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REPORT

Scientific report from the Norwegian and Russian Barents Sea ecosystem surveys in August-October 2024 (BESS)

2. edition

Edited by
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Polar branch of the FSBSI “VINRO” (“PINRO”)

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Summary (English):

The aim of the national Norwegian/Russian ecosystem surveys in the Barents Sea and adjacent waters, August-October (BESS) is to monitor the status and changes in the Barents Sea ecosystem and provide data to support scientific research and manager advice. The survey has since 2004 been conducted annually in the autumn, as a collaboration between the Institute of Marine Research (IMR) in Norway and the Polar branch of the VNIRO (PINRO) in Russia. The general surveys plan and tasks were agreed upon at the annual IMR-VNIRO/PINRO Meeting 12-14 March 2024. Ship routes and other technical details are agreed on by correspondence between the survey coordinators. BESS aims at covering the entire Barents Sea. Each party carries out research in its own sector of the sea but uses the same methodology.

T*his is the 2. ediition of this report, with inclusion of Marine Environment, added sub-chapters in Plankton Communities and more information on Fish Recruitment.*

Ecosystem stations are distributed in a 35×35 nautical mile regular grid, and the ship tracks follow this design. In the area around Svalbard/Spitsbergen, some additional bottom trawl hauls for demersal fish survey indices estimation. Additional pelagic trawls were done in the main capelin distribution areas for identification of acoustic records. The research carried out from 17.08-12.10 by the Russian R/V “Vilnyus” and Norwegian R/Vs Kronprins Haakon” G.O. Sars” and Johan Hjort”.

This report summarising results of the observations that are available at the time of publication. Further data will be published later in the next reports. From 2026, the report series will be named «**IMR/Polar Branch of VINRO Joint Report Series**».

Content

1 - Background

Author(s): Dmitry Prozorkevich (VNIRO-PINRO), Elena Eriksen and Stine Karlson (IMR)

The aim of the Barents Sea ecosystem survey (BESS) in August-October is to monitor the status and changes of in the Barents Sea ecosystem. The survey has since 2004 been conducted annually, as collaboration between the IMR in Norway and the Polar Branch of VNIRO (PINRO) in Russia. The general survey plan, tasks, and sailings routes are usually agreed at the annual PINRO-IMR Scientist Meeting in March, but in 2024, due to external factors making physical meetings between Norwegian and Russian researchers difficult, they were agreed by correspondence. The 21th BESS was carried out during the period from 17-th August to 12th October 2024. by the Norwegian research vessels ("Kronprins Haakon", "G.O. Sars" and "Johan Hjort") and the Russian vessels ("Vilnyus"). The scientists and technicians taking part in the survey onboard the research vessels are listed in Table 1. As always, we would like to express our sincere gratitude to all the crew and scientific personnel onboard research vessels for their dedicated work. We also will express our sincere gratitude to all the people involved in planning and reporting of BESS 2024. This is the first part of the survey report summarising status for the environment and the living Barents Sea based on the survey data. The information obtained in BESS 2024 will be further used for the assessment of fish and invertebrate stocks, the evaluation of changes in environmental conditions and biota, and the implementation of various international and national projects.

Table 1. *Vessels and participants (with main expertise) in the Barents Sea Ecosystem Survey 2024.*

Research vessel	Participants
”Vilnyus” (17.08–07.10)	Kudryashova Alexandra (Cruise leader, Benthos), Alexander Pronyuk (Pelagic, Demersal fish), Alexey Rolsky (Pelagic, Demersal fish), Yury Kalashnikov (Pelagic, Demersal fish), Daniil Marshalkovsky (Pelagic, Demersal fish), Kristina Rolskya (Plankton, Benthos), Nina Moiseeva (Plankton, benthos, Pelagic fish), Maksim Gubanishchev (Hydrologist), Alexey Kanischev (Hydrologist), Sergey Harlin (Instrumentation), Denis Okatov (Instrumentation), Marina Kalashnikova (Parasitologist), Roman Klepikovskiy (Sea birds and mammals observer)
"Kronprins Haakon" (22.09-12.10)	Elena Eriksen (Cruise leader), Mette Strand (Benthos), Silje Seim (Demersal fish), Åse Husebø (Demersal fish), Eilert Hermansen (Pelagic fish), Erling Boge (Pelagic fish), Jon Rønning (Plankton), Felicia Keulder-Stenevik (Benthos), Hildegunn Mjanger (Demersal fish), Lisbet Solbakken (Demersal fish), Claudia Erber (Marine mammals observer), Frode Holen (Marine mammals observer), Asgeir Steinsland (Instrument chef), Leif Johan Ohnstad (Instrumentation), Eli Gustad (Plankton), Jacob Max Christensen (Scientist guest, UiT), Nicolas Straube (Scientist guest, University museum).

Research vessel	**Participants**
”G.O. Sars” (19.08–16.09)	Part 1 (19.08-02.09) Rupert Wienerroither Cruise leader), Heidi Gabrielsen (Benthos), Else Holm (Demersal fish), Erlend Lindau Langhelle (Demersal fish), Tommy Gorm-Hansen Tøsdal (Pelagic fish), Frøydis Tousgaard Rist (Pelagic fish), Jon Rønning (Plankton), Andrey Voronkov (Benthos), Irene Huse (Demersal fish), Celina Eriksson Bjånes (Demersal fish), Thomas André Sivertsen (Marine mammals observer), Lars Kleivane (Marine mammals observer), Egil Frøyen (Instrumentation), Frank Storebø (Instrumentation), Hege Skaar (Plankton), Edel Erdal (Environmental chemist), Guri Nesje (Environmental chemist), Alex Rosa Casla (student/guest). Part 2 (02.09-16.9) Irene Huse (Cruise leader), Heidi Gabrielsen (Benthos), Andrey Voronkov (Benthos), Else Holm (Demersal fish), Anne Sæverud (Demersal fish), Thomas André Sivertsen (Marine mammal observer), Anna Tiu Kristina Simila (Marine mammal observer), Martin Dahl (Instrument chef), William Skjold (Instrumentation), Marianne Petersen (Plankton), Audun Hjertager (Demersal fish), Grethe Beate Thorsheim (Demersal fish), Susanne Tonheim (Pelagic fish), Stine Karlson (Pelagic fish), Jane Strømstad Møgster (Plankton), Tanja Kogel (Environmental chemist), Anders Fuglevik (Environmental chemist), Alex Rosa Casla (student/guest).
”Johan Hjort” (25.08-30.09)	Part 1 (25.08-11.09) Knut Korsbrekke (Cruise leader), Alexander Plotkin (Benthos), Vidar Fauskanger (Demersal fish), Silje Seim (Demersal fish), Sigmund Grønnevik (Demersal fish), Magne Olsen (Demersal fish), Rune Strømme (Instrumentation), Fredrik Gelin (Instrumentation), Erling Boge (Pelagic fish), Vilde Regine Bjørdal (Pelagic fish), Eli Gustad (Plankton), Hilde Arnesen (Plankton), Penny Lee Liebig (Benthos), George McCallum (Marine Mammal observer), Anthony Mayer (Marine Mammal observer), Hilde Elise Heldal (Environmental chemist), Grethe Tveit (Environmental chemist), Aslak Roaldkvam Skåra (Norwegian Radiation and Nuclear Safety Authority/guest). Part 2 (11.09-30.09) Georg Skaret (Cruise leader), Ragni Olssøn (Benthos), Frederike Boehm (Marine Mammal observer), Anne Kari Sveistrup (Benthos), Sofie Gundersen (Demersal fish), Vidar Fauskanger (Demersal fish), Halvard Aas Midtun (Demersal fish), Rune Strømme (Instrumentation), Fredrik Gelin (Instrumentation), Timo Meissner (Pelagic fish), Frøydis Tousgaard Rist (Pelagic fish), Tommy Gorm-Hansen Tøsdal (Pelagic Fish), Monica Martinussen (Plankton), Linda Fonnes Lunde (Plankton), Yasmin Hunt (Marine Mammal observer).

2 - Survey Execution

Author(s): Dmitry Prozorkevich (VNIRO-PINRO) and Elena Eriksen (IMR)

Figures by: S. Karlson and E. Bagøien

BESS aims to cover the entire ice-free area of the Barents Sea and, from south to north. The ecosystem stations are distributed on a regular 35×35 nautical mile regular grid except for the slope around Svalbard/Spitsbergen, with additional bottom trawl hauls for demersal fish indices estimation and additional acoustic transects east for Svalbard/Spitsbergen for the capelin stock size estimation. The planned vessel tracks for BESS 2024 are given in fig. 2.1.

BESS 2024 was largely implemented according to the plan. The realized tracks of the research vessels with the sampling taken are shown in Figs. 2.2 and 2.3. The execution of BESS 2024 did not reveal any major changes or irregularities. A relatively large part of the Russian EEZ to the west of the Novaya Zemlya was closed for fishing at the request of the Russian Ministry of Defence, so survey area along the archipelago coast was not fully covered (Fig. 2.2). The restricted navigation area along Novaya Zemlya leads to a gap in information on fish and invertebrates, primarily cod, polar cod and snow crab. The Norwegian vessel 'Johan Hjort' suffered technical problems and had to end the cruise a week early. In order to cover the capelin area, “Kronprins Haakon” changed plans and went into the capelin area, working northwards and then covering the north and west of Svalbard/Spitsbergen. Due to fishing restrictions on the Russian shelf, some of the coverage of Loophole has been shared between Russian and Norwegian vessels. Bad weather throughout the survey slowed down the progress of the survey. The Russian vessel was given five extra vessel-days compared to original plan. However, a strong and lasting storm in the end of September prevented the survey and the north and north-eastern parts of the sea was not surveyed as in previous years (Figs. 2.2 and 2.3). Still, BESS 2024 was largely conducted according to the planned coverage, except small area west of Svalbard/Spitsbergen and west of Novaya Zemlya. The planned schedule for BESS 2024 was 149 days (99NOR+55RUS), while the effective vessel days (time be-tween first and last sample in the vessel logs) was 135 days (82NOR+53RUS). The difference between the two is as expected, as vessels need time for sailing to and from the harbor and preparation before sampling and bad weather. The temporal and spatial progression during the survey was good (Fig. 2.4). Note that in reports from earlier years, only the planned schedule is reported.

The ecosystem survey in 2024 was similar to previous years, covering most ecosystem components. In addition, the standard oceanographic sections "Vardø-Nord" and "Hinlopen" with lower effort (due to weather conditions and technical problems) were taken by the Norwegian vessels and the “Kola” (twice) and Kanin sections were taken by the Russian vessel (Fig. 2.3). During the BESS, in total 320 pelagic hauls, 317 demersal hauls, 393 CDT and 393 plankton nets were taken.

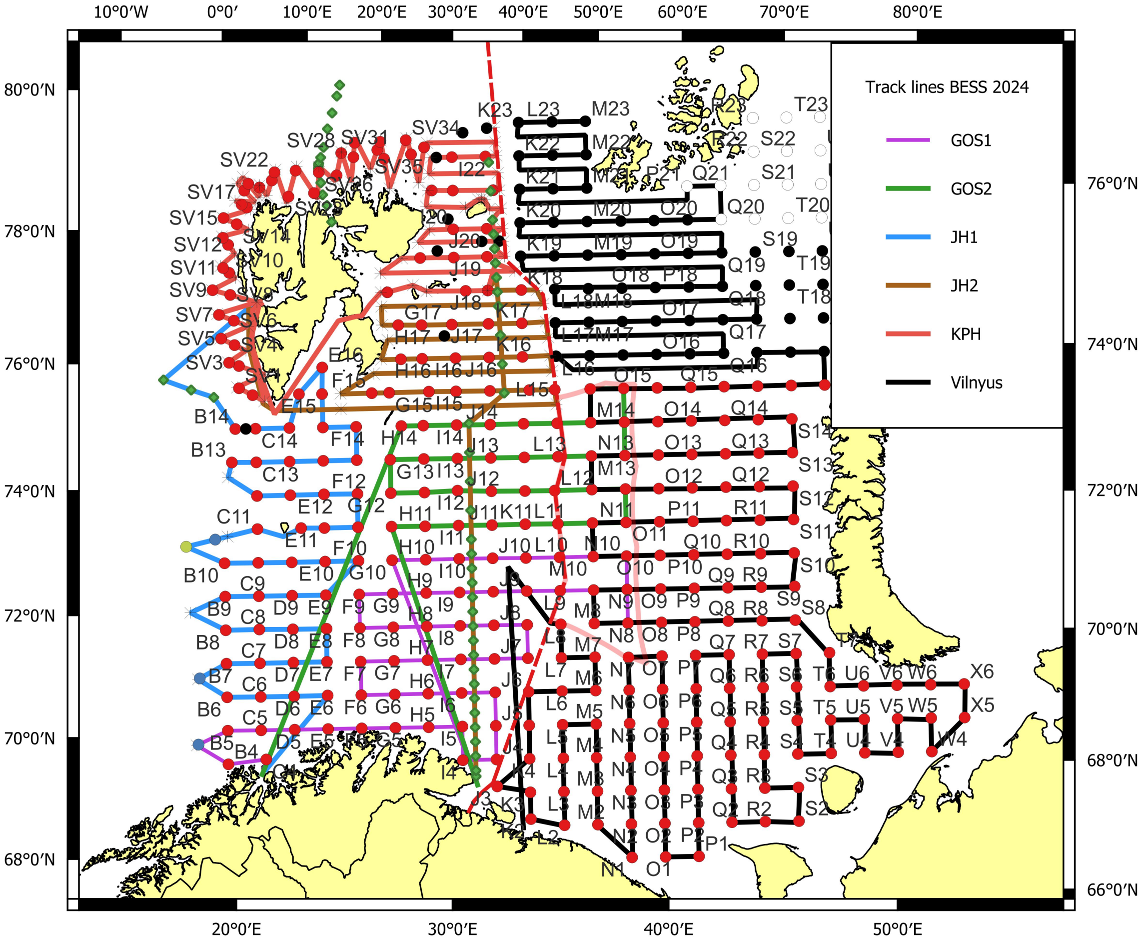

Figure 2.1. *BESS 2024 planned survey map with ecosystem stations and vessel tracks.*

