. length measured	-	184	184	
	Nos. aged	-	-	-	
Liparidae	***Careproctus* sp./ Snailfish**				9.8 (4-20)
	No of stations with samples	33	-	33	
	Nos. length measured	94	-	94	
	Nos. aged	-	-	-	
Liparidae	***Careproctus micropus*/**				9.0
	No of stations with samples	-	2	2	
	Nos. length measured	-	2	2	
	Nos. aged	-	-	-	
Liparidae	***Careproctus ranula*/ Scotian snailfish**				7.4 (4-9)
	No of stations with samples	-	6	6	
	Nos. length measured	-	7	7	
	Nos. aged	-	-	-	
Liparidae	***Careproctus* cf. *reinhardti*/ Sea tadpole**				10.7 (5-22)
	No of stations with samples	13	25	38	
	Nos. length measured	24	39	62	

	Nos. aged	10	-	10	
Liparidae	***Liparis bathyarcticus*/ Variegated snailfish**				10.2 (1-24)
	No of stations with samples	15	24	39	
	Nos. length measured	54	40	94	
	Nos. aged	-	-	-	
Liparidae	***Liparis fabricii*/ Gelatinous snailfish**				6.3 (1-19)
	No of stations with samples	50	41	91	
	Nos. length measured	774	718	1492	
	Nos. aged	40	-	40	
Liparidae	***Liparis* sp./ Snailfish**				5.0 (3.0-7.0)
	No of stations with samples	2	-	2	
	Nos. length measured	2	-	2	
	Nos. aged	-	-	-	
Liparidae	***Liparis tunicatus*/ Greenland seasnail**				9.5 (9-10)
	No of stations with samples	-	1	1	
	Nos. length measured	-	2	2	
	Nos. aged	-	-	-	
Liparidae	***Paraliparis bathybius*/ Black seasnail**				23.0 (21-24)
	No of stations with samples	4	-	4	
	Nos. length measured	4	-	4	
	Nos. aged	-	-	-	
Liparidae	**Shortfin snailfish aggr.**				7.0 (6-8)
	No of stations with samples	5	-	5	
	Nos. length measured	5	-	5	
	Nos. aged	-	-	-	
Lophiidae	***Lophius piscatorius*/ Anglerfish**				22.3 (10-38)
	No of stations with samples	2	-	2	
	Nos. length measured	3	-	3	
	Nos. aged	2	-	2	
Lotidae	***Brosme brosme*/ Cusk**				30.3 (3-63)
	No of stations with samples	18	2	20	
	Nos. length measured	55	2	57	
	Nos. aged	19	-	19	
Macrouridae	***Macrourus berglax*/ Rough rat-tail**				21.8 (11-32)
	No of stations with samples	5	-	5	
	Nos. length measured	13	-	13	
	Nos. aged	12	-	12	
Myctophidae	***Benthosema glaciale* / Glacier lanternfish**				3.3 (2-8)
	No of stations with samples	28	15	34	
	Nos. length measured	408	60	283	
	Nos. aged	-	-	-	
Myctophidae	***Lampanyctus* sp./**				5.0
	No of stations with samples	1	-	1	
	Nos. length measured	1	-	1	
	Nos. aged	-	-	-	
Myctophidae	***Lampanyctus macdonaldi*/ Rakery beaconlamp**				9.0 (5-13)
	No of stations with samples	4	-	2	
	Nos. length measured	4	-	2	
	Nos. aged	-	-	-	
Myctophidae	**Myctophidae g.sp./ Lanternfishes**				4.5 (2-8)
	No of stations with samples	33	-	45	
	Nos. length measured	549	-	755	
	Nos. aged	-	-	-	
Osmeridae	***Mallotus villosus*/ Capelin**				9.5 (1.5-18.5)
	No of stations with samples	235	250	485	
	Nos. length measured	12623	17729	30352	
	Nos. aged	3028	754	3782	
Osmeridae	***Osmerus dentex*/ Rainbow smelt**				17.2 (10-22)
	No of stations with samples	-	11	11	
	Nos. length measured	-	215	215	
	Nos. aged	-	77	77	
Paralepididae	***Arctozenus risso*/ White barracudina**				24.1 (9-29)
	No of stations with samples	27	-	27	

	Nos. length measured	50	-	50	
	Nos. aged	3	-	3	
Petromyzontidae	***Lethenteron camtschaticum*/ Arctic lamprey**				26.2 (23-30)
	No of stations with samples	-	5	5	
	Nos. length measured	-	12	12	
	Nos. aged	-	-	-	
Petromyzontidae	***Petromyzon marinus*/ Sea lamprey**				68.0
	No of stations with samples	1	-	1	
	Nos. length measured	1	-	1	
	Nos. aged	-	-	-	
Pleuronectidae	***Glyptocephalus cynoglossus*/ Witch flounder**				16.3 (2-44)
	No of stations with samples	3	-	3	
	Nos. length measured	3	-	3	
	Nos. aged	1	-	1	
Pleuronectidae	***Hippoglossus hippoglossus*/ Atlantic halibut**				65.0
	No of stations with samples	1	-	1	
	Nos. length measured	1	-	1	
	Nos. aged	-	-	-	
Pleuronectidae	***Hippoglossoides platessoides*/ Long rough dab**				17.5 (1-51)
	No of stations with samples	192	234	426	
	Nos. length measured	4869	18218	23087	
	Nos. aged	337	402	739	
Pleuronectidae	***Limanda limanda*/ Dab**				15.8 (6-33)
	No of stations with samples	-	18	18	
	Nos. length measured	-	249	249	
	Nos. aged	-	50	50	
Pleuronectidae	***Liopsetta glacialis*/ Arctic flounder**				16.2 (12-29)
	No of stations with samples	-	8	8	
	Nos. length measured	-	55	55	
	Nos. aged	-	22	22	
Pleuronectidae	***Microstomus kitt*/ Lemon sole**				16.4 (1-40)
	No of stations with samples	7	-	7	
	Nos. length measured	28	-	28	
	Nos. aged	10	-	10	
Pleuronectidae	***Pleuronectes platessa*/ European plaice**				38.2 (19-59)
	No of stations with samples	1	29	30	
	Nos. length measured	1	394	395	
	Nos. aged	-	74	74	
Pleuronectidae	***Reinhardtius hippoglossoides*/ Greenland halibut**				19.8 (1-81)
	No of stations with samples	110	47	157	
	Nos. length measured	668	458	1126	
	Nos. aged	290	207	497	
Psychrolutidae	***Cottunculus microps*/ Polar sculpin**				9.8 (2-25)
	No of stations with samples	30	3	33	
	Nos. length measured	50	3	53	
	Nos. aged	9	-	9	
Psychrolutidae	***Cottunculus sadko*/ Sadko sculpin**				10.3 (7-14)
	No of stations with samples	-	2	2	
	Nos. length measured	-	4	4	
	Nos. aged	-	-	-	
Rajidae	***Amblyraja hyperborea*/ Arctic skate**				41.1 (8-76)
	No of stations with samples	12	4	16	
	Nos. length measured	20	6	26	
	Nos. aged	-	-	-	
Rajidae	***Amblyraja radiata*/ Thorny skate**				41.2 (9-62)
	No of stations with samples	70	43	113	
	Nos. length measured	138	139	277	
	Nos. aged	25	-	25	
Rajidae	***Rajella fyllae*/ Round ray**				35.8 (12-52)
	No of stations with samples	7	-	7	
	Nos. length measured	9	-	9	
	Nos. aged	-	-	-	

Salmonidae	***Salmo salar*/ Atlantic salmon**				30.0
	No of stations with samples	-	1	1	
	Nos. length measured	-	1	1	
	Nos. aged	-	-	-	
Scombridae	***Scomber scombrus*/ Atlantic mackerel**				36.7 (28-42)
	No of stations with samples	15	-	15	
	Nos. length measured	61	-	61	
	Nos. aged	40	-	40	
Scorpaenidae	***Sebastes norvegicus*/ Golden redfish**				29.7 (8-59)
	No of stations with samples	26	19	45	
	Nos. length measured	56	55	111	
	Nos. aged	-	-	-	
Scorpaenidae	***Sebastes mentella*/ Deepwater redfish**				22.1 (3-44)
	No of stations with samples	85	60	145	
	Nos. length measured	3089	986	4075	
	Nos. aged	38	67	105	
Scorpaenidae	***Sebastes* sp./ Redfish**				3.7 (1-12)
	No of stations with samples	180	3	183	
	Nos. length measured	3633	3	3636	
	Nos. aged	50	-	50	
Scorpaenidae	***Sebastes viviparus* / Norway redfish**				19.1 (7-31)
	No of stations with samples	19	1	20	
	Nos. length measured	312	1	313	
	Nos. aged	10	-	10	
Squalidae	***Somniosus microcephalus*/ Greenland shark**				317.0 (310-324)
	No of stations with samples	1	1	2	
	Nos. length measured	1	1	2	
	Nos. aged	-	-	-	
Sternoptychidae	***Maurolicus muelleri*/ Pearlside**				4.1 (3-7)
	No of stations with samples	25	17	42	
	Nos. length measured	119	185	304	
	Nos. aged	-	-	-	
Stichaeidae	***Anisarchus medius*/ Stout eelblenny**				4.5 (3-17)
	No of stations with samples	21	17	38	
	Nos. length measured	201	137	338	
	Nos. aged	-	-	-	
Stichaeidae	***Leptoclinus maculatus*/ Daubed shanny**				8.2 (2-21)
	No of stations with samples	123	232	355	
	Nos. length measured	1688	5779	7467	
	Nos. aged	87	-	87	
Stichaeidae	***Leptoclinus* sp., *Lumpenus* sp./**				5.0
	No of stations with samples	1	-	1	
	Nos. length measured	1	-	1	
	Nos. aged	-	-	-	
Stichaeidae	***Lumpenus fabricii*/ Slender eelblenny**				14.6 (9-19)
	No of stations with samples	-	6	6	
	Nos. length measured	-	38	38	
	Nos. aged	-	-	-	
Stichaeidae	***Lumpenus lampretaeformis*/Snake blenny**				7.4 (3-36)
	No of stations with samples	83	62	145	
	Nos. length measured	757	332	1089	
	Nos. aged	33	-	33	
Triglidae	***Eutrigla gurnardus*/ grey gurnard**				37.3 (34-43)
	No of stations with samples	6	-	6	
	Nos. length measured	10	-	10	
	Nos. aged	7	-	7	
Zoarcidae	***Gymnelus retrodorsalis*/ Aurora unernak**				10.1 (6-14)
	No of stations with samples	4	6	10	
	Nos. length measured	8	10	18	
	Nos. aged	2	-	2	
Zoarcidae	***Gymnelus* sp./**				12.0 (11.5-13)
	No of stations with samples	-	2	2	
	Nos. length measured	-	3	3	
	Nos. aged	-	-	-	

Zoarcidae	***Lycenchelys sarsii*/ Sars' wolf eel**				13.0 (9-17)
	No of stations with samples	3	-	3	
	Nos. length measured	4	-	4	
	Nos. aged	-	-	-	
Zoarcidae	***Lycodes adolfi*/ Adolf's eelpout**				8.0
	No of stations with samples	1	-	1	
	Nos. length measured	1	-	1	
	Nos. aged	-		-	
Zoarcidae	***Lycodes esmarkii*/ Esmark's eelpout**				25.6 (7-60)
	No of stations with samples	17	-	17	
	Nos. length measured	66	-	66	
	Nos. aged	5	-	5	
Zoarcidae	***Lycodes eudipleurostictus*/ Doubleline eelpout**				(19.0) 11-35
	No of stations with samples	11	-	11	
	Nos. length measured	42	-	42	
	Nos. aged	-	-	-	
Zoarcidae	***Lycodes gracilis*/ Vahl's eelpout**				17.9 (7-32)
	No of stations with samples	54	16	70	
	Nos. length measured	327	118	446	
	Nos. aged	112	-	150	
Zoarcidae	***Lycodes paamiuti*/ Paamiut eelpout**				14.3 (3-15)
	No of stations with samples	2	-	2	
	Nos. length measured	4	-	4	
	Nos. aged	-	-	-	
Zoarcidae	***Lycodes pallidus*/ Pale eelpout**				12.3 (5-25)
	No of stations with samples	19	38	57	
	Nos. length measured	80	271	351	
	Nos. aged	18	-	18	
Zoarcidae	***Lycodes polaris*/ Canadian eelpout**				16.3 (7-24)
	No of stations with samples	-	9	9	
	Nos. length measured	-	12	12	
	Nos. aged	-	-	-	
Zoarcidae	***Lycodes reticulatus*/ Arctic eelpout**				17.6 (5-49)
	No of stations with samples	14	32	46	
	Nos. length measured	50	84	134	
	Nos. aged	14	-	14	
Zoarcidae	***Lycodes rossi*/ Threespot eelpout**				12.9 (5-28)
	No of stations with samples	29	27	56	
	Nos. length measured	85	107	192	
	Nos. aged	12	-	12	
Zoarcidae	***Lycodes seminudus*/ Halfnaked eelpout**				16.3 (7-45)
	No of stations with samples	4	9	13	
	Nos. length measured	4	21	26	
	Nos. aged	1	-	1	
Zoarcidae	***Lycodes squamiventer*/ Scalebelly eelpout**				14.8 (10-22)
	No of stations with samples	3	-	3	
	Nos. length measured	9	-	9	
	Nos. aged	-	-	-	
Zoarcidae	***Lycodes* sp./ Eelpout**				3.1 (2-8)
	No of stations with samples	2	1	3	
	Nos. length measured	6	1	7	
	Nos. aged	-	-	-	
Zoarcidae	***Lycodonus flagellicauda*/ Clue tail eelspout**				20.0 (16-24)
	No of stations with samples	3	-	3	
	Nos. length measured	3	-	3	
	Nos. aged	-	-	-	

Appendix 3. Invertebrate sampling in ecosystem survey 2015

Prepared by D. Zakharov

Scientific vessels: HH-Helmer Hanssen, VL-Vilnyus, GOS-G.O. Sars, JH-Johan Hjort

Phylum	Class	Order	Family	Species	Author	GOS	HH	JH	VL	Total
Porifera				Porifera g. sp.		11	17	40	45	113
	Calcarea	Calcarea	Sycettidae	*Sycon sp.*				7		7
	Demospongiae	Astrophorida	Geodiidae	*Geodia barretti*	Hentschel, 1929	10	2	1		13
				Geodia macandrewii	Bowerbank, 1858	8		1		9
				Geodia sp.				2	31	33
			Pachastrellidae	*Thenea muricata*	(Bowerbank, 1858)	1	3	22	2	28
				Thenea sp.		19		1		20
			Stellettidae	*Stryphnus ponderosus*	Bowerbank, 1866	6				6
			Tetillidae	*Tetilla cranium*	(O.F. Mueller, 1776)	9	2	2		13
				Tetilla polyura	Schmidt, 1870	10	3	30	2	45
				Tetilla sp.				8		8
		Axinellida	Axinellidae	*Axinella infundibuliformis*	(Linnaeus, 1759)			1		1
				Axinella rugosa	(Bowerbank, 1866)			1		1
				Axinella sp.				6	2	8
				Axinella ventilabrum	(Johnston, 1842)	1		3		4
				Axinellidae g. sp.		8	6	9		23
				Phakellia sp.		3	2	4	1	10
		Dyctioceratida	Spongiidae	*Spongionella carteri*	(Burton, 1930)			3		3
		Hadromerida	Polymastiidae	*Polymastia sp.*		3	4	9	9	25
				Polymastia thielei	Koltun, 1964			2		2
				Polymastia uberrima	(Schmidt, 1870)	3			5	8
				Polymastiidae g. sp.			1	1	1	3
				Quasillina brevis	(Bowerbank, 1861)			2		2
				Radiella grimaldi	(Topsent, 1913)	9		34	25	68
				Radiella hemisphaericum	(Sars, 1872)	11		7		18