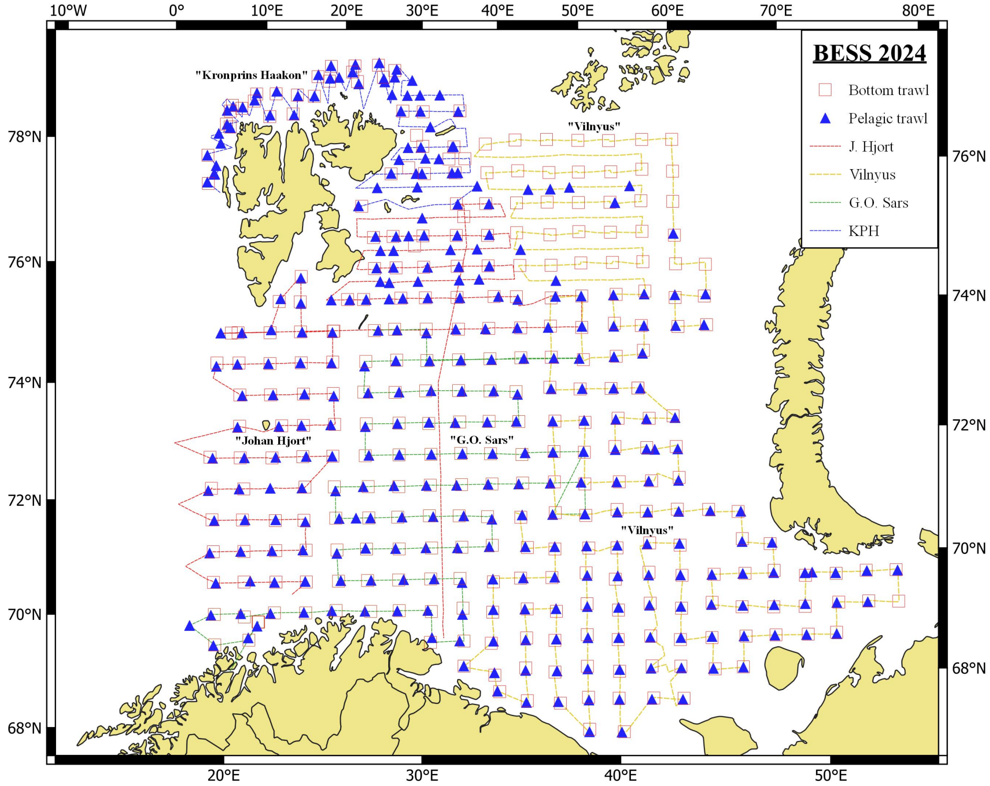

Figure 2.2 *BESS 2024, realized vessel tracks with pelagic and bottom trawl sampling stations, note that some trawl stations are taken in addition to the regular ecosystem stations.*

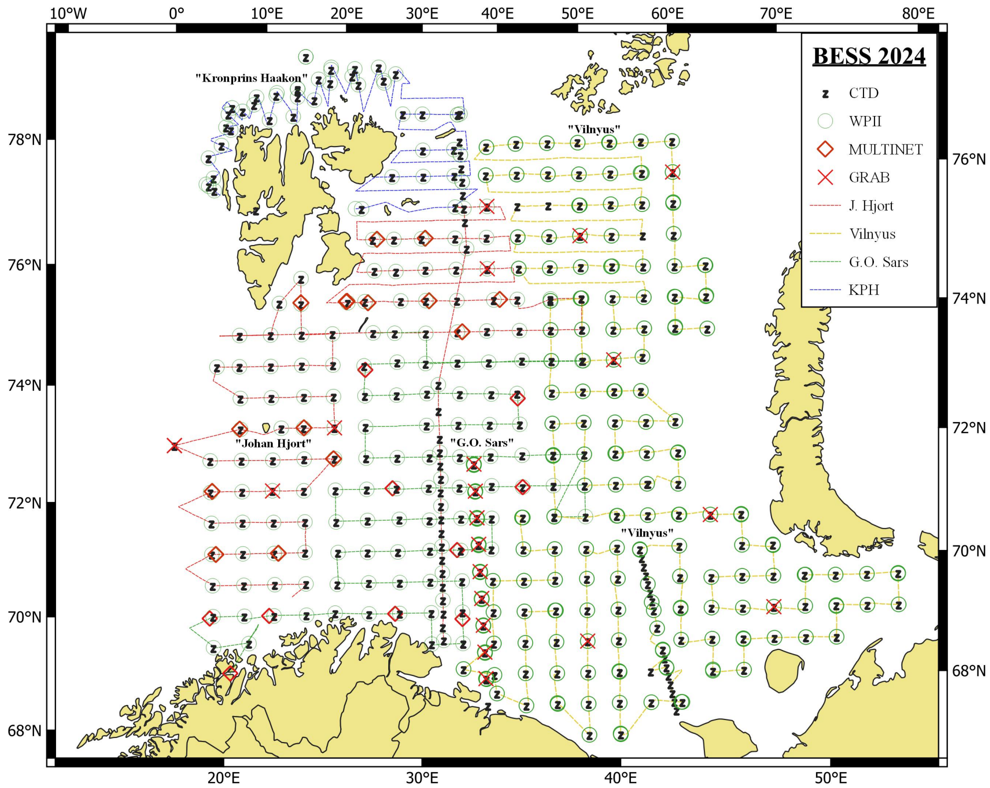

Figure 2.3 *BESS 2024 realized vessel tracks with hydrography, plankton and other samples at ecosystem stations.*

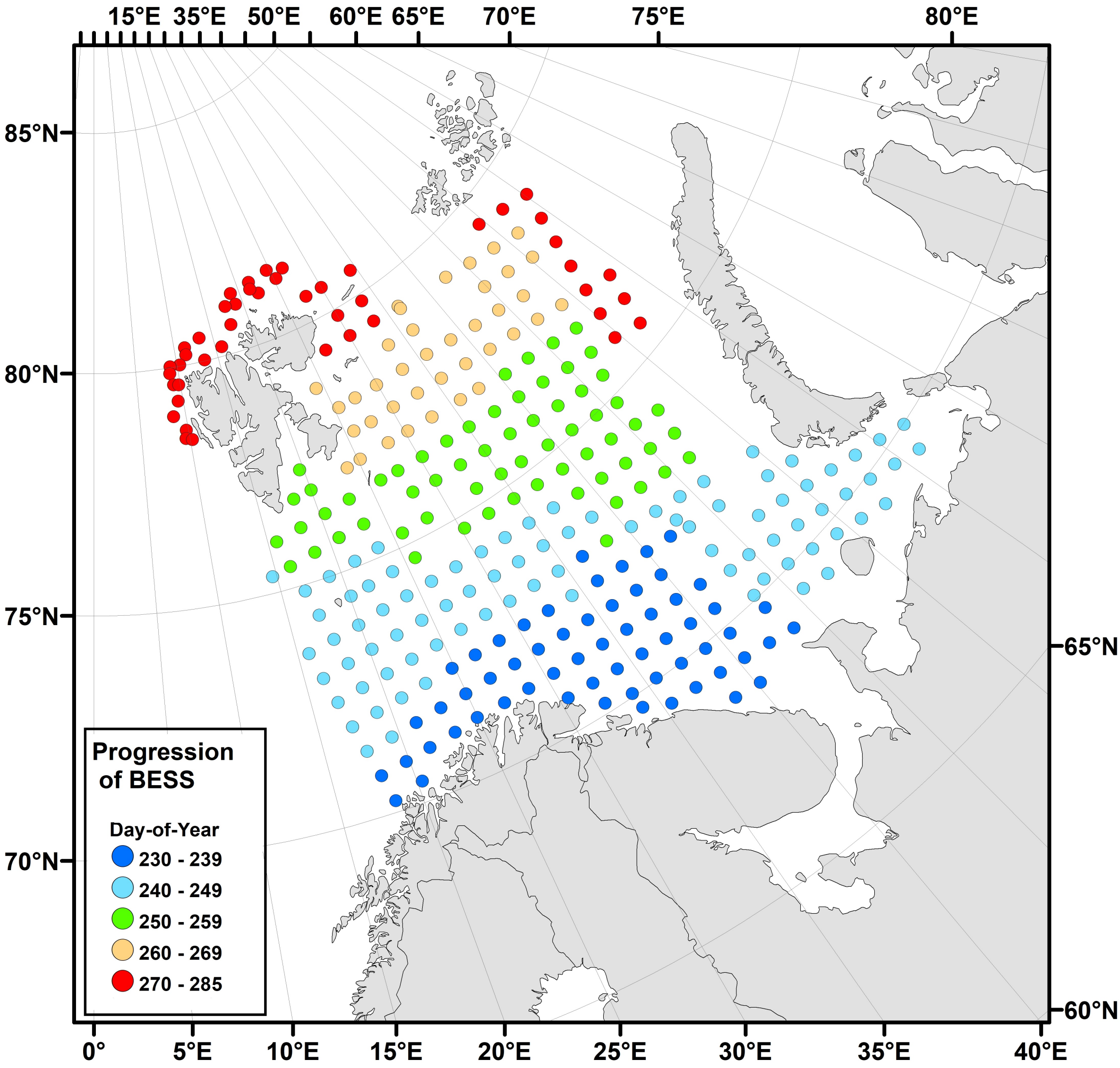

__Figure 2.4__ Progression of BESS 2024 in space and time. Points represent samples taken at ecosystem stations during the survey. The point's colour indicates the number of Julian days between the first and last day of the survey. The colours scale from blue (early in the survey) to red (late in the survey).

2.1 Sampling methods

In 2024, compared to 2023, there were no changes in sampling gear. Manta trawl was included as standard equipment for monitoring microplastics at BESS in 2022 and was also used in 2024. Fifty samples were collected on Russian vessel and 34 on board Norwegian vessels. A new length stratified individual sampling of haddock was introduced in 2022, increasing samples from one to two fish taken per 5 cm group. This was continued in 2024.

Plankton stations were carried out within the entire survey water area with sampling in the bottom-0 m layer. On the Kola hydrological section, plankton sampling collected separate for the layers: bottom-0 m, 100-0 m and 50-0 m.

The survey sampling manuals can be obtained by contacting the survey coordinators.

These manuals include methodological and technical descriptions of equipment, the trawling and capture procedures by the sampling tools, sampling and registration of the catch in the lab, and the methods that are used for calculating the abundance and biomass of the biota.

2.2.1 Special investigations

BESS is a useful platform for conducting additional studies in the Barents Sea. These studies can be testing of new methodology, sampling of data additional to the standard monitoring, or sampling of other types of data. It is imperative that the special investigations do not influence the standard monitoring activities at the survey. The special investigations vary from year to year, and below is a list of special investigation conducted on Russian and Norwegian vessels at BESS 2024, with contact persons. This chapter also briefly mentions some investigations that are typical during survey but not described in the main text of the BESS Report.

2.2.1.1 Annual monitoring of pollution levels

In 2024 PINRO continued the annual monitoring of pollution levels in the Barents Sea in accordance with a national program. Samples of seawater, sediments, fish and invertebrates was collected and analysed for persistent organic pollutants (POPs, e.g. PCBs, DDTs, HCHs, HCB) and heavy metals (e.g. lead, cadmium, mercury) and arsenic. The samples were collected at RV "Vilnyus" during BESS in different parts of the Barents Sea. The results from chemical analyses are available in the annual PINRO report “Status of biological resources…”.

Contact: Andrey Zhilin, PINRO (zhilin@pinro.vniro.ru)

2.2.1.2 Collection of samples for biochemical studies

Frozen samples of commercial and non-commercial fish and invertebrates were collected for biochemical studies (ratio of body parts, chemical composition of nutrients, molecular weight of muscle proteins, amino acids and lipid fractions composition) in accordance with a research program. Samples were frozen at a temperature -18°C immediately after catching before rigor mortis.

Contact: Kira Rysakova, PINRO (rysakova@pinro.vniro.ru)

2.2.1.3 Fish pathology research

PINRO undertakes yearly investigations of fish diseases in the Barents Sea (mainly in REEZ). Seven commercially important fish species (total 10 thousand ind.) were studied. Red king crabs (83 ind.) and snow crabs (total 197 ind.) were examined also for define “shell disease of crustaceans”. The main purpose of the pathology research is annual estimation of epizootic state of commercial fish and crabs species. The observations are entered into a database on pathology. This investigation was started by PINRO in 1999.

Results are available in the annual PINRO report “Status of biological resources…”

Contact: Irina Mukhina, PINRO (imukhina@pinro.vniro.ru)

2.2.1.4 Parasitological study

In 2023, observations of the infestation of commercial fish species with helminths that are hazardous to human health continued on board the RV Vilnyus. Cod, haddock, polar cod, capelin, Atlantic herring place and LRD were examined in order to identify hazardous parasites. The results will be published later in PINRO annual report. Moreover, parasite larvae *Pseudoterranova* sp. from different areas of the Barents Sea were collected and fixed for further genetic studies.

Contact: Irina Mukhina, PINRO (imukhina@pinro.vniro.ru)

2.2.1.5 Plankton and fish calorie content investigation

In August and October, hydrochemical observations were made onboard RV “Vilnyus” in the Kola section. Dissolved oxygen in the surface and bottom layers as well as biochemical oxygen demand during 5 days in the bottom layer were measured.

Contact: Igor Manushyn, PINRO (manushyn@pinro.vniro.ru)

2.2.1.6 Hydrochemical observations

In August and October, hydrochemical observations were made onboard RV “Vilnyus” in the Kola section. Dissolved oxygen in the surface and bottom layers as well as biochemical oxygen demand during 5 days in the bottom layer were measured.

Contact: Alexander Trofimov, PINRO (trofimov@pinro.vniro.ru)

2.2.1.7 Fish diet study

Since 2004, investigations of diet of most abundant pelagic and demersal fish have been conducted annually during the BESS. In 2024 survey, onboard of Russian vessels stom-achs of polar cod (225), capelin (125), Atlantic herring (225) cod (269), haddock (152), Greenland halibut (87) and skates (14) were collected and fixed for detail analysis. In addition, 15 kg of small non-commercial fish were frozen whole. Express quantitative analysis onboard RV “Vilnyus” during the cruise include of 3213 stomachs of 16 fish species. Of these, 849 cod stomachs were analyzed.
Onboard of Norwegian vessels 1020 stomachs of cod were collected and frozen for detailed analysis. In addition, samples were collected and frozen for capelin, polar cod and Atlantic herring.

Contact: Andrey Dolgov, PINRO (dolgov@pinro.vniro.ru), *Irina Prokopchuk, PINRO* (irene_pr@pinro.vniro.ru), *Bjarte Bogstad, IMR* (bjarte.bogstad@hi.no)

3 - Data Management

Author(s): Dmitry Prozorkevich (VNIRO-PINRO) and Elena Eriksen (IMR)

3.1 Data Bases

A wide variety of data are collected during the ecosystem surveys. All data collected during the BESS are quality controlled and verified by experts: oceanography by Randi B. Ingvaldsen (IMR) and Aleksandr Trofimov (PINRO) fish catch data by Herdis Langøy Mørk (IMR) and Tatyana Prokhorova (PINRO) during and after the survey; plankton data by Jon Rønning and Espen Bagøien (IMR) and Irina Prokopchuk (PINRO); benthos data by Anne Kari Sveistrup (IMR) and Nataliya Strelkova (PINRO); and marine mammals data by Frederike Boehm (IMR) and Roman Klepikovskiy (PINRO). The data are stored in IMR and PINRO national databases, with different formats. However, the data is exchanged so that both sides have access to each other's data and use equal joint data.

3.2 Data Application

The BESS aimed to cover the whole Barents Sea ecosystem geographically and provide survey data for commercial fish and shellfish stock estimation. Stock estimation is particularly important for capelin, because capelin TAC is based on the survey result, and the Norwegian-Russian Fishery Commission determines TAC immediately after the survey. In addition, a broad spectrum of physical variables, ecosystem components and pollution are monitored and reported. The survey data will be used by each party for various purposes within the framework of national and international programs.

This survey report is based on joint data and contains the main results of the monitoring. The survey report will be published in the IMR/PINRO Joint Report series. Missing chapters will be published in the 2025 BESS survey report.