Phylum	Class	Order	Family	Species	Author	GOS	HH	JH	VL	Total
				Sphaerotylus aff. borealis	(Swarchevsky, 1906)		2			2
				Sphaerotylus sp.				1		1
				Tentorium semisuberites	(Schmidt, 1870)	6	7	15	2	30
			Stylocordylidae	*Stylocordyla borealis*	(Loven, 1866)	3	1	3	2	9
			Suberitidae	*Homaxinella sp.*				1		1
				Suberites ficus	(Johnston, 1842)		1	27	13	41
				Suberites sp.					4	4
			Tethyidae	*Tethya citrina*	Sarà & Melone, 1965	1	1	2	1	5
				Tethya norvegica	Bowerbank, 1872	5	1	2		8
				Tethya sp.				4		4
		Halichondriida	Halichondriidae	*Halichondria sp.*				5		5
		Haplosclerida	Haliclonidae	*Gellius arcoferus*				4		4
				Haliclona sp.			3	2	2	7
				Haliclona urceolis	(Rathke & Vahl, 1800)			1		1
				Haliclona ventilabrum	(Fristedt, 1887)			1		1
		Poecilosclerida	Cladorhizidae	*Asbestopluma sp.*		3		2		5
				Chondrocladia gigantea	(Hansen, 1885)			1		1
				Cladoriza sp.			9	2		11
			Hamacanthidae	*Hamacantha sp.*				3		3
			Hymedesmiidae	*Hymedesmia sp.*		1				1
			Mycalidae	*Mycale lingua*	(Bowerbank, 1866)	5		5		10
				Mycale sp.				10		10
			Myxillidae	*Forcepia sp.*				5		5
				Forcepia thielei	Lundbeck, 1905			1		1
				Myxilla incrustans	(Johnston, 1842)				2	2
				Myxilla sp.				1	1	2
		Polymastiida	Polymastiidae	*Quasillina sp.*				1		1
	Hexactinellida	Hexactinosida	Euretidae	*Chonelasma sp.*				1		1

Phylum	Class	Order	Family	Species	Author	GOS	HH	JH	VL	Total
		Hexasterophora	Rossellidae	*Trichasterina bispiculigastra*	Rezwoj		3	7		10
		Lyssacinosida	Rossellidae	*Asconema sp.*				2		2
Cnidaria				Cnidaria g. sp.					2	2
	Anthozoa	Actiniaria		Actiniaria g. sp.		2	3	7	12	24
			Actiniidae	*Actinia equina*	(L., 1758)			28		28
				Bolocera tuediae	(Johnston, 1832)	12		1	5	18
				Urticina felina	(L., 1767)		2	15	1	18
				Urticina sp.					1	1
			Actinostolidae	*Actinostola callosa*	(Verrill, 1882)	1		13		14
				Actinostola sp.		2	3			5
				Anthosactis janmayeni	Danielssen, 1890			4		4
				Stomphia coccinea	(O.F. Mueller, 1776)	1		12	2	15
			Edwardsiidae	*Edwardsia arctica*	Carlgren, 1921			1		1
				Edwardsia finmarchica	Carlgren, 1921			1		1
				Edwardsiidae g. sp.		1				1
			Hormathiidae	*Hormathia digitata*	(O.F. Mueller, 1776)	22	7	71	65	165
				Hormathia digitata m. nodosa	Fabricius, 1780				1	1
				Hormathia digitata m. parasitica	Danielssen, 1890		2		23	25
				Hormathia sp.					4	4
			Liponematidae	*Liponema multicornis*	(Verrill, 1879)	11	1	11	6	29
			Metridiidae	*Metridium senile*	(L., 1767)			2		2
			Sagartiidae	Sagartiidae g. sp.			1			1
		Alcyonacea		Alcyonacea g. sp.					2	2
			Clavulariidae	*Clavularia arctica*	(M. Sars, 1860)		1	2		3
			Isididae	*Isidella lofotensis*	Sars, 1868		3			3
			Nephteidae	*Drifa glomerata*	(Verrill, 1869)	1	2	20	39	62
				Duva florida	(Rathke, 1806)			30	47	77

Phylum	Class	Order	Family	Species	Author	GOS	HH	JH	VL	Total
				Gersemia fruticosa	(M. Sars, 1860)		4	62		66
				Gersemia rubiformis	(Ehrenberg, 1834)	3	3	48	15	69
				Gersemia sp.					5	5
				Nephtheidae g. sp.			6	1		7
		Cerianthida	Cerianthidae	Cerianthidae g. sp.				1		1
				Cerianthus sp.				1		1
		Pennatulacea	Umbellulidae	*Umbellula encrinus*	(L., 1758)	2	7			9
		Scleractinia		Scleractinia g. sp.			1			1
			Flabellidae	*Flabellum (Ulocyathus) deludens*	Marenzeller, 1904			1		1
		Scleractinida	Caryophyllidae	*Caryophyllia smithii*	Stokes and Broderip, 1828	4				4
		Zoanthacea	Epizoanthidae	Epizoanthidae g. sp.				7	1	8
				Epizoanthus incrustatus	(Dueben & Koren, 1847)	1		1		2
				Epizoanthus sp.		10	1	9	2	22
		Zoantharia	Zoanthidae	Zoanthidae g. sp.				1		1
	Hydrozoa			Hydroidea g. sp.					3	3
				Hydrozoa g. sp.			1	3	31	35
		Anthoathecata	Corynidae	*Sarsia sp.*				2		2
		Athecata	Corynidae	*Sarsia princeps*	(Haeckel, 1879)			1		1
			Eudendriidae	Eudendriidae g. sp.					2	2
				Eudendrium capillare	Alder, 1856			3		3
			Tubulariidae	*Tubularia indivisa*	L., 1758	1				1
		Leptothecata	Plumulariidae	*Plumularia sp.*				1		1
			Sertulariidae	*Thuiaria ochotensis*	(Mereschkowsky, 1878)			1		1
		Thecaphora	Campanulariidae	*Campanularia volubilis*	(L., 1758)			12		12
				Campanulariidae g. sp.			1		1	2
				Gonothyraea loveni	(Allman, 1859)			2		2
				Obelia geniculata	(L., 1758)			1		1