From 2026, the BESS report will be published in a report series named «**IMR/Polar Branch of VINRO Joint Report Series**».

All reports from BESS from 2004 until the latest are available at this web site: https://imr.brage.unit.no/imr-xmlui/handle/11250/2658167.

4- Marine Environment, ed 2.

Author(s): Tatyana Prokhorova (VNIRO-PINRO), Bjørn Einar Grøsvik (IMR) and Roman Klepikovski (VNIRO-PINRO)

4.1 Hydrography

Text by: A. Trofimov and R. Ingvaldsen

Figures by: A. Trofimov

4.1.1 Geographic variation

Horizontal distributions of temperature and salinity are shown for depths of 0, 50, 100 m and near the bottom in Figs 4.1.1.1–4.1.1.8, and anomalies of temperature and salinity at the surface and near the bottom are presented in Figs 4.1.1.9–4.1.1.12. The anomalies have been calculated using the long-term means for the period 1991–2020.

In August–September 2024, surface temperature was on average 2.9°C higher than the long-term mean all over the surveyed area, with the largest positive anomalies (>4°C) in the southern Barents Sea (Fig. 4.1.1.9). Compared to 2023, the surface temperature in 2024 was much higher (by 1.5°C on average) in most of the area (~80%), with the largest positive differences (>2°C) in the south. Negative differences (−0.5°C on average) were mainly found in the northern and northeastern parts of the sea.

Arctic waters were mainly found, as usual, in the 50–100 m layer north of 77°N (Fig. 4.1.1.3 and 4.1.1.5). Temperatures at depths of 50 and 100 m were higher than the long-term means (on average, by 0.6 and 0.5°C respectively) in about 60% of the surveyed area, with the largest positive anomalies (>1°C) at 50 m depth in the central, northwestern and northern Barents Sea. Negative anomalies (on average, −0.6°C at 50 m and −0.4°C at 100 m) were mostly found in the southeastern and eastern parts of the sea. Compared to 2023, the 50 and 100 m temperatures in 2024 were lower (on average, by 1.1 and 0.7°C respectively) in 65 and 63% of the surveyed area, with the largest negative differences (>2°C in magnitude) at 50 m in the southeast. Positive differences were mainly observed in the southwestern and northern Barents Sea, with the largest values (>1°C) at 50 m in the north. Small temperature anomalies and differences between 2024 and 2023 (both negative and positive, <0.5°C in magnitude) occupied from 42 to 62% of the area.

Bottom temperature was in general 0.4°C above average in 57% of the surveyed area, with the largest positive anomalies (>1°C) in the northwestern Barents Sea (Fig. 4.1.1.10). Negative anomalies (−0.5°C on average) were found in the central and southeastern parts of the sea, with the largest values (>1°C in magnitude) in the southeast. Bottom waters in 2024 were 0.8°C colder than in 2023 in 70% of the surveyed area, with the largest negative differences (>2°C in magnitude) in the southeast. The largest positive differences (>1°C) were in the northwest (east of the Lofoten/Spitsbergen Archipelago). Small temperature anomalies and differences between 2024 and 2023 (both negative and positive, <0.5°C in magnitude) occupied two thirds and half of the area respectively. In August–October 2024, the area covered by bottom water with temperatures below zero was 31% in the Barents Sea (71–79°N 25–55°E) being 14% higher than that in the previous year and close to those in 2019–2022 (32–39%).

Surface salinity was on average 0.4 higher than the long-term mean in 58% of the surveyed area, with the largest positive anomalies (>0.8) in the northern Barents Sea (Fig. 4.1.1.11). Negative anomalies (–0.4 on average) were mainly observed in the southwestern, southern and southeastern parts of the sea, with the largest values (>0.8 in magnitude) in the southeast. In August–September 2024, surface waters were on average 0.4 fresher than in 2023 in 57% of the surveyed area, with the largest negative differences (>0.8 in magnitude) in the southeast. They were saltier (on average, by 0.3) mainly in the central and northernmost Barents Sea, with the largest positive differences (>0.8) in the north.

Salinity at 50 m depth was higher than average (by 0.1 on average) in most of the surveyed area (61%), with the largest positive anomalies (>0.2) mostly south of the Lofoten/Spitsbergen Archipelago. The largest negative anomalies (>0.2 in magnitude) were mainly found in the southwesternmost and southeasternmost Barents Sea. In August–September 2024, waters at 50 m were fresher (by 0.1 on average) than in 2023 in half of the area, with the largest negative differences (>0.2 in magnitude) in the southwesternmost, southeasternmost and northern parts of the sea. At a depth of 50 m, both positive and negative anomalies and differences were larger than at 100 m. Small salinity anomalies and differences of <0.1 in magnitude occupied about 70 and 90% of the surveyed area at depths of 50 and 100 m respectively.

Bottom salinity was slightly lower than average in most of the area (81%) (Fig. 4.1.1.12). Positive anomalies were found south of the Lofoten/Spitsbergen Archipelago, over the Lofoten/Spitsbergen Bank. In August–September 2024, bottom waters were a bit saltier than in 2023 in 65% of the surveyed area. As a whole, bottom salinity anomalies and differences were small (<0.1 in magnitude) almost all over the area (88 and 90% respectively).

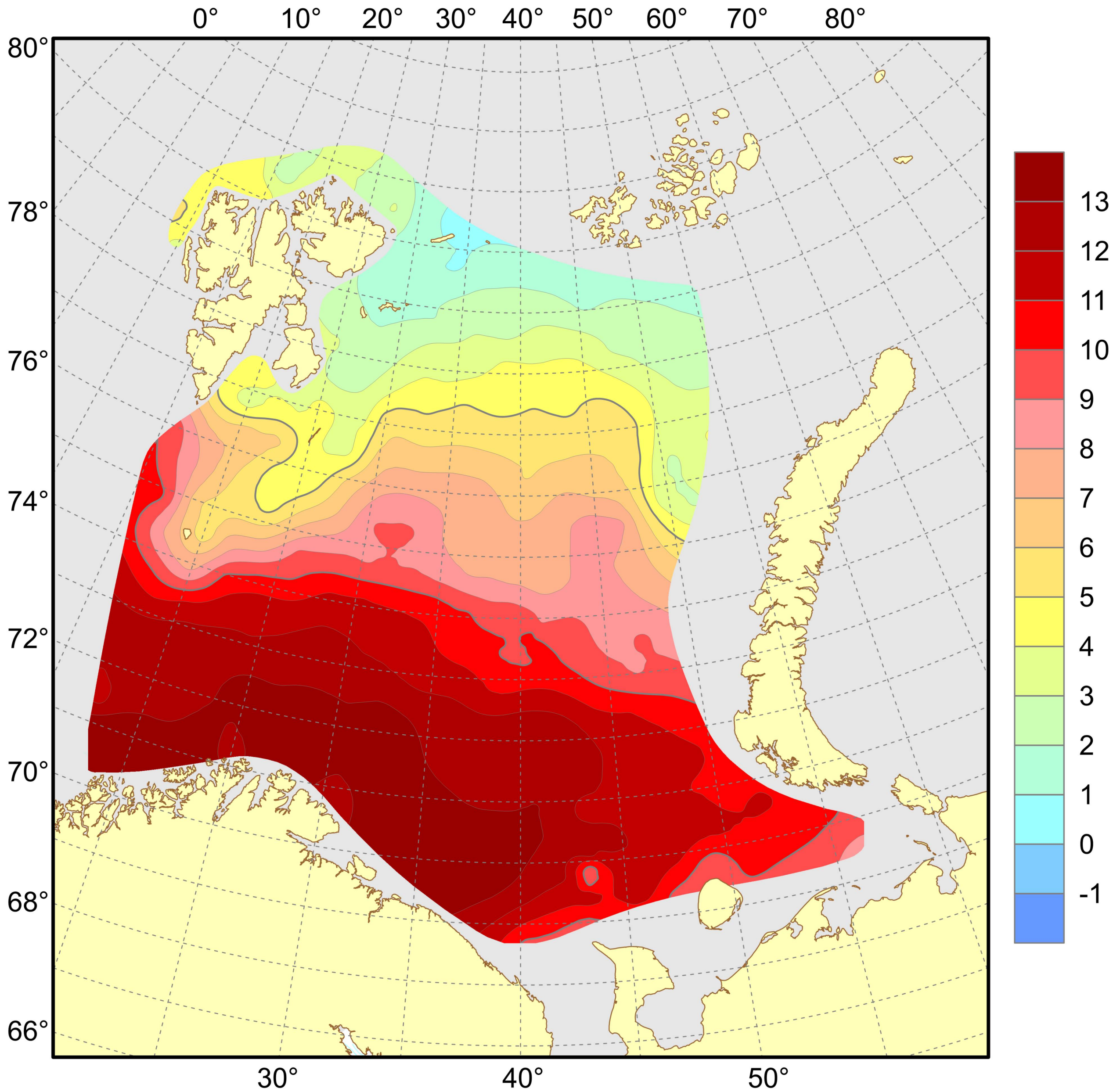

Figure 4.1.1.1. *Distribution of surface temperature (°C), August–October 2024.*

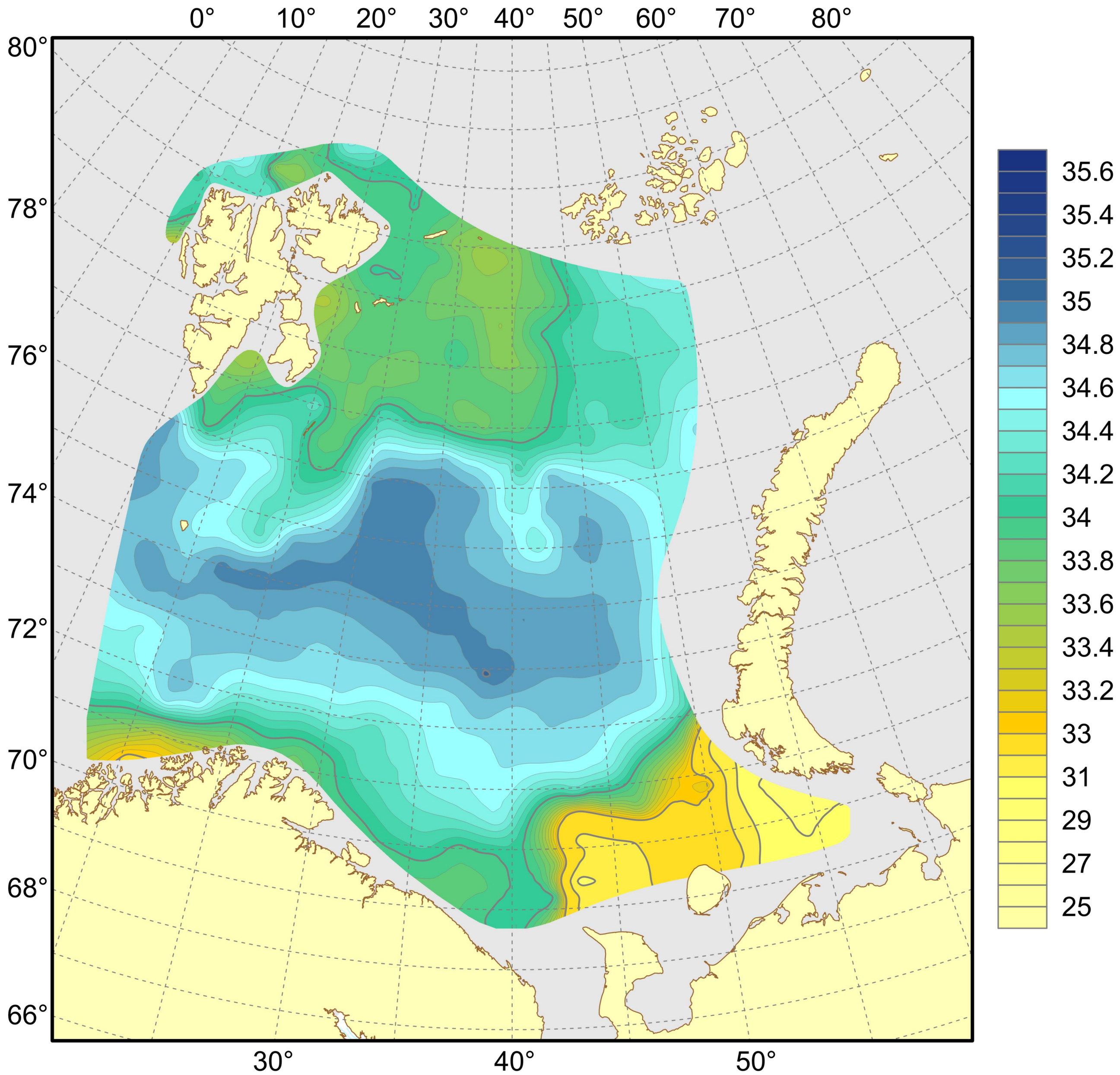

Figure 4.1.1.2. *Distribution of surface salinity, August–October 2024.*

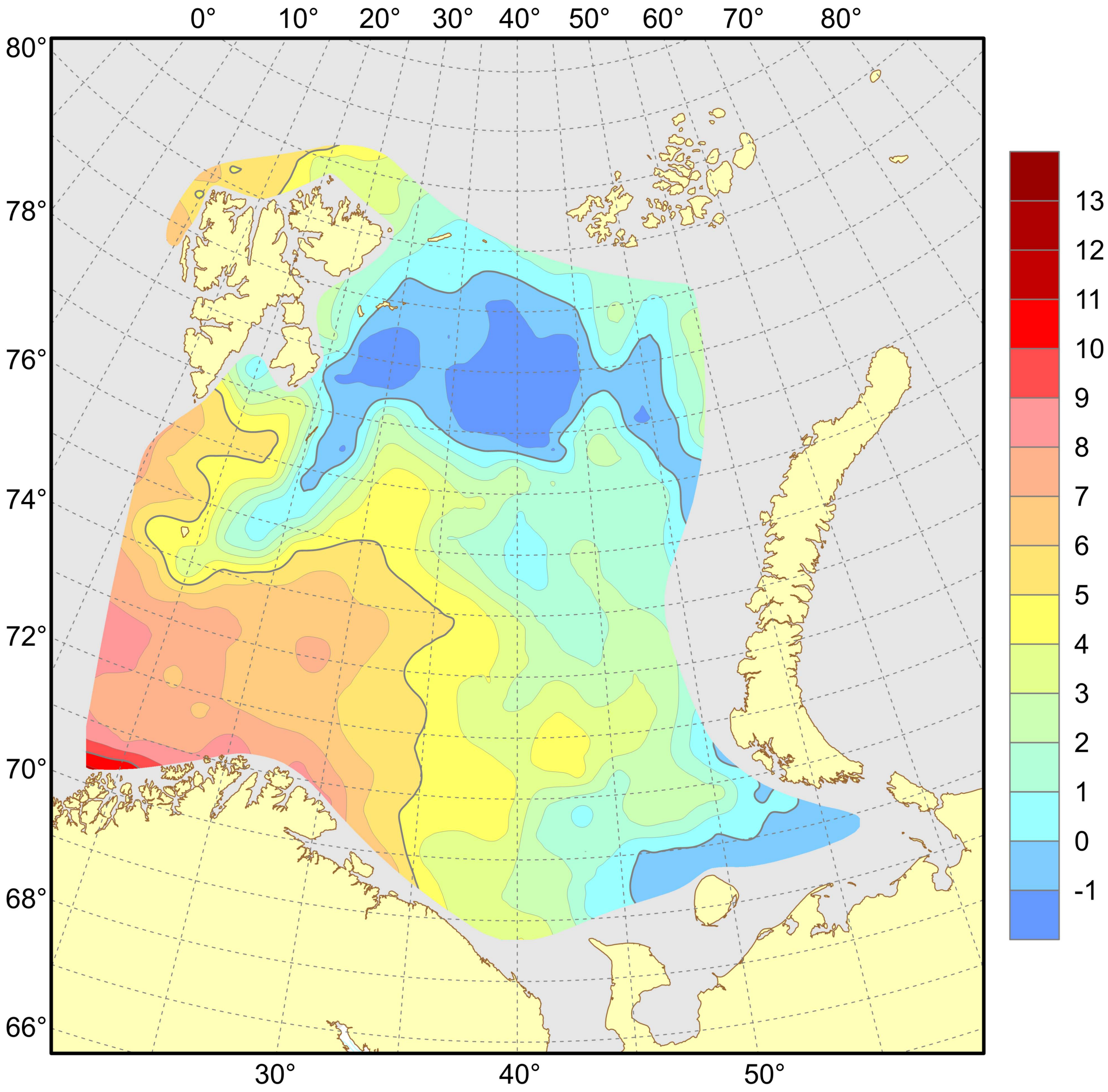

Figure 4.1.1.3. *Distribution of temperature (°C) at the 50 m depth, August–October 2024.*