Phylum	Class	Order	Family	Species	Author	GOS	HH	JH	VL	Total
				Obelia longissima	(Pallas, 1766)			13		13
				Orthopyxis integra	(McGillivray, 1842)			4		4
				Rhizocaulus verticillatus	(L., 1758)			8		8
			Campanulinidae	*Calycella syringa*	(L., 1767)			6		6
				Lafoeina maxima	Levinsen, 1893			9		9
			Haleciidae	Haleciidae g. sp.			2	2	1	5
				Halecium beanii	(Johnston, 1838)			4		4
				Halecium curvicaule	Lorenz, 1886			2		2
				Halecium marsupiale	Bergh, 1887			1		1
				Halecium muricatum	(Ellis & Solander, 1786)	1		14		15
				Halecium sp.		1		4		5
				Halecium tenellum	Hincks, 1861			1		1
			Lafoeidae	*Filellum serpens*	(Hassal, 1848)			5		5
				Grammaria abietina	(M. Sars, 1850)			7		7
				Grammaria immersa	Nutting, 1901			1		1
				Lafoea dumosa	(Fleming, 1828)			44		44
				Lafoea sp.		5	1			6
				Lafoeidae g. sp.			3		1	4
			Laodiceidae	*Ptychogena lactea*	A. Agassiz, 1865		2	10		12
				Staurophora mertensii	Brandt, 1835			1		1
			Mitrocomidae	*Halopsis ocellata*	A. Agassiz, 1863			1		1
			Sertulariidae	*Abietinaria abietina*	(L., 1758)			30		30
				Hydrallmania falcata	(L., 1758)			9		9
				Sertularella gigantea	Mereschkowsky, 1878			5		5
				Sertularella rugosa	(L., 1758)			1		1
				Sertularella sp.		2				2
				Sertularia mirabilis	(Verrill, 1873)			3		3
				Sertularia plumosa	(Clark, 1876)			1		1

Phylum	Class	Order	Family	Species	Author	GOS	HH	JH	VL	Total
				Sertularia tenera	G.O. Sars, 1874			4		4
				Sertulariidae g. sp.		1	1			2
				Symplectoscyphus tricuspidatus	(Alder, 1856)			14		14
				Thuiaria arctica	(Bonnevie, 1899)			2		2
				Thuiaria articulata	(Pallas, 1766)			3		3
				Thuiaria breitfussi	(Kudelin, 1914)			1		1
				Thuiaria carica	Levinsen, 1893			1		1
				Thuiaria obsoleta	(Lepechin, 1781)			9		9
				Thuiaria thuja	(L., 1758)	2		2	2	6
			Tiarannidae	*Modeeria plicatile*	(M. Sars, 1863)			14		14
		Trachylida	Rhopalonematidae	*Aglantha digitale*	(O. F. Mueller, 1776)				1	1
	Scyphozoa	Stauromedusae	Eleutherocarpidae	*Lucernaria quadricornis*	O. F. Mueller, 1776			1		1
				Lucernaria walteri	Antipa, 1891			1		1
Annelida	Polychaeta			Polychaeta g. sp.				19		19
		Amphinomida	Euphrosinidae	*Euphrosine borealis*	Oersted, 1843	4	2	17		23
		Capitellida	Maldanidae	*Asychis biceps*	(M. Sars, 1861)		1			1
				Maldane sarsi	Malmgren, 1867		1			1
				Maldanidae g. sp.		1		18	2	21
		Chaetopterida	Chaetopteridae	*Spiochaetopterus typicus*	M. Sars, 1856			50	49	99
		Eunicida	Eunicidae	Eunicidae g. sp.				5		5
			Onuphidae	*Nothria hyperborea*	(Hansen, 1878)	3				3
				Nothria sp.				43	5	48
				Onuphidae g. sp.				5		5
		Flabelligerida	Flabelligeridae	*Brada granulosa*	Hansen, 1880		2	39		41
				Brada inhabilis	(Rathke, 1843)	15		65	29	109
				Brada sp.					1	1
				Brada villosa	(Rathke, 1843)			6		6

Phylum	Class	Order	Family	Species	Author	GOS	HH	JH	VL	Total
				Flabelligeridae g. sp.				11	1	12
				Pherusa plumosa	(O.F. Mueller, 1776)			11		11
		Opheliida	Opheliidae	*Ophelia sp.*				1		1
				Opheliidae g. sp.				2		2
			Scalibregmidae	*Polyphysia crassa*	(Oersted, 1843)	1				1
				Scalibregmidae g. sp.				1	1	2
		Oweniida	Oweniidae	Oweniidae g. sp.				2	3	5
		Phyllodocida	Aphroditidae	*Aphrodita aculeata*	L., 1761	2				2
				Aphroditidae g. sp.					1	1
				Laetmonice filicornis	Kinberg, 1855	5				5
			Glyceridae	*Glycera sp.*		1				1
			Nephtyidae	*Aglaophamus malmgreni*	(Théel, 1879)		1			1
				Nephtyidae g. sp.				46	14	60
				Nephtys paradoxa	Malmgren, 1874		2			2
				Nephtys sp.		2				2
			Nereididae	*Nereis pelagica*	L., 1761	1				1
				Nereis sp.		2				2
			Phyllodocidae	Phyllodocidae g. sp.				9	10	19
			Polynoidae	*Bylgides groenlandicus*	(Malmgren, 1867)		2			2
				Eucranta villosa	(Malmgren, 1865)		2			2
				Eunoe globifera	(G. Sars, 1872)		3			3
				Eunoe nodosa	(M. Sars, 1861)	1				1
				Harmothoe aspera	(Hansen, 1878)				1	1
				Harmothoe sp.					29	29
				Lagisca rarispina	(M. Sars, 1861)		1			1
				Polynoidae g. sp.		17		81	17	115
			Syllidae	Eusyllinae g. sp.					2	2
		Sabellida	Sabellidae	*Chone duneri*	Malmgren, 1867		1			1

Phylum	Class	Order	Family	Species	Author	GOS	HH	JH	VL	Total
				Potamilla neglecta	(M. Sars, 1851)		1			1
				Sabellidae g. sp.		4		18	4	26
			Serpulidae	Serpulidae g. sp.			1	6		7
		Terebellida	Ampharetidae	*Ampharete finmarchica*	(M. Sars, 1866)		2			2
				Ampharete sp.				1		1
				Ampharetidae g. sp.				23		23
			Flabelligeridae	*Brada incrustata*	Stoep-Bowitz, 1948	6				6
			Pectinariidae	*Pectinaria hyperborea*	(Malmgren, 1865)	1		14		15
				Pectinaria sp.					1	1
				Pectinariidae g. sp.				12		12
			Terebellidae	*Pista maculata*	(Dalyell, 1853)			5		5
				Terebellidae g. sp.				28	10	38
				Terebellinae g. sp.					1	1
Sipuncula	Sipunculidea			Sipunculidea g. sp.					2	2
		Golfin giiformes	Golfingiidae	*Golfingia elongata*	(Keferstein, 1863)			1		1
				Golfingia margaritacea margaritacea	(M. Sars, 1851)			3		3
				Golfingia sp.					6	6
				Golfingia vulgaris vulgaris	(Blainville, 1827)			1		1
			Phascolionidae	*Phascolion sp.*			5		2	7
				Phascolion strombus strombus	(Montagu, 1804)	5		50	1	56
Cephalorhyncha	Priapulida	Priapulomorpha	Priapulidae	*Priapulopsis bicaudatus*	(Koren & Danielssen, 1868)	1		6		7
				Priapulus caudatus	Lamarck, 1816			7		7
				Priapulus sp.					1	1
Echiura	Echiurida	Echiuroinea	Bonelliidae	*Hamingia arctica*	Danielssen & Koren, 1881	11		14	13	38
Nemertini	Nemertini			Nemertini g. sp.		1		43	5	49
Arthropoda		Scalpelliformes	Scalpellidae	*Scalpellum scalpellum*	(Linnaeus, 1767)			2		2