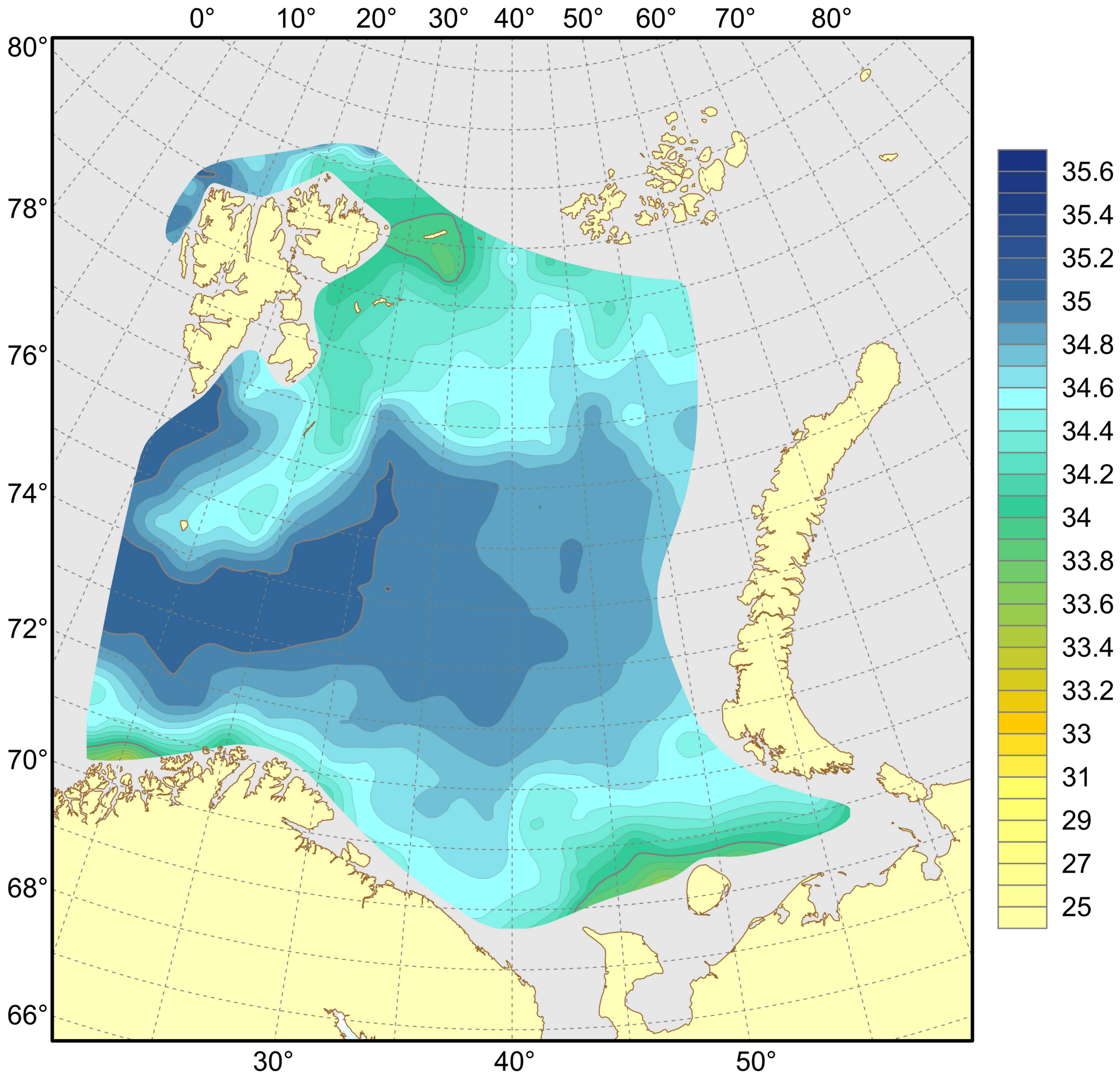

Figure 4.1.1.4. *Distribution of salinity at the 50 m depth, August–October 2024.*

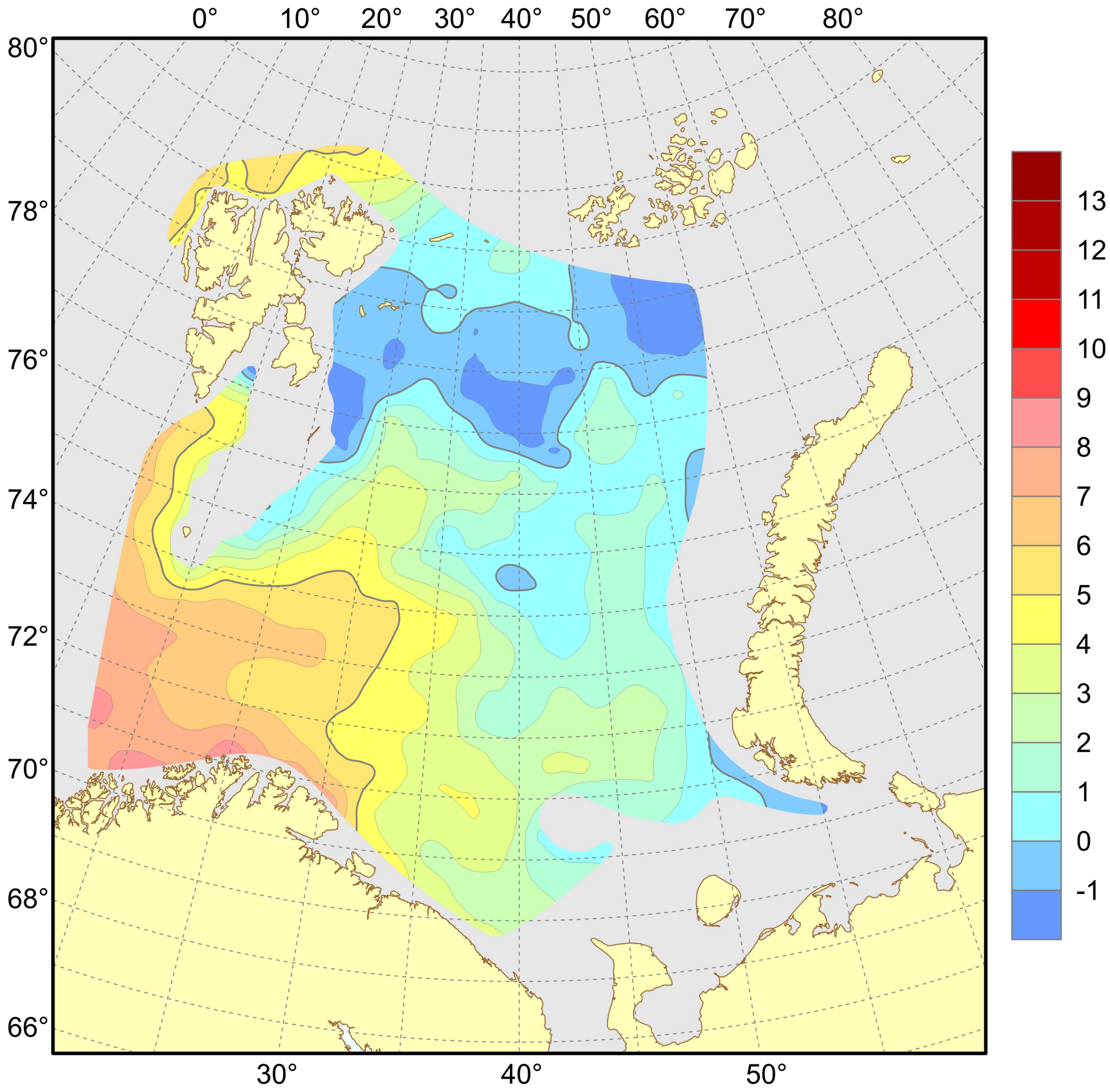

Figure 4.1.1.5. *Distribution of temperature (°C) at the 100 m depth, August–October 2024.*

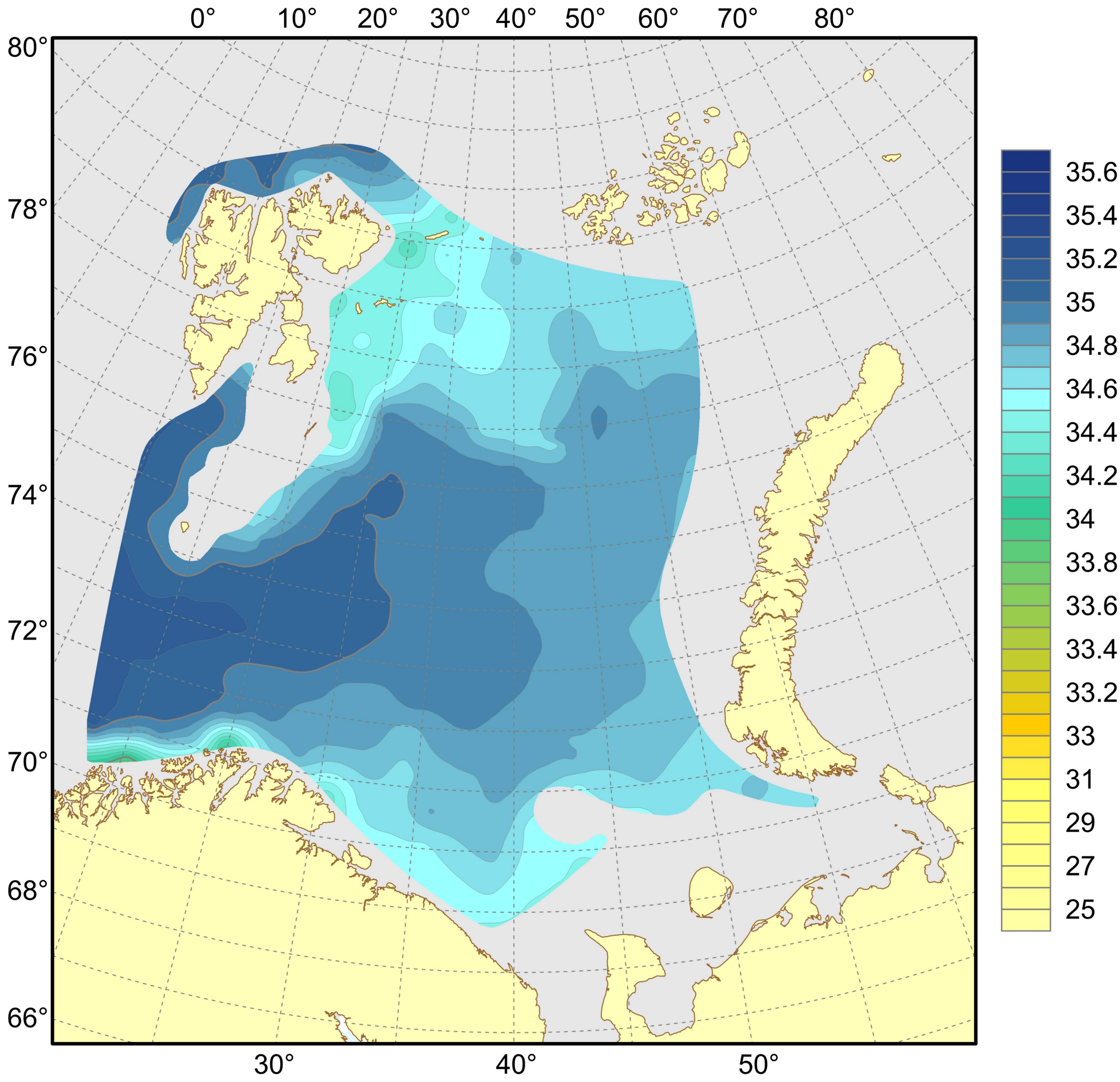

Figure 4.1.1.6. *Distribution of salinity at the 100 m depth, August–October 2024.*

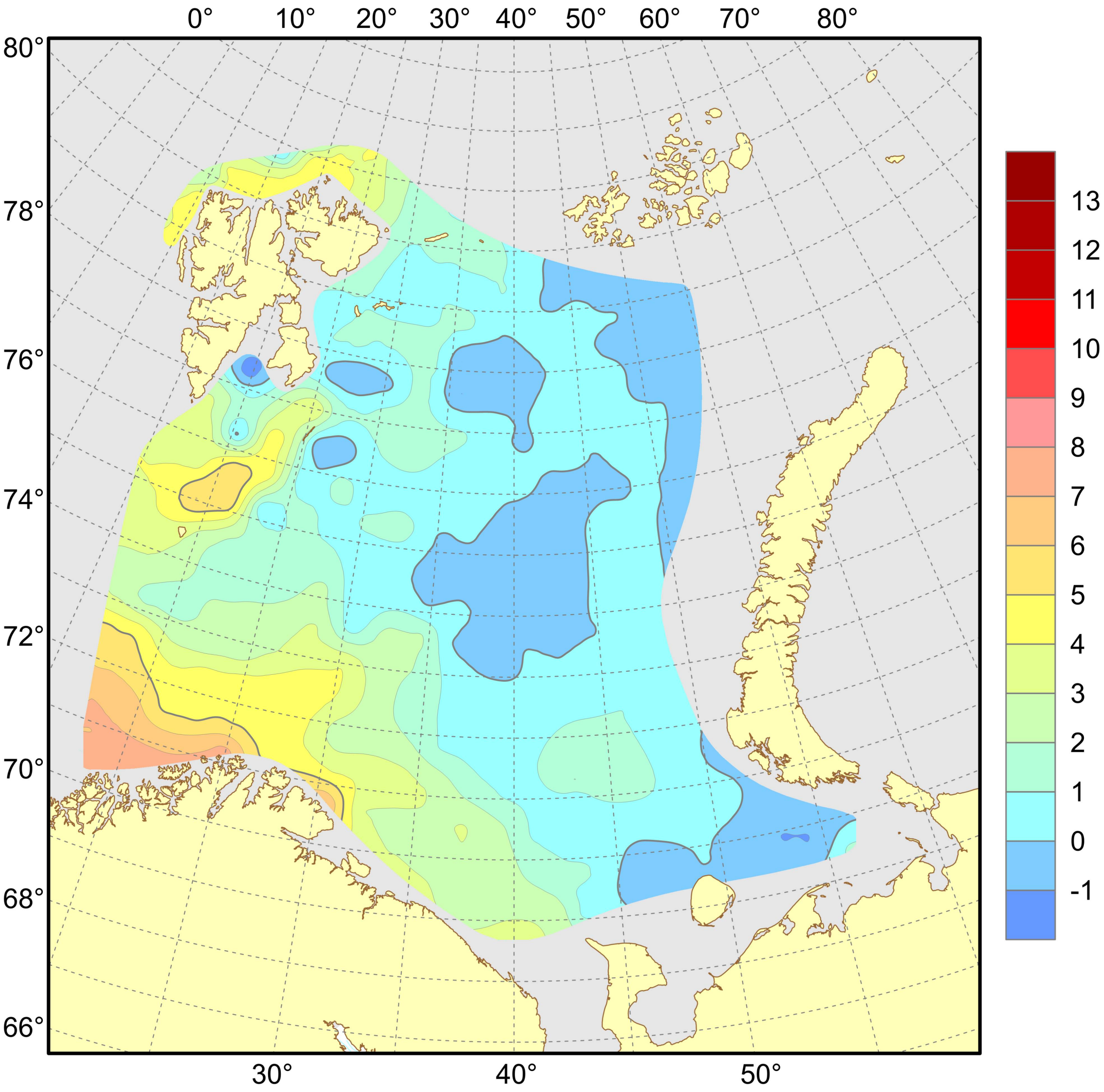

Figure 4.1.1.7. *Distribution of temperature (°C) at the bottom, August–October 2024.*

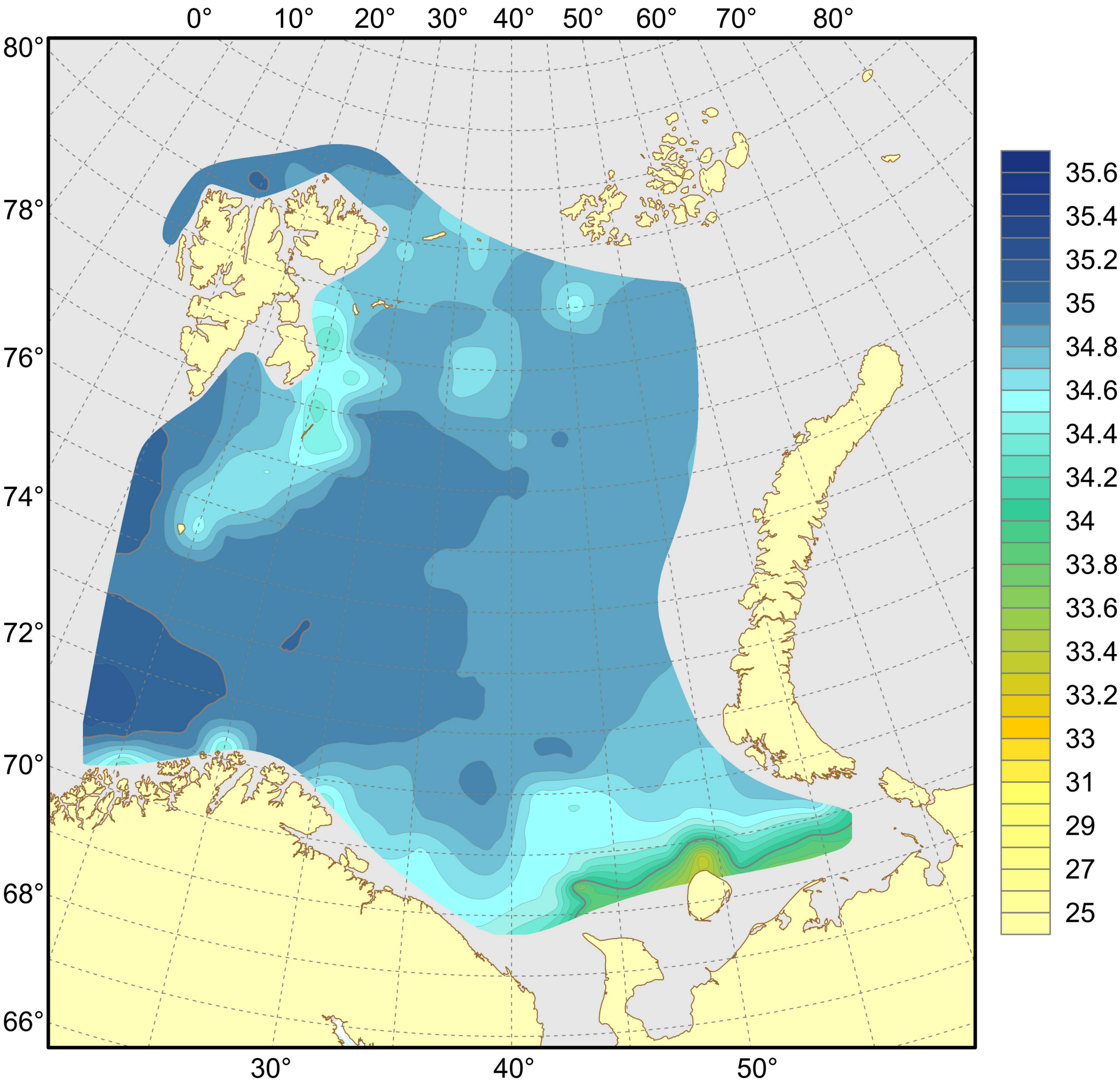

Figure 4.1.1.8. *Distribution of salinity at the bottom, August–October 2024.*

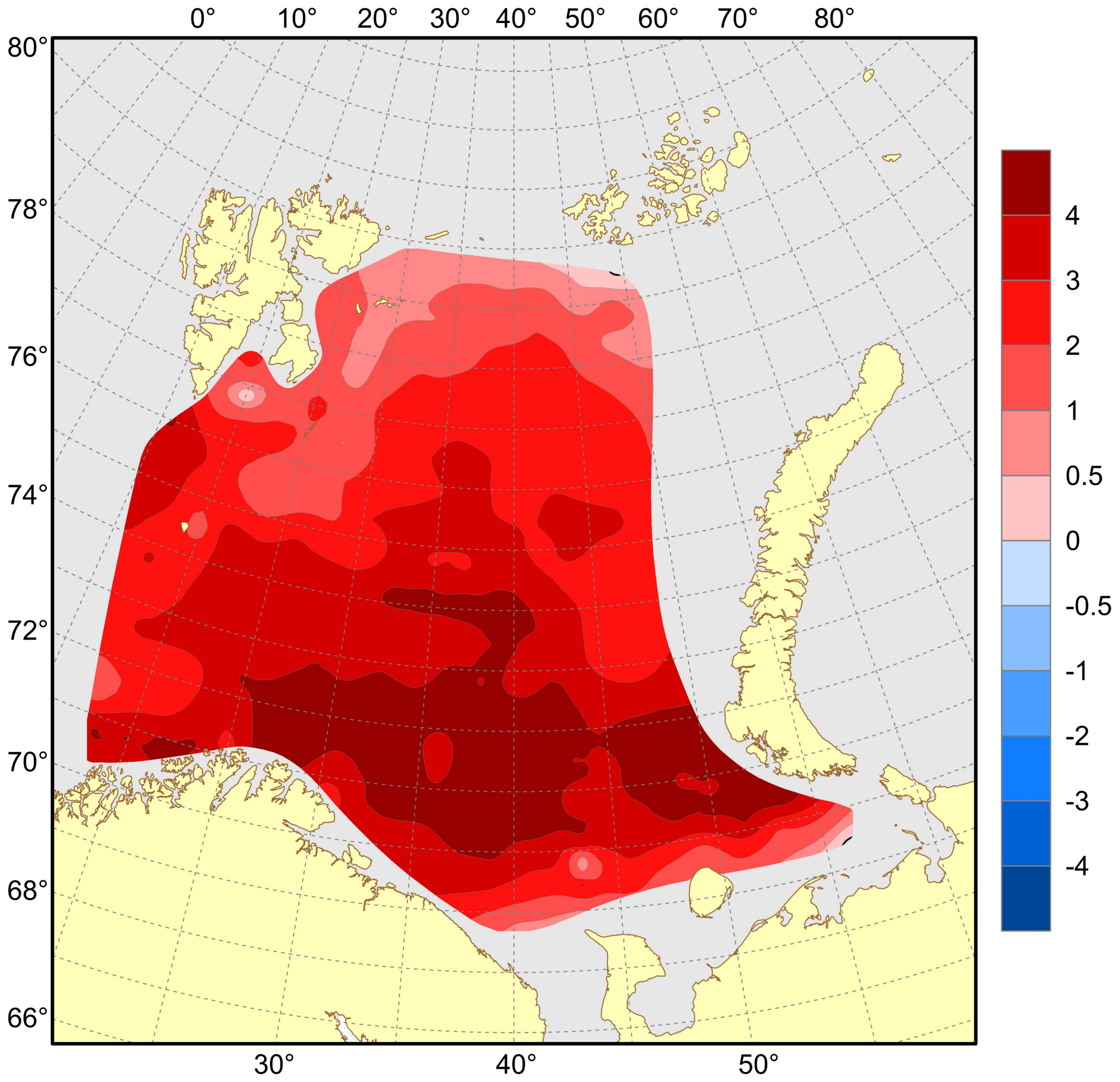

Figure 4.1.1.9. *Surface temperature anomalies (°C), August–September 2024.*

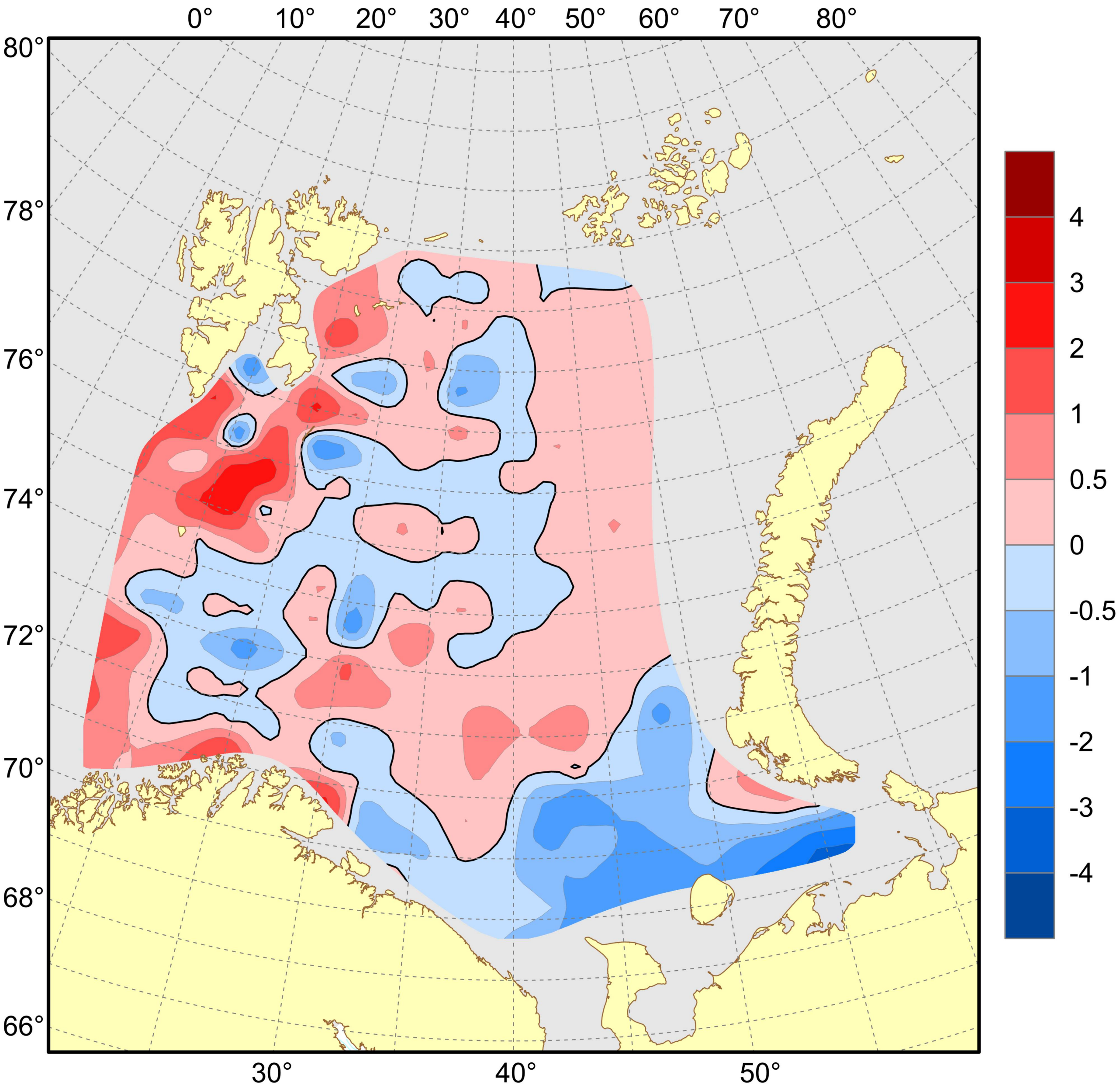

Figure 4.1.1.10. *Temperature anomalies (°C) at the bottom, August–September 2024.*