Phylum	Class	Order	Family	Species	Author	GOS	HH	JH	VL	Total
	Cirripedia	Thoracica	Balanomorpha	*Balanus balanus*	(L., 1758)			12		12
				Balanus crenatus	Bruguiere, 1789	1				1
				Balanus sp.					34	34
			Scalpellidae	*Ornatoscalpellum stroemii*	(M. Sars, 1859)		1			1
	Malacostraca	Amphipoda		Amphipoda g. sp.				7	10	17
			Acanthonotozomatidae	*Acanthonotozoma cristatum*	(Ross, 1835)			1		1
				Acanthonotozoma sp.				1		1
			Amathillopsidae	*Amathillopsis spinigera*	Heller, 1875		2	1		3
			Ampeliscidae	*Ampelisca eschrichti*	Kroeyer, 1842	1		3	1	5
				Ampelisca sp.				5	1	6
				Byblis gaimardi	(Kroeyer, 1846)			2		2
				Haploops setosa	Boeck, 1871			1	1	2
				Haploops sp.				1	1	2
			Atylidae	*Atylus smittii*	(Goes, 1866)			1		1
			Calliopiidae	*Cleippides quadricuspis*	Heller, 1875		4		1	5
			Corophiidae	*Neochela monstrosa*	(Boesk, 1861)	1		3		4
			Epimeriidae	*Epimeria loricata*	G.O. Sars, 1879	21	11	38	7	77
				Epimeriidae g. sp.				1		1
				Paramphithoe hystrix	(Ross, 1835)	1	1	36	3	41
			Eusiridae	*Eusirus holmi*	Hansen, 1887	1	13			14
				Rhachotropis aculeata	(Lepechin, 1780)		5	28	5	38
			Gammaridae	Gammaridae g. sp.				1	5	6
				Gammarus wilkitzkii	Birula, 1897				2	2
			Lysianassidae	*Anonyx nugax*	(Phipps, 1774)	1		1		2
				Anonyx sp.		7	17	40	35	99
				Lysianassidae g. sp.				1		1
				Onisimus sp.				1		1
			Oedicerotidae	*Acanthostepheia malmgreni*	(Goes, 1866)			18	21	39

Phylum	Class	Order	Family	Species	Author	GOS	HH	JH	VL	Total
				Arrhis phyllonyx	(M. Sars, 1858)	1	2	11		14
				Oediceros sp.				1		1
				Oedicerotidae g. sp.				2		2
				Paroediceros lynceus	(M. Sars, 1858)			1		1
			Photidae	*Goesia depressa*	(Goes, 1866)			1		1
			Stegocephalidae	*Phippsiella similis*	(G.O. Sars, 1891)		1	1	2	4
				Stegocephalidae g. sp.			1	2	2	5
				Stegocephalopsis ampulla	(Phipps, 1774)		1			1
				Stegocephalus inflatus	Kroeyer, 1842	2	8	40	13	63
				Stegocephalus sp.			1	2		3
			Stenothoidae	*Metopa sp.*				25		25
		Cumacea		Cumacea g. sp.				13	1	14
			Diastylidae	*Diastylis sp.*			1			1
		Decapoda		Decapoda g. sp.					1	1
				Natantia g. sp.				1		1
			Crangonidae	*Pontophilus norvegicus*	M. Sars, 1861	29	8	13		50
				Sabinea sarsi	Smith, 1879	5	3	2	5	15
				Sabinea septemcarinata	(Sabine, 1821)	2	6	75	142	225
				Sclerocrangon boreas	(Phipps, 1774)		2	7	16	25
				Sclerocrangon ferox	(G.O. Sars, 1821)		8	31	42	81
				Sclerocrangon sp.					1	1
			Galatheidae	*Galathea strigosa*	(Linnaeus, 1761)	1				1
			Geryonidae	*Geryon trispinosus*	(Herbst, 1803)			1		1
			Hippolytidae	*Eualus gaimardi*	(Milne-Edwards, 1837)			12	10	22
				Eualus pusiolus	(Kroeyer, 1841)				1	1
				Hippolytidae g. sp.			1			1
				Lebbeus polaris	(Sabine, 1821)	12	10	44	21	87
				Spirontocaris lilljeborgii	(Danielssen, 1859)	5		1		6

Phylum	Class	Order	Family	Species	Author	GOS	HH	JH	VL	Total
				Spirontocaris phippsii	(Kroeyer, 1841)			1		1
				Spirontocaris sp.			2		9	11
				Spirontocaris spinus	(Sowerby, 1802)	2		34	11	47
			Lithodidae	*Lithodes maja*	(L., 1758)	6		1	1	8
				Paralithodes camtschaticus	(Tilesius, 1815)			3	11	14
			Majidae	*Chionoecetes opilio*	(Fabricius, 1788)			7	82	89
				Hyas araneus	(L., 1758)		4	25	45	74
				Hyas coarctatus	Leash, 1815	14		10	1	25
			Munididae	*Munida bamffica*	(Pennant, 1777)	12		10		22
			Paguridae	*Pagurus bernhardus*	(L., 1758)		1	1	6	8
				Pagurus pubescens	(Kroeyer, 1838)	17	5	36	47	105
			Pandalidae	*Atlantopandalus propinqvus*	(G.O. Sars, 1870)	10	4	4	4	22
				Dichelopandalus bonnieri	Caullery, 1896			1		1
				Pandalina sp.					1	1
				Pandalus borealis	Kroeyer, 1837	23	16	82	124	245
				Pandalus montagui	Leach, 1814		3		2	5
		Isopoda	Aegidae	*Aega psora*	L., 1758	5				5
				Aega sp.		4		5		9
				Rocinela danmoniensis	Leach, 1818	2				2
			Cirolanidae	*Natatolana borealis*	(Lilljeborg, 1851)	1				1
			Idotheidae	*Saduria sabini*	(Kroeyer, 1849)	4		22	12	38
				Saduria sibirica	(Birula, 1896)				1	1
			Leptanthuridae	Leptanthuridae g. sp.				4		4
			Paranthuridae	*Calathura brachiata*	(Stimpson, 1854)			11	1	12
		Mysidacea	Boreomysidae	*Boreomysis arctica*	(Kroeyer, 1861)		4			4
			Mysidae	Mysidacea g. sp.					2	2
	Pycnogonida	Pantopoda		Pycnogonida g. sp.					30	30
			Callipallenidae	*Pseudopallene brevicolis*	G.O. Sars, 1891	1		1		2

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				Pseudopallene malleolata	(G.O. Sars, 1879)			5		5
			Colossendeidae	*Colossendeis angusta*	G.O. Sars, 1877	1		3	1	5
				Colossendeis proboscidea	(Sabine, 1824)		1	5	2	8
				Colossendeis sp.					1	1
			Nymphonidae	*Boreonymphon abyssorum*	(Norman, 1873)	2	1	1	11	15
				Boreonymphon ossiansarsi	Knaben, 1972	6		33		39
				Boreonymphon robustum	(Bell, 1855)			10		10
				Nymphon elegans	Hansen, 1887	1		13		14
				Nymphon grossipes	(Fabricius, 1780)			7		7
				Nymphon hirtipes	Bell, 1853	4		57	10	71
				Nymphon hirtum	(Fabricius, 1780)		1	10		11
				Nymphon leptocheles	G.O. Sars, 1888			1		1
				Nymphon longimanum	Sars, 1888			4		4
				Nymphon longitarse	Kroeyer, 1845			4		4
				Nymphon macronyx	G.O. Sars, 1877			4		4
				Nymphon micronyx	Sars, 1888			2		2
				Nymphon mixtum	Kroeyer, 1844-45	2				2
				Nymphon schimkewitschi	Losina-Losinsky, 1929			1		1
				Nymphon serratum	G.O. Sars, 1879		1	6		7
				Nymphon sluiteri	Hoek, 1881			2		2
				Nymphon sp.			1	3		4
				Nymphon spinosum	(Goodsir, 1842)		4		2	6
				Nymphon stroemi stroemi	Kroeyer, 1845	7	3	52	9	71
				Nymphonidae g. sp.					1	1
			Pycnogonidae	*Pycnogonum litorale*	(Strom, 1762)	3		1		4
Mollusca				Mollusca g. sp.					22	22
	Bivalvia			Bivalvia g. sp.					4	4
		Anomalodesmata	Cuspidariidae	*Cuspidaria arctica*	(M. Sars, 1859)	1				1

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				Cuspidaria glacialis	(G.O. Sars, 1878)			31	1	32
			Thraciidae	*Thracia myopsis*	Moeller, 1842			1		1
				Thracia septentrionalis	Jeffreys, 1872			1		1
				Thracia sp.				1		1
		Arcoida	Arcidae	*Bathyarca glacialis*	(Gray, 1824)	18	1	40	7	66
				Bathyarca pectunculoides	(Scacchi, 1835)			4		4
				Bathyarca sp.					1	1
			Limopsidae	*Limopsis cristata*	Jeffreys, 1876			1		1
		Carditoida	Astartidae	*Astarte acuticostata*	(Friele, 1877)			3		3
				Astarte borealis	(Schumacher, 1817)	4		2		6
				Astarte crebricostata	McAndrews & Forbes, 1847	2				2
				Astarte crenata	(Gray, 1842)	19		69	10	98
				Astarte elliptica	(Brown, 1827)			2		2
				Astarte montagui	(Dillwyn, 1817)			2		2
				Astarte sp.		1		1	8	10
				Astarte sulcata	(Da Costa, 1778)			2		2
		Euheterodonta	Hiatellidae	*Hiatella arctica*	(Linnaeus, 1767)	2	1	27	18	48
				Panomya norvegica	(Spengler, 1793)			5		5
		Limoida	Limidae	*Limatula gwyni*	(Sykes, 1903)			1		1
		Myoida	Myidae	*Mya truncata*	Linnaeus, 1758			3		3
		Mytiloida	Mytilidae	*Modiolula phaseolina*	(Philippi, 1844)			2		2
				Modiolus modiolus	(Linnaeus, 1758)				1	1
				Musculus discors	(Linnaeus, 1767)			1		1
				Musculus glacialis	(Leche, 1883)			1		1
				Musculus laevigatus	(J.E. Gray, 1824)			2		2
				Musculus niger	(J.E. Gray, 1824)			5		5
				Musculus sp.				1	1	2

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				Mytilus edulis	Linnaeus, 1758				1	1
		Nuculanoida	Nuculanidae	*Nuculana pernula*	(O.F. Müller, 1779)			4	2	6
			Yoldiidae	*Yoldia hyperborea*	(Gould, 1841)		1	5		6
				Yoldiella intermedia	(M. Sars, 1865)			3	1	4
				Yoldiella lenticula	(Moeller, 1842)			1		1
				Yoldiella lucida	(Loven, 1846)			1		1
		Nuculida	Nuculidae	*Ennucula tenuis*	(Montagu, 1808)			1		1
		Pectinoida	Anomiidae	*Heteranomia squamula*	(Linnaeus, 1767)			2		2
				Monia patelliformis	(Linnaeus, 1761)			1		1
			Pectinidae	*Chlamys islandica*	(O.F. Mueller, 1776)	3	9	35	55	102
				Chlamys sp.					2	2
				Delectopecten vitreus	(Gmelin, 1791)	1		1		2
				Palliolum tigerinum	(O.F. Müller, 1776)			1		1
				Pseudamussium peslutrae	(Linnaeus, 1771)	5		6		11
				Pseudamussium sulcatum	(O.F. Mueller, 1776)			3		3
			Propeamussiidae	*Cyclopecten hoskynsi*	(Forbes, 1844)			1	1	2
				Similipecten greenlandicus	(G. B. Sowerby II, 1842)	5		37	34	76
		Veneroida	Cardiidae	*Ciliatocardium ciliatum*	(Fabricius, 1780)	2		40	34	76
				Serripes groenlandicus	(Mohr, 1786)				11	11
			Tellinidae	*Macoma calcarea*	(Gmelin, 1791)			6	5	11
				Macoma moesta	(Dashayes, 1855)			1		1
				Macoma sp.					1	1
	Caudofoveata			Caudofoveata g. sp.			1	1		2
	Cephalopoda			Cephalopoda g. sp.				1		1
		Octopoda	Bathypolypodinae	Bathypolypodinae g. sp.				5		5
				Bathypolypus arcticus	(Prosch, 1849)		8	5	5	18
				Bathypolypus bairdii	(Verrill, 1873)	9		1		10
				Bathypolypus sp.				2		2

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			Cirroteuthidae	*Cirroteuthis muelleri*	Eschricht, 1836	1	5			6
		Sepiida	Sepiolidae	*Rossia moelleri*	Steenstrup, 1856			5	1	6
				Rossia palpebrosa	Owen, 1834	5		14	11	30
				Rossia sp.		1		13	5	19
	Gastropoda			Gastropoda g. sp.		1	1	1	10	13
		Bucciniformes	Beringiidae	*Beringius ossiani*	(Friele, 1879)	6			2	8
				Beringius turtoni	(Bean, 1834)			4		4
			Buccinidae	Buccinidae g. sp.				20		20
				Buccinum angulosum	Gray, 1839				4	4
				Buccinum belcheri	Reeve, 1855			13		13
				Buccinum ciliatum ciliatum	(Fabricius, 1780)			4		4
				Buccinum ciliatum sericatum	Hancock, 1846	1				1
				Buccinum cyaneum	Bruguiere, 1789-1792			4		4
				Buccinum elatior	(Middendorff, 1849)			16	20	36
				Buccinum finmarchianum	Verkruezen, 1875		1	5		6
				Buccinum fragile	Verkruezen in G.O. Sars, 1878	4		25	5	34
				Buccinum glaciale	L., 1761			5	4	9
				Buccinum hydrophanum	Hancock, 1846	2	4	33	9	48
				Buccinum micropoma	Jensen in Thorson, 1944			6		6
				Buccinum nivale	Friele, 1882			1		1
				Buccinum polare	Gray, 1839			2	2	4
				Buccinum sp.		1		4	3	8
				Buccinum undatum	L., 1758			2		2
				Colus altus	(S. Wood, 1848)			11	2	13
				Colus holboelli	(Moeller,1842)	5		4		9
				Colus islandicus	(Mohr, 1786)	5	1	38	7	51
				Colus kroyeri	(Moeller,1842)			2	2	4

Phylum	Class	Order	Family	Species	Author	GOS	HH	JH	VL	Total
				Colus pubescens	(Verrill, 1882)			6		6
				Colus sabini	(Gray, 1824)	10	3	24	31	68
				Colus sp.		3		2	5	10
				Colus turgidulus	(Jeffreys, 1877)			7	2	9
				Eggs Buccinidae g. sp.					6	6
				Neptunea communis	(Middendorff, 1901)				1	1
				Neptunea denselirata	Brogger, 1901		1	7	10	18
				Neptunea despecta	(L., 1758)	11		13	16	40
				Neptunea sp.				4		4
				Pyrulofusus deformis	(Reeve, 1847)			1	1	2
				Turrisipho dalli	(Friele in Tryon, 1881)	6				6
				Turrisipho lachesis	(Moerch, 1869)	4	1	15	4	24
				Turrisipho sp.		1			2	3
				Turrisipho voeringi	Bouchet et Waren, 1985			2		2
				Volutopsis norvegicus	(Gmelin, 1790)	3		13	4	20
			Muricidae	*Boreotrophon clathratus*	(L., 1767)			2		2
				Boreotrophon sp.		1				1
		Cephalaspidea	Diaphanidae	*Diaphana sp.*					1	1
			Philinidae	*Philine finmarchica*	G.O. Sars, 1878			50		50
				Philinidae g. sp.		4			8	12
			Scaphandridae	*Cylichna alba*	(Brown, 1827)			1		1
				Scaphander punctostriatus	(Mighels & Adams, 1842)	1		6	4	11
				Scaphander sp.					7	7
		Cerithiiformes	Naticidae	*Bulbus smithi*	Brown, 1839			10	1	11
				Cryptonatica affinis	(Gmelin, 1791)	11	1	25	11	48
				Lunatia pallida	(Broderip & Sowerby, 1829)			32	8	40
				Naticidae g. sp.		1		1		2