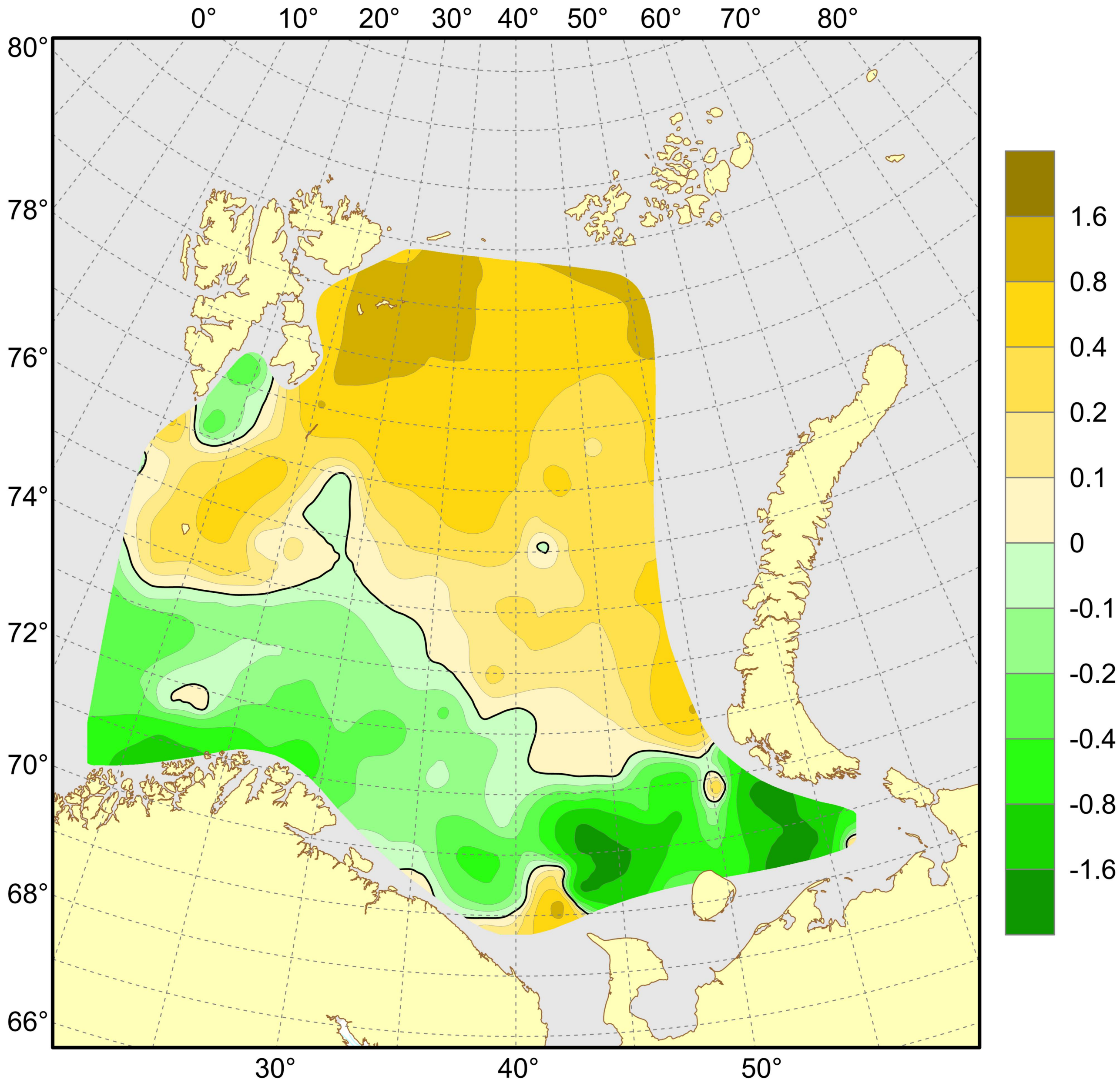

Figure 4.1.1.11. *Surface salinity anomalies, August–September 2024.*

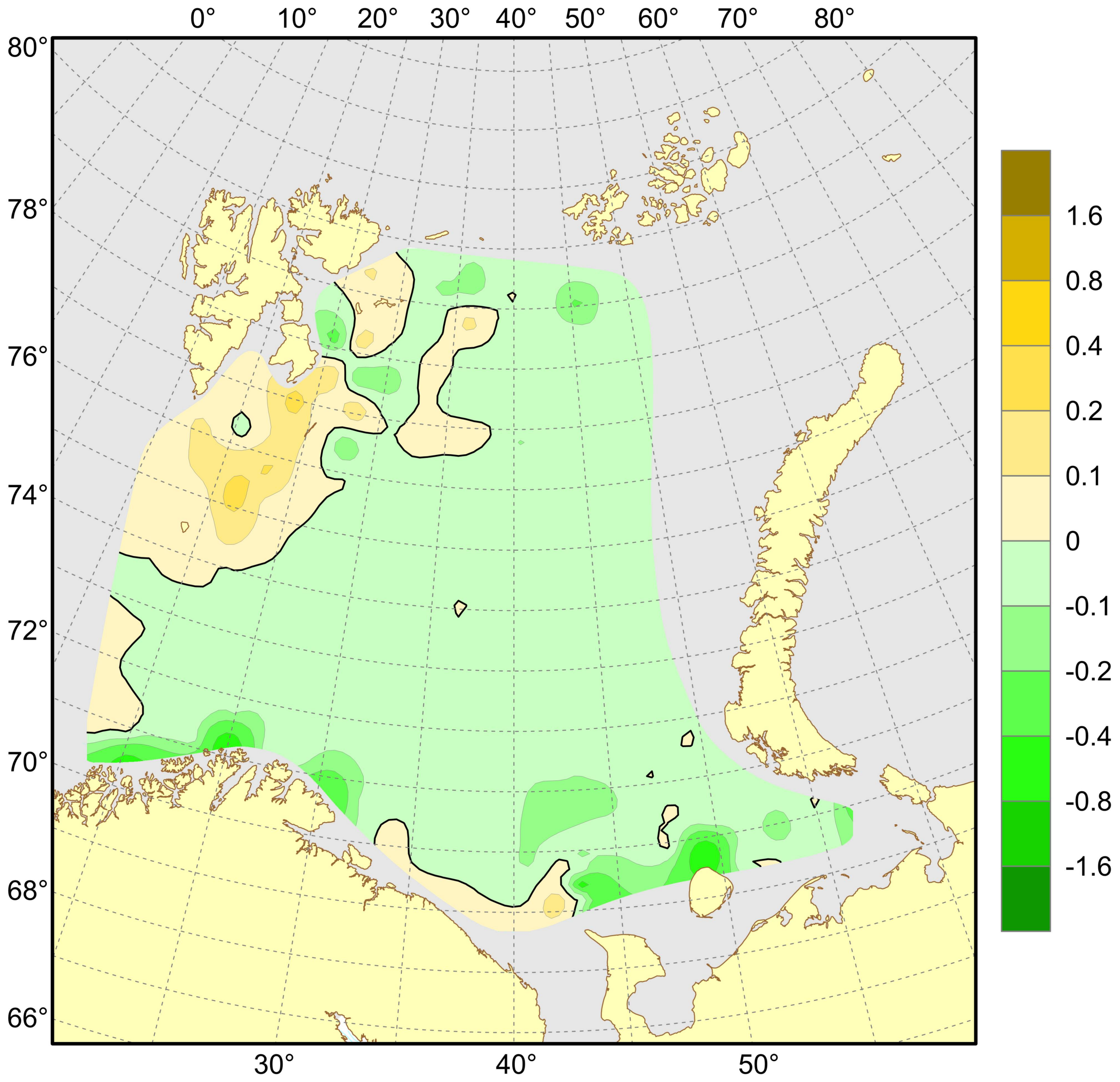

***Figure 4.1.1.12**. Salinity anomalies at the bottom, August–September 2024.*

4.1.2 Standard sections

Table 4.1.2.1 shows mean temperatures in the main parts of standard oceanographic sections of the Barents Sea, along with historical data back to 1965.

The *Fugløya–Bear Island* and the southern part of the *Vardø–North* sections cover the inflow of Atlantic and Coastal water masses from the Norwegian Sea to the Barents Sea. The mean Atlantic Water (50–200 m) temperature in the inflow region to the Barents Sea, i.e. at the *Fugløya–Bear* Island section, was 0.9°C higher than the long-term mean (1991–2020) and 0.8°C warmer than in 2023 (Table 4.1.2.1). The high anomalies are biased due to the section being sampled about a month later in the season than usual. Slightly further east, in the southern part of the *Vardø–North* section, temperatures were higher than both the long-term mean (1.0°C) and that in 2023 (0.6°C) (Table 4.1.2.1).

The *Kola* and *Kanin* sections cover the flow of coastal and Atlantic waters in the southern Barents Sea. In August–October 2024, the *Kola* section was sampled twice: in the middle of August (Table 4.1.2.1) and in early October. In August, temperature in the upper 50 m layer in the *Kola* section was 0.7, 1.4 and 2.1°C higher than the long-term mean (1991–2020) in the inner (coastal waters), central and outer (Atlantic waters) parts of the section respectively. In 50–200 m layer, coastal waters were 0.8°C warmer than usual while Atlantic water temperature was close to average with a small negative anomaly of −0.2°C in the central part of the section and a positive anomaly of +0.3°C in its outer part. From August to October, positive temperature anomalies in coastal waters increased up to +1.8 and +1.4°C in the 0–50 and 50–200 m layers. In Atlantic waters, the anomaly in the upper 50 m layer remained almost the same in the central part of the section (+1.5°C) and decreased down to +1.4°C in the outer part, whereas in the 50–200 m layer, they increased up to +0.3 and +0.7°C respectively. In the *Kanin* section, the mean temperature of the whole water column in August was 1.1°C lower and 0.1°C higher than the long-term mean (1991–2020) in the shallow inner and deeper outer parts of the section respectively (Table 4.1.2.1).

Since 2012–2014, the hydrographic monitoring in the northern Barents Sea was strengthened by extending the *Vardø–North* section all the way up to 81°N, and by establishing a new standard section north of Svalbard/Spitsbergen (the *Hinlopen* section). Both sections are to be sampled in late September – early October. The northern part of the *Vardø–North* section covers mainly Arctic waters, while the Hinlopen section covers the Atlantic Water flowing along the slope toward the deep Arctic Ocean. Unfortunately, none of these time series could be updated in 2024 due to lack of sufficient coverage.

Table 4.1.2.1. *Mean water temperatures in the main parts of standard oceanographic sections in the Barents Sea and adjacent waters in August–September 1965–2024. 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), Fugløya – Bear Island (FBI, 71º30′N, 19º48′E – 73º30′N, 19º20′E), Vardø – North South (VN S, 72º15′N – 74º15′N, 31º13′E), Vardø-North N (WN N, 77º30′N – 79º30′N), and Hinlopen (80º32′N – 81º06′N).*

Year	Section and layer (depth in metres)								
	Kola	Kola	Kola	Kanin S	Kanin N	FBI	VN S	VN N	Hinlopen
	0-50	50–200	0–200	0–bot.	0-bot.	50–200	50-200	30-100	100-500
1965	6.7	3.9	4.6	4.6	3.7	5.2	3.8	-	-
1966	6.7	2.6	3.6	1.9	2.2	5.3	3.2	-	-
1967	7.5	4.0	4.9	6.1	3.4	6.3	4.4	-	-
1968	6.4	3.7	4.4	4.7	2.8	5.0	3.4	-	-
1969	6.7	3.1	4.0	2.6	2.0	6.3	3.8	-	-
1970	7.8	3.7	4.7	4.0	3.3	5.6	4.1	-	-
1971	7.1	3.2	4.2	4.0	3.2	5.6	3.8	-	-
1972	8.7	4.0	5.2	5.1	4.1	6.1	4.6	-	-
1973	7.7	4.5	5.3	5.7	4.2	5.7	4.9	-	-
1974	8.1	3.9	4.9	4.6	3.5	5.8	4.3	-	-
1975	7.0	4.6	5.2	5.6	3.6	5.7	4.5	-	-
1976	8.1	4.0	5.0	4.9	4.4	5.8	4.4	-	-
								-	

Year	Section and layer (depth in metres)								
1977	6.9	3.4	4.3	4.1	2.9	4.9	3.6	-	-
1978	6.6	2.5	3.6	2.4	1.7	4.9	3.2	-	-
1979	6.5	2.9	3.8	2.0	1.4	4.7	3.6	-	-
1980	7.4	3.5	4.5	3.3	3.0	5.5	3.7	-	-
1981	6.6	2.7	3.7	2.7	2.2	5.3	3.4	-	-
1982	7.1	4.0	4.8	4.5	2.8	6.0	4.1	-	-
1983	8.1	4.8	5.6	5.1	4.2	6.1	4.8	-	-
1984	7.7	4.1	5.0	4.5	3.6	5.7	4.2	-	-
1985	7.1	3.5	4.4	3.4	3.4	5.6	3.7	-	-
1986	7.5	3.5	4.5	3.9	3.2	5.5	3.8	-	-
1987	6.2	3.3	4.0	2.7	2.5	5.1	3.5	-	-
1988	7.0	3.7	4.5	3.8	2.9	5.7	3.8	-	-
1989	8.6	4.8	5.8	6.5	4.3	6.2	5.1	-	-
1990	8.1	4.4	5.3	5.0	3.9	6.3	5.0	-	-
1991	7.7	4.5	5.3	4.8	4.2	6.2	4.8	-	-
1992	7.5	4.6	5.3	5.0	4.0	6.1	4.6	-	-
1993	7.5	4.0	4.9	4.4	3.4	5.8	4.2	-	-
1994	7.7	3.9	4.8	4.6	3.4	5.9	4.8	-	-
1995	7.6	4.9	5.6	5.9	4.3	6.1	4.6	-	-
1996	7.6	3.7	4.7	5.2	2.9	5.7	3.7	-	-
1997	7.3	3.4	4.4	4.2	2.8	5.4	4.0	-	-
1998	8.4	3.4	4.7	2.1	1.9	5.8	3.9	-	-
1999	7.4	3.8	4.7	3.8	3.1	6.1	4.8	-	-
2000	7.6	4.5	5.3	5.8	4.1	5.8	4.2	-	-
2001	6.9	4.0	4.7	5.6	4.0	5.9	4.2	-	-
2002	8.6	4.8	5.8	4.0	3.7	6.5	4.6	-	-
2003	7.2	4.0	4.8	4.2	3.3	6.2	4.7	-	-
2004	9.0	4.7	5.7	5.0	4.2	6.4	4.8	-	-
2005	8.0	4.4	5.3	5.2	3.8	6.2	5.0	-	-
2006	8.3	5.3	6.1	6.1	4.5	6.9	5.3	-	-
2007	8.2	4.6	5.5	4.9	4.3	6.5	4.9	-	-
2008	6.9	4.6	5.2	4.2	4.0	6.4	4.7	-	-
2009	7.2	4.3	5.0	-	4.3	6.4	5.2	-	-

Year	Section and layer (depth in metres)								
2010	7.8	4.7	5.5	4.9	4.5	6.2	-	-	-
2011	7.6	4.0	4.9	5.0	3.8	6.4	5.1	-0.2	-
2012	8.2	5.3	6.0	6.2	5.2	6.4	5.7	-0.4	-
2013	8.8	4.6	5.6	5.5	4.6	6.3	4.9	-	-
2014	8.0	4.6	5.4	4.5	4.1	6.1	5.2	-0.6	3.5
2015	8.5	4.8	5.7	6.1	4.6	6.6	5.5	0.2	3.6
2016	8.7	4.7	5.8	-	5.5	6.5	5.1	-1.1	4.1
2017	7.9	4.8	5.6	-	-	6.4	5.2	0.3	3.8
2018	8.1	4.9	5.7	-	-	6.0	-	-1.1	3.9
2019	7.8	4.4	5.2	5.5	4.1	5.9	4.7	-0.8	3.7
2020	8.2	4.3	5.3	-	-	6.2	5.1	-1.1	3.4
2021	7.9	4.5	5.3	6.0	4.3	6.1	5.0	-0.7	3.5
2022	-	-	-	-	-	6.4	5.0	-0.8	3.2
2023	8.5	4.7	5.6	-	-	6.3	5.2	-	3.7
2024	9.3	4.2	5.4	3.8	4.0	7.1	5.8		-
Average 1991–2020	**7.9**	**4.4**	**5.3**	**4.9**	**3.9**	**6.2**	**4.8**	**-**	**-**

4.2 Anthropogenic pollution

4.2.1 Marine litter

Figures by: D. Prozorkevich

Surface observations of litter were carried out along the known-length transects of with marine mammal observations from Norwegian and Russian vessels.