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			Turritellidae	*Tachyrhynchus reticulatus*	(Mighels & Adams, 1842)			2		2
			Velutinidae	*Limneria undata*	(Brown, 1838)		1	2	2	5
				Onchidiopsis glacialis	(M. Sars, 1851)			1		1
				Piliscus commodus	(Middendorff, 1851)			7		7
				Velutina sp.				13	1	14
				Velutina velutina	(Mueller, 1776)			2		2
				Velutinidae g. sp.				2		2
		Coniformes	Admetidae	*Admete viridula*	(Fabricius, 1780)			1		1
			Turridae	*Curtitoma sp.*				1		1
				Oenopota sp.				2		2
				Oenopotinae g. sp.				1		1
		Epitoniiformes	Epitoniidae	*Boreoscala groenlandica*	(Moeller, 1842)	2		3		5
		Littorinimorpha	Capulidae	Capulidae g. sp.				3		3
		Nudibranchia		Doridacea g. sp.		8				8
				Nudibranchia g. sp.			1	26	2	29
			Aeolidiidae	*Aeolidia sp.*		1				1
			Dendronotidae	*Dendronotus frondosus*	(Ascanius, 1774)	2		9		11
				Dendronotus sp.		1		7	10	18
			Doridoxidae	*Doridoxa sp.*				1		1
			Onchidoridiae	Onchidoridae g. sp.					2	2
			Polyceridae	*Colga villosa*	(Odhner, 1907)			12		12
		Patelliformes	Lepetidae	*Lepeta coeca*	(O.F. Mueller, 1776)			4		4
			Tecturidae	*Capulacmaea radiata*	(M. Sars, 1851)	1			1	2
		Pleurotomariiformes	Fissurellidae	*Puncturella sp.*				1		1
		Sacoglossa	Limapontiidae	*Limapontia sp.*			2			2
		Trochiformes	Trochidae	*Margarites costalis*	(Gould, 1841)			5		5
				Margarites groenlandicus	(Gmelin, 1790)			15	2	17
				Margarites sp.		1	1		3	5

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				Solariella obscura	(Couthouy, 1838)			8		8
	Polyplacophora			Polyplacophora g. sp.				5		5
		Lepidopleurida	Hanleyidae	*Hanleya nagelfar*	(Bean, 1844)	1				1
				Hanleya sp.		3				3
	Solenogastres			Solenogastres g. sp.			1	3		4
		Cavibelonia	Proneomeniidae	*Proneomenia sp.*		1				1
			Simrothiellidae	*Kruppomenia sp.*				3		3
		Neomeniamorpha	Neomeniidae	Neomeniidae g. sp.				2		2
Echinodermata	Asteroidea			Asteroidea g. sp.				4	4	8
		Forcipulatidae	Asteriidae	*Asterias rubens*	L., 1758			4	11	15
				Icasterias panopla	(Stuxberg, 1879)		1	51	20	72
				Leptasterias af. groenlandica	(Steenstrup, 1857)				1	1
				Leptasterias groenlandica	(Steenstrup, 1857)			3		3
				Leptasterias muelleri	(M. Sars, 1846)			3	1	4
				Leptasterias sp.		1		8	20	29
				Stephanasterias albula	(Stimpson, 1853)		1	1		2
				Stichastrella rosea	(O.F. Mueller, 1776)			3		3
				Urasterias linckii	(Mueller & Troschel, 1842)	1		46	55	102
		Notomyotida	Benthopectinidae	*Pontaster tenuispinus*	(Dueben & Koren, 1846)	25	2	64	36	127
		Paxillosida	Astropectinidae	*Bathybiaster vexillifer*	(W. Thomson, 1873)		3		2	5
				Leptychaster arcticus	(M. Sars, 1851)	15	2	8		25
			Ctenodiscidae	*Ctenodiscus crispatus*	(Retzius, 1805)	22	8	76	137	243
		Spinulosida	Echinasteridae	*Henricia sp.*		24	5	53	15	97
		Valvatida	Goniasteridae	*Ceramaster granularis granularis*	(Retzius, 1783)	10	1	6		17
				Hippasteria phrygiana phrygiana	(Parelius, 1768)	7	1	5	40	53
				Pseudarchaster parelii	(Dueben & Koren, 1846)	3		1		4
			Poraniidae	*Poraniomorpha hispida*	(Sars, 1872)	8		5		13

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				Poraniomorpha tumida	(Stuxberg, 1878)	3		21	6	30
		Velatida	Korethrasteridae	*Korethraster hispidus*	W. Thomson, 1873	1				1
			Pterasteridae	*Hymenaster pellucidus*	W. Thomson, 1873	6	5	18	4	33
				Pteraster militaris	(O.F. Mueller, 1776)	8	3	28	9	48
				Pteraster obscurus	(Perrier, 1891)	2	3	4		9
				Pteraster pulvillus	M. Sars, 1861	10	7	17	3	37
				Pteraster sp.				1	5	6
			Solasteridae	*Crossaster papposus*	(L., 1768)	7	7	30	32	76
				Crossaster sp.					2	2
				Crossaster squamatus	(Doederlein, 1900)	5				5
				Lophaster furcifer	(Dueben & Koren, 1846)	1	1	18	1	21
				Solaster endeca	(L., 1771)			16	14	30
				Solaster glacialis	(Danielssen & Koren, 1881)			2		2
				Solaster sp.		2		7	6	15
				Solaster syrtensis	Verrill, 1894	1		3	3	7
	Crinoidea	Comatulida	Antedonidae	*Heliometra glacialis*	(Owen, 1833 ex Leach MS)		4	29	45	78
	Echinoidea			Echinoidea g. sp.		1				1
		Echinoida	Echinidae	*Echinus acutus*	Lamarck, 1816			2		2
				Echinus esculentus	L., 1758			2		2
				Echinus sp.		4				4
			Strongylocentrotidae	*Strongylocentrotus droebachiensis*	O.F. Mueller, 1776		3	3	80	86
				Strongylocentrotus pallidus	(G.O. Sars, 1871)	13	5	59		77
				Strongylocentrotus sp.		1	3	4	3	11
		Spatangoida	Spatangidae	*Brisaster fragilis*	(Dueben & Koren, 1846)	15		1	3	19
				Spatangus purpureus	(O.F. Mueller, 1776)			4		4
				Spatangus sp.				1		1
	Holothuroidea			Holothuroidea g. sp.				3	4	7