Plastic was the most frequent material type of floating litter observations (69.0 % of observations) (Fig. 4.2.1.1). The maximum surface observation of plastic litter was 0.30 m3 per nm (a roll of rope from a crab trap). The average surface observation of plastic was 0.007 m3 per nm. Fishery related litter was recorded in 46.9 % of plastic litter observations at the surface (Fig. 4.2.1.2). Fishery related plastic was represented by ropes, pieces of nets and floats/buoys. Fishery plastic maximum and average volume was 0.30 m3 per nm and 0.014 m3 per nm, respectively, and it is larger than non-fishery plastic (maximum and average observations of 0.001 m3 per nm and 0.0001 m3/ per nm, respectively).

Treated wood (wooden sticks, pallets and logs) was recorded in 23.9 % of the surface litter observations. The maximum observation of wood was 0.08 m3 per nm, with the average of 0.015 m3 per nm. It should be noted that wood is the natural type of litter and biodegrades naturally in the environment.

Metal, paper and rubber were observed singularly (1.4-4.2 % of the observations).

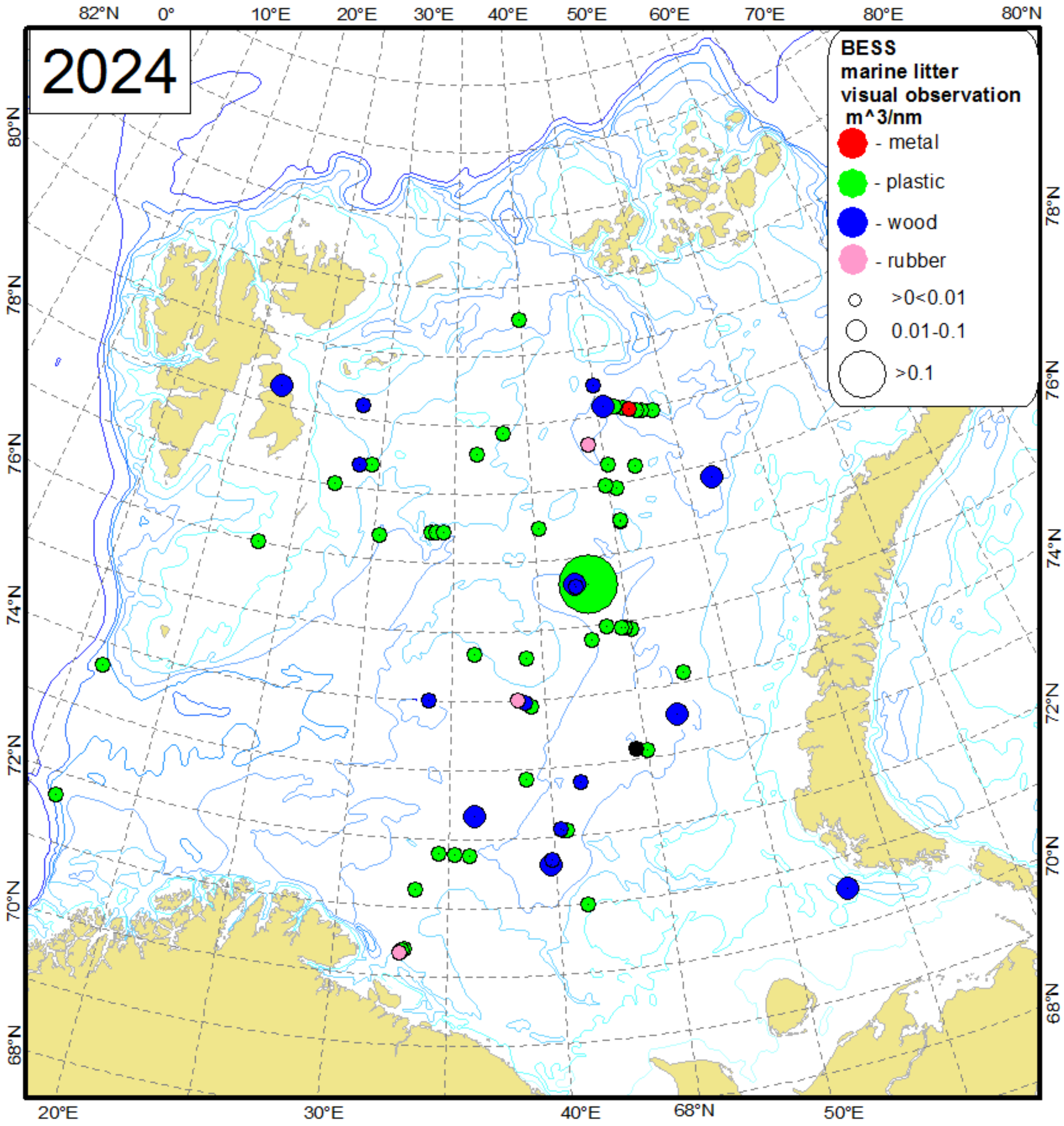

***Figure 4.2.1.1** Type of observed anthropogenic litter at the surface in the BESS 2024 (m3/ nm).*

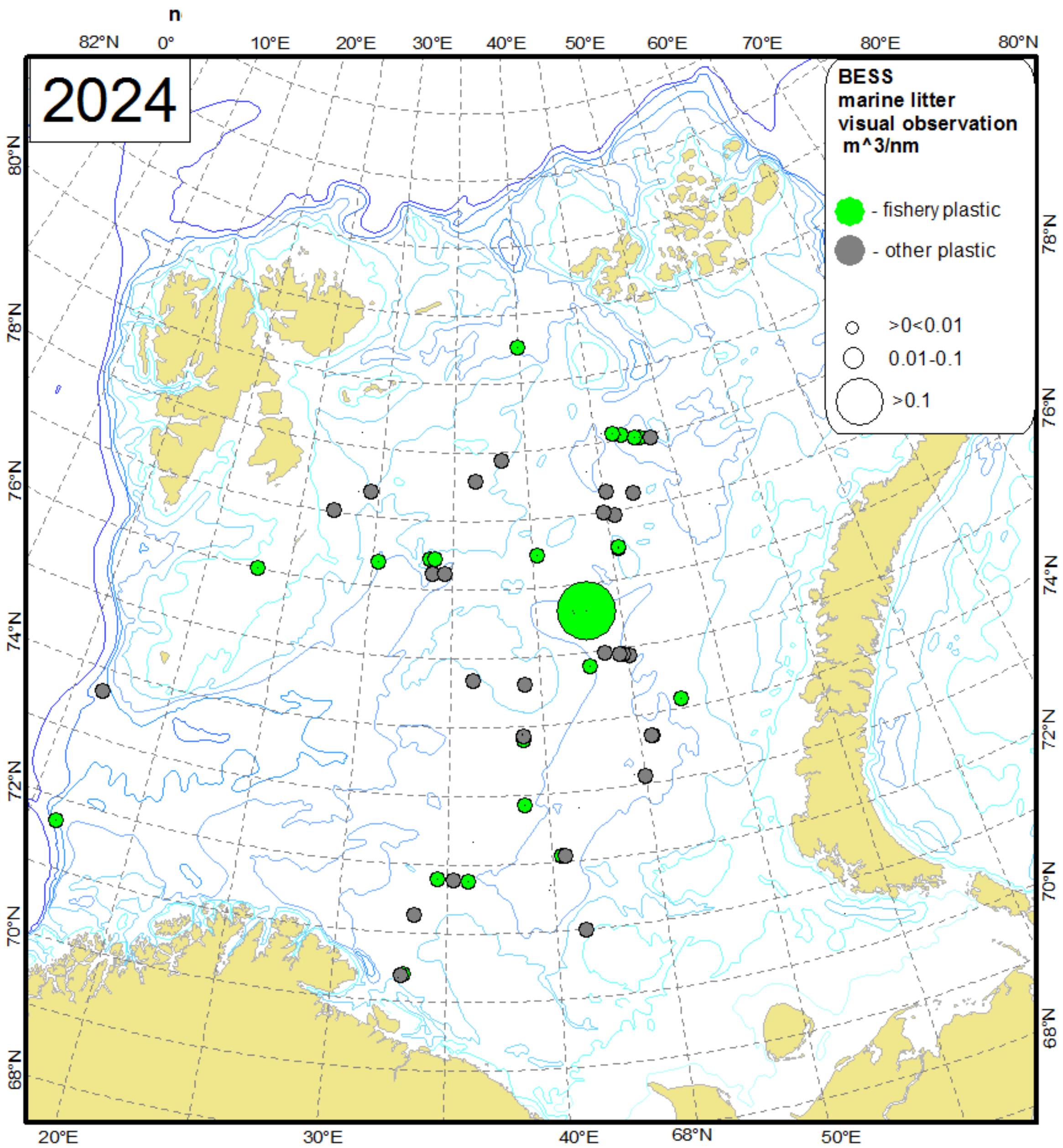

Figure 4.2.1.2 *Litter observations of plastic at the surface indicated as fishery related and other litter in the BESS 2024 (m3/ nm).*

Observations of litter in the trawl stations were done during the survey. Onboard the Norwegian vessels litter from trawls were recorded according to the international manual for seafloor litter data collection and reporting from demersal trawl samples. Onboard the Russian vessels a detailed description of the litter was carried out, which then made it possible to classify.

Anthropogenic litter was observed in 11.3 % of pelagic trawl stations (Fig. 4.2.1.3). Plastic usually is the most frequent material type observed in pelagic trawls and constituted 97.2 % of the observations (it was recorded in 11.0 % of all pelagic trawls). Weight of plastic litter from pelagic trawls varied from 0.00004 kg per nm to 0.149 kg per nm, with an average of 0.007 kg per nm. Fishery related litter (such as ropes made from synthetic fibres and pieces of fishing net) constituted 54.3 % of litter registrations from pelagic trawls (Fig. 4.2.1.4).

Other types of litter in pelagic trawls are textile (observed in 1.3 % of pelagic trawl stations and constituted 11.1 % of the litter observations) and unrecognisable items and items that do not fit in other categories («other»), which was registered only in one pelagic station. Weight of textile varied from 0.001 kg per nm to 0.003 kg per nm. It should be noted that textile is a natural product, e.g. ropes made from natural fibres (such as cotton, sisal, hemp, or coir) or all types of clothing (textile and woven products).

From the bottom trawls, 24.2 % of the stations contained litter (Fig. 4.2.1.5). Plastic was the most frequently observed material in the bottom trawls as in the pelagic (89.0 % of stations with observed litter and 21.5 % of the bottom trawls). Weight of plastic litter in bottom trawls varied from 0.0001 kg per nm to 1.248 kg per nm, with an average of 0.04 kg per nm. Fishery related litter constituted 64.6 % of registrations from bottom trawls (Fig. 4.2.1.6).

Wood (processed objects made of wood, e.g. logs, or planks) and textile belong to categories of natural product. Wood was observed in 2.6 % of bottom trawl stations (in 11.0 % bottom trawls with litter registrations). Weight of wood in bottom trawls varied from 0.006 kg per nm to 0.786 kg per nm, with an average of 0.28 kg per nm. Textile was registered in 3.6 % of bottom trawl stations (in 15.1 % bottom trawls with litter). Weight of wood in bottom trawls was 0.001-0.115 kg per nm, with an average of 0.02 kg per nm.

Other material types of litter (metal, glass or unrecognisable items) were observed in bottom trawls singularly (2.7-5.5 % of the bottom trawl stations with observed litter).

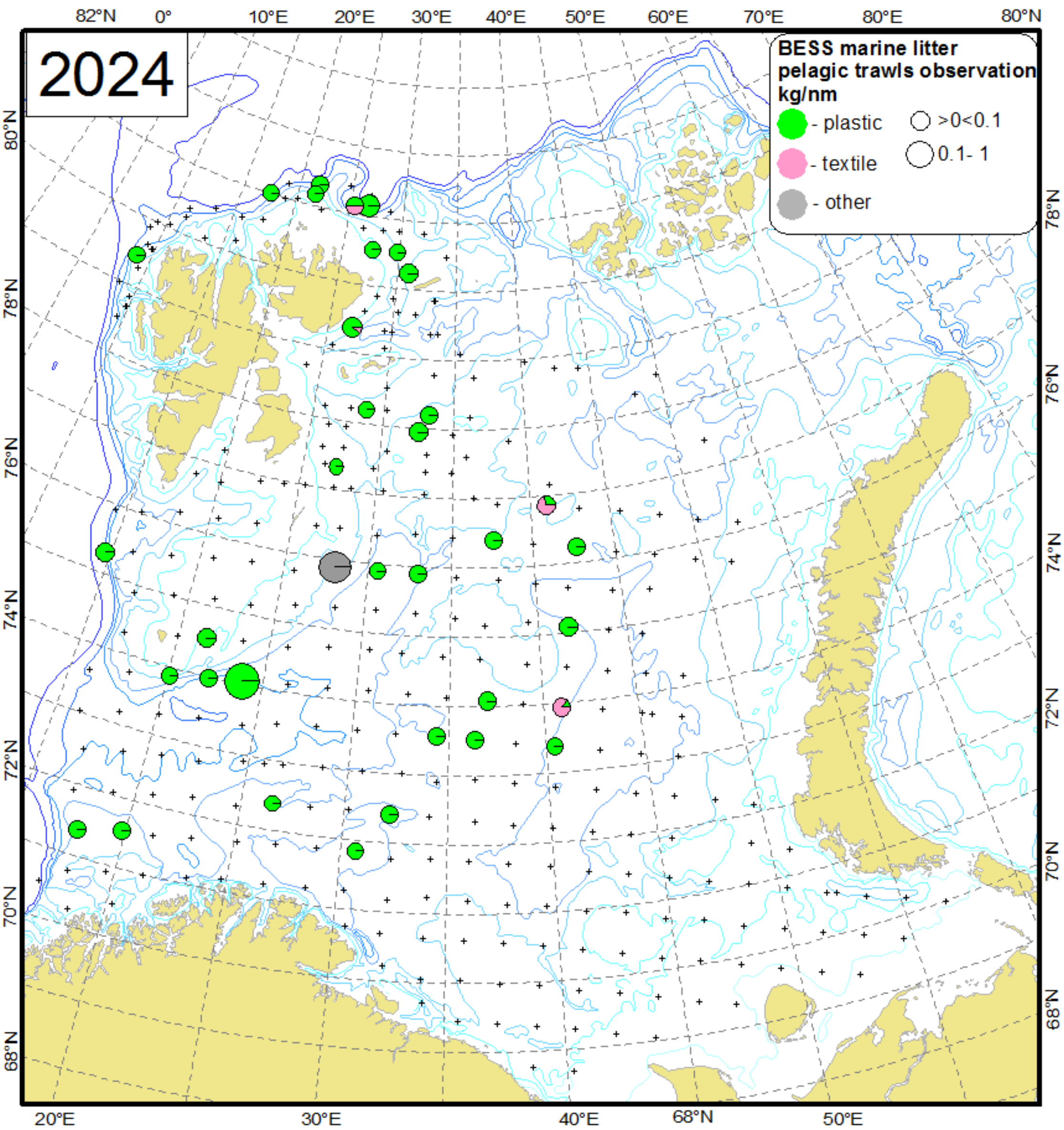

Figure 4.2.1.3 *Type of anthropogenic litter collected in the pelagic trawls (kg per nm) in the BESS 2024 (crosses – pelagic trawl stations).*