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		Apodida	Myriotrochidae	*Myriotrochus rinkii*	Steenstrup, 1851	4		43		47
		Aspidochirotida	Stichopodidae	*Parastichopus tremulus*	(Gunnerus, 1767)	7		5		12
		Dendrochirotida	Cucumariidae	*Cucumaria frondosa*	(Gunnerus, 1867)			3	10	13
				Thyonidium drummondi	(Thompson, 1840)			3	3	6
			Phyllophoridae	*Pentamera calcigera*	(Stimpson, 1851)				2	2
			Psolidae	*Psolus phantapus*	Strussenfelt, 1765			9	13	22
				Psolus sp.			1	4	13	18
				Psolus squamatus	(O.F. Muller, 1776)			1		1
		Molpadiida	Caudinidae	*Eupyrgus scaber*	Luetken, 1857		1	4		5
			Molpadiidae	*Molpadia arctica*	von Marenzeller, 1878				2	2
				Molpadia borealis	(M. Sars, 1859)	15	3	44	58	120
				Molpadiidae g. sp.					2	2
	Ophiuroidea			Ophiuroidea g. sp.					4	4
		Euryalida	Gorgonocephalidae	*Gorgonocephalus arcticus*	(Leach, 1819)		2	14	49	65
				Gorgonocephalus eucnemis	(Mueller & Troschel, 1842)		6	8	31	45
				Gorgonocephalus lamarcki	(Mueller & Troschel, 1842)	1		5		6
				Gorgonocephalus sp.			1	2	21	24
		Ophiurida	Amphiuridae	*Amphiura sp.*				1		1
				Amphiura sundevalli	(Mueller & Troschel, 1842)			1		1
			Ophiacanthidae	*Ophiacantha anomala*	G.O. Sars, 1872	1				1
				Ophiacantha bidentata	(Retzius, 1805)	5	6	65	32	108
			Ophiactidae	*Ophiactis balli*	(W. Thompson, 1840)	1				1
				Ophiopholis aculeata	(L., 1767)	12	14	76	21	123
			Ophiomyxidae	*Ophioscolex glacialis*	Mueller & Troschel, 1842	8	3	55	46	112
			Ophiotrichidae	*Ophiothrix fragilis*	(Abildgaard, in O.F. Müller, 1789)	1				1
			Ophiuridae	*Ophiocten sericeum*	(Forbes, 1852)	6		34	1	41
				Ophiopleura borealis	Danielssen & Koren, 1877		1	15	44	60

Phylum	Class	Order	Family	Species	Author	GOS	HH	JH	VL	Total
				Ophiura affinis	Luetken, 1858	1				1
				Ophiura albida	Forbes, 1841			5	4	9
				Ophiura ophiura	(Linnaeus, 1758)			3		3
				Ophiura robusta	(Ayers, 1851)			3	53	56
				Ophiura sarsi	Luetken, 1855	17	8	70	29	124
				Ophiura sp.				1	11	12
Brachiopoda				Brachiopoda g. sp.					4	4
	Craniata	Craniida	Craniidae	*Novocrania anomala*	(Mueller, 1776)			1		1
	Rhynchonellata	Rhynchonellida	Hemithyrididae	*Hemithyris psittacea*	(Gmelin, 1790)	1		14	4	19
		Terebratulida	Cancellothyrididae	*Terebratulina retusa*	(L., 1758)	12				12
				Terebratulina sp.			5	7	1	13
			Dallinidae	*Dallina septigera*	(Lovén, 1846)	1				1
			Macandreviidae	*Macandrevia cranium*	(Mueller, 1776)	7	1	13		21
Bryozoa	Gymnolaemata			*Bryozoa g. sp.*		1	1	6	16	24
		Cheilostomida		Cheilostomida g. sp.				7		7
			Bicellariidae	Bicellariidae g. sp.				1		1
				Bugula sp.					1	1
			Bugulidae	*Dendrobeania sp.*				8	3	11
			Candidae	*Scrupocellaria sp.*				4		4
			Celleporidae	*Cellepora sp.*		3		9		12
				Celleporina sp.				5	1	6
			Eucrateidae	*Eucratea sp.*			1			1
			Flustridae	*Flustra sp.*				1		1
				Flustridae g. sp.			1	11		12
				Securiflustra securifrons	(Pallas, 1766)			16	12	28
			Microporidae	*Microporina articulata*	(Fabricius, 1821)			1		1
			Myriaporidae	*Myriapora sp.*			3	23	2	28
			Phidoloporidae	*Reteporella beaniana*	(King, 1846)			1		1

Phylum	Class	Order	Family	Species	Author	GOS	HH	JH	VL	Total
				Reteporella sp.				9		9
			Reteporidae	*Retepora beaniana*	(King, 1846)	5				5
				Retepora sp.		2	4	8		14
				Sertella septentrionalis	Jullen, 1933		1			1
			Schizoporellidae	*Myriozoella sp.*			1			1
			Scrupariidae	*Eucratea loricata*	(L., 1758)			28	5	33
			Scrupocellariidae	*Tricellaria sp.*				3		3
				Tricellaria ternata	(Ellis & Solander, 1786)			2		2
			Smittinidae	*Cystisella saccata*	Busk, 1856			5	4	9
				Parasmittina jeffreysii	(Norman, 1903)	2				2
				Porella sp.			1	10		11
				Pseudoflustra solida	(Stimpson, 1854)			19		19
				Pseudoflustra sp.				1		1
				Smittinidae g. sp.				3		3
		Ctenostomata	Alcyonidiidae	*Alcyonidium proboscideum*	(Kluge, 1962)				2	2
				Alcyonidium disciforme	Smitt, 1872			4	3	7
				Alcyonidium gelatinosum	(L., 1767)		2	41	1	44
				Alcyonidium sp.				10	2	12
		Cyclostomata	Corymboporidae	*Defrancia lucernaria*	(M. Sars, 1851)		2	1		3
			Diastoporidae	*Diplosolen intricarius*	(Smitt, 1872)	4	1	10		15
			Horneridae	*Hornera sp.*					2	2
				Stegohornera lichenoides	(L., 1758)	7	6	23	3	39
	Stenolaemata	Cyclostomatida	Crisiidae	*Crisia sp.*				2		2
Chordata	Ascidiacea			Ascidiacea g. sp.		1	2	13	20	36
		Aplousobranchia	Didemnidae	Didemnidae g. sp.				2		2
				Didemnum albidum	(Verrill, 1871)	5		12		17
				Didemnum sp.				2		2
			Polycitoridae	*Eudistoma vitreum*	(Sars, 1851)		2	20		22

Phylum	Class	Order	Family	Species	Author	GOS	HH	JH	VL	Total
				Polycitoridae g. sp.				1		1
			Polyclinidae	*Synoicum sp.*				4		4
				Synoicum turgens	Phipps, 1774	1		1		2
		Phlebobranchia	Ascidiidae	*Ascidia prunum*	(Mueller, 1776)	18		31		49
				Ascidia sp.				3	8	11
				Ascidia virginea				2		2
			Cionidae	*Ciona intestinalis*	(L., 1767)	3		2	2	7
				Ciona sp.					1	1
		Stolidobranchia	Molgulidae	*Eugyra pedunculata*	Traustedt, 1886			1		1
				Molgula sp.			1	1		2
			Pyuridae	*Boltenia echinata*	(L., 1767)			1		1
				Halocynthia pyriformis	(Rathke, 1806)			1	1	2
				Microcosmus glacialis	(M. Sars, 1859)			1		1
				Microcosmus sp.				1		1
			Styelidae	*Botryllus schlosseri*	(Pallas, 1776)			1		1
				Cnemidocarpa rhizopus	(Redikorzev, 1907)			2		2
				Dendrodoa aggregata	(Rathke, 1806)			5		5
				Dendrodoa sp.		1		1		2
				Kukenthalia borealis	(Gottschaldt, 1894)	6	2	18		26
				Polycarpa fibrosa	(Stimpson, 1852)			1		1
				Styela coriacea	(Alder & Hancock, 1848)			1		1
				Styela rustica	(L., 1767)			4		4
				Styela sp.		1		3		4

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