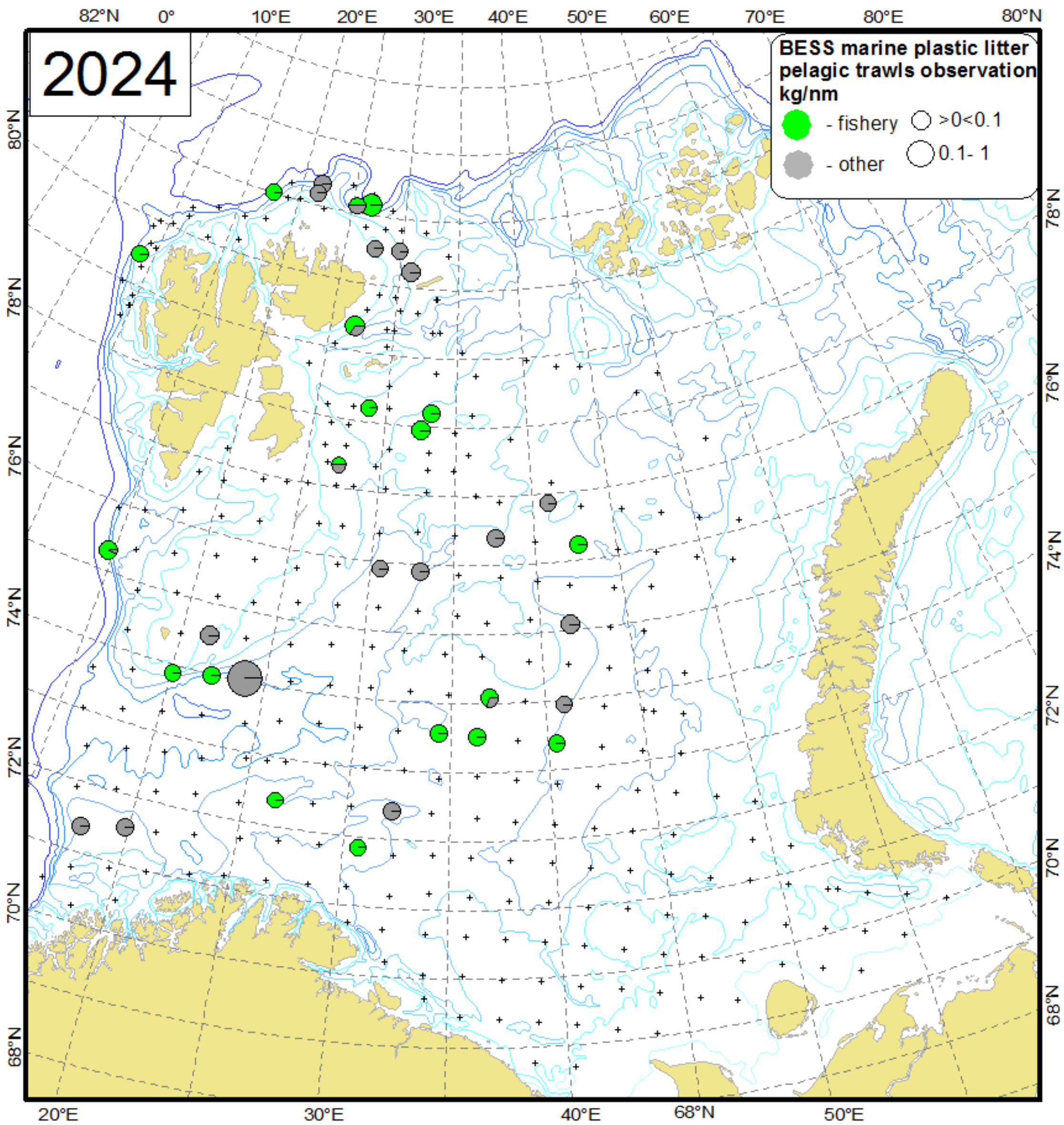

Figure 4.2.1.4 *Fishery related plastic observation versus other plastic litter collected in the pelagic trawls in the BESS 2024 (kg per nm, crosses – trawl stations).*

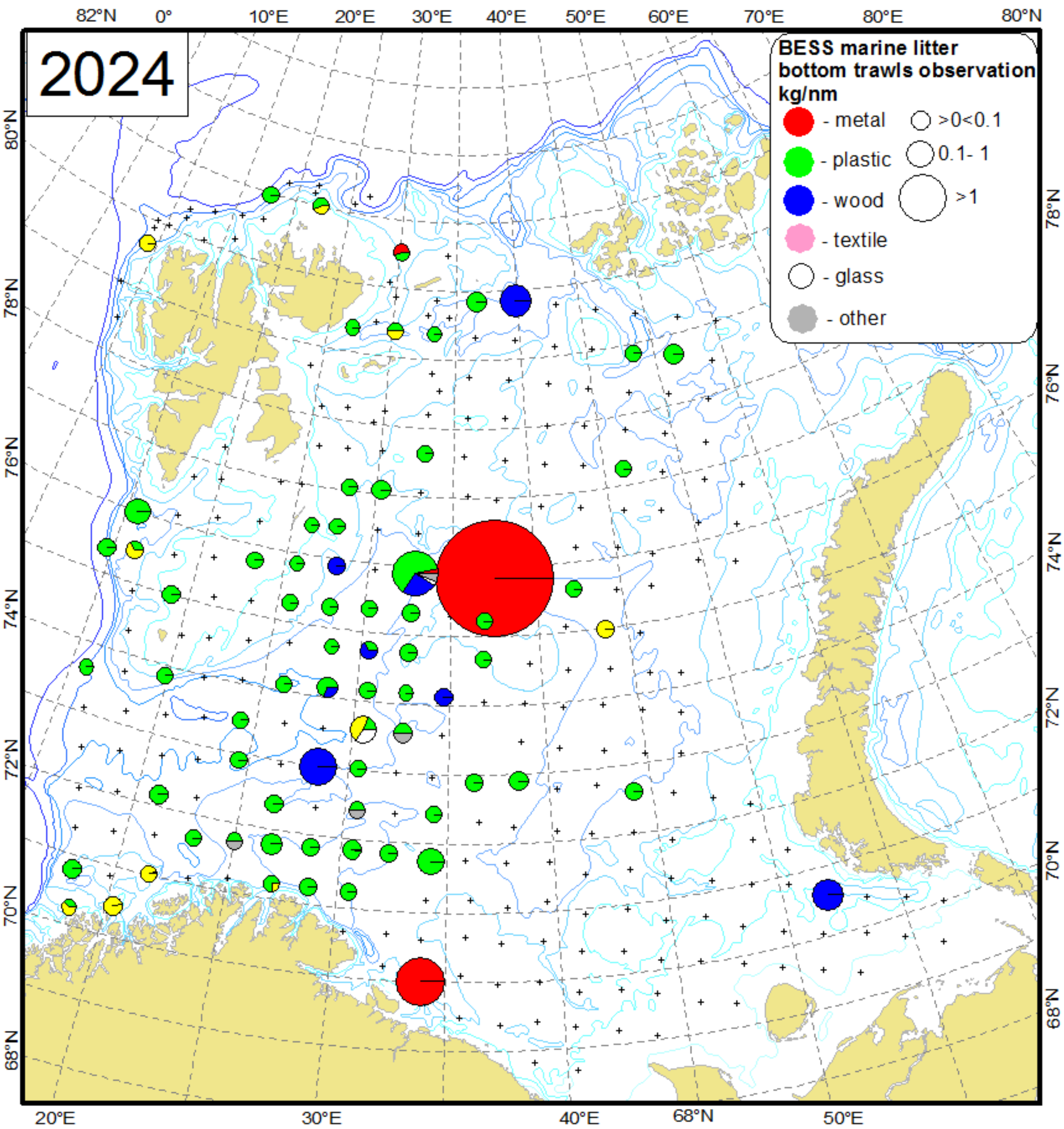

Figure 4.2.1.5 *Type of anthropogenic litter collected in the bottom trawls (kg per nm) in the BESS 2024 (crosses – bottom trawl stations).*

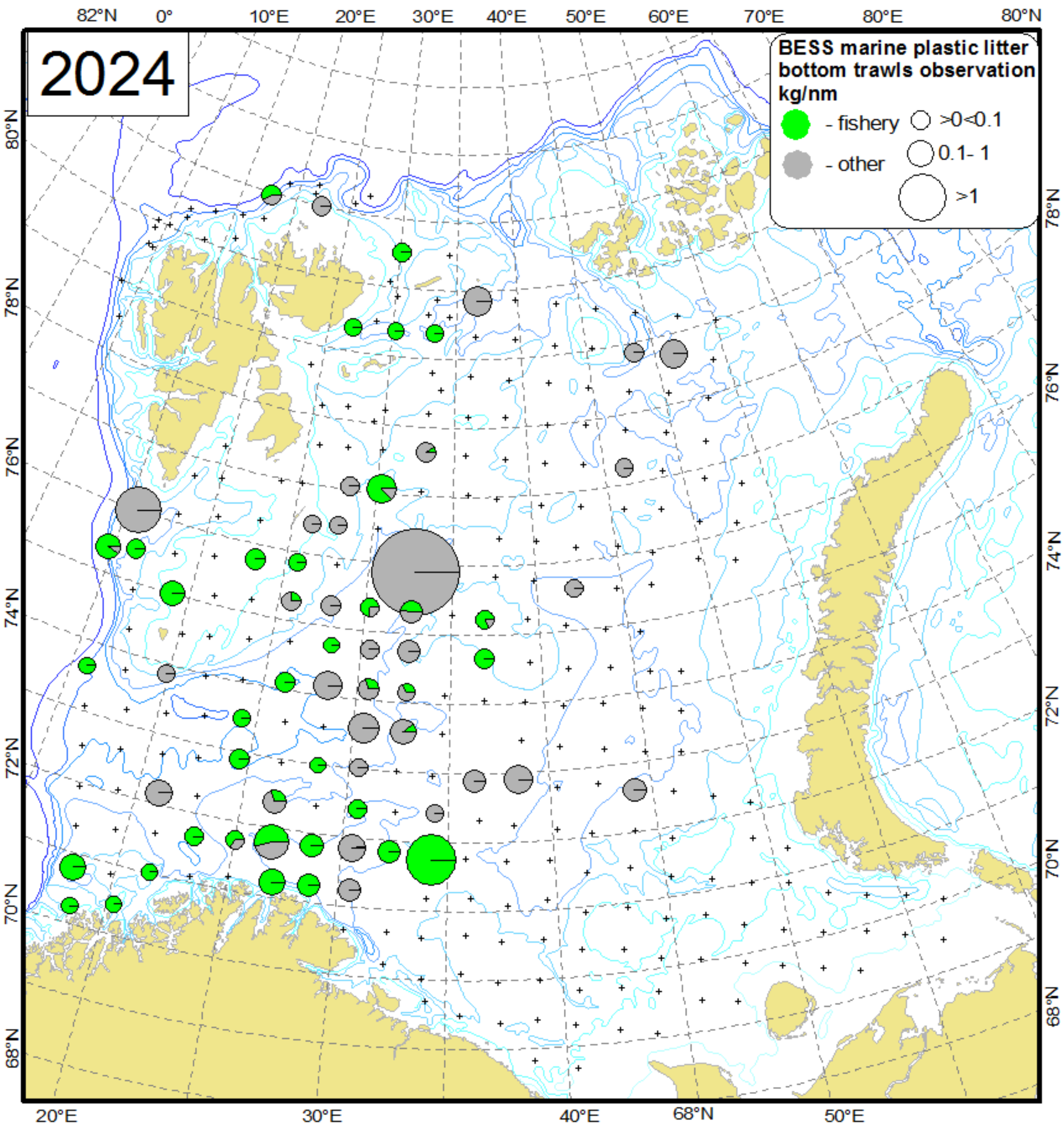

Figure 4.2.1.6 *Fishery related plastic observation versus other plastic litter collected in the bottom trawls in the BESS 2024 (kg per nm, crosses – trawl stations).*

5 - Plankton Communities, ed. 2

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5.1 Phytoplankton

Text and figures by: Sarah Lerch

Samples used to characterize phytoplankton community composition and abundance were collected from a total of 88 stations over the course of three separate cruises. Samples were collected from *Hinlopen and Vardø-Nord* Extended during the BESS between August and October. In this report we also present results that were obtained on other cruises (*Fugløya-Bjørnøya* section in June and September) but are relevant for research at BESS. Microscopy was used to identify and quantify taxa in 30 preselected stations along the section, covering multiple Barents sea sub-regions (Fig. 5.1.1). Algae-net and metabarcoding samples were also collected which can be used to qualitatively assess community composition. In total, 18 Algae-net and 55 metabarcoding samples were collected.

Samples for algal cell counts (100 ml) were taken from 10 m CTD collected water and fixed in Neutral Lugol. Microscope counts were performed following the Utermöhl (1958) method on CTD samples to quantify abundance and community composition at the IMR Flødevigen Plankton Laboratory. Qualitative Algae-net samples were collected using a vertical net tow (10 µm mesh; 0.1 m^2 opening; 30-0 m), fixed with 2 ml 20% formalin in a 100 ml bottle and stored for future use. Metabarcoding samples were collected by filtering approximately 2 l of seawater, pre-filtered with 180 µm mesh, on to 25 mm filters with a pore size of 5 µm. Samples were then stored at -80 °C for future DNA extraction and sequencing.

Microscopy algal counts include heterotrophic and autotrophic groups, these communities will therefore be referred to as microplankton in the summarized results below.

5.1.1 Results

Based on microscopy counts, the average concentration of Barents Sea microplankton in the late summer/ early fall (August-October) was 3.89×105 ± 5.68×10^5 cells l^{-1}. The average community was numerically dominated by flagellates (55%, 2.16×10^5 ± 5.91×105 cells l^{-1}), cryptophytes (14%, 5.48×10^4 ± 4.27×10^4 cells l^{-1}), and haptophytes (9%, 3.51×10^4 ± 9.03×10^4 cells l^{-1}).

Microplankton abundances and communities varied spatially across the Barents Sea in the late summer/ early fall (Figure 5.1.2). Cell concentrations varied by two orders of magnitude between stations with a minimum concentration of 2.76×10^4 cells l^{-1} and maximum of 2.89×10^6 cells l^{-1}. Higher concentration stations were generally found on the southern section of the *Vardø-N* Extended transect. The community at the highest concentration station was almost completely comprised of flagellates, other stations showed a more diverse mixture of flagellates with cryptophytes and in some cases haptophytes.

Within these data diatoms are the only purely photosynthetic group described at a high taxonomic level. During the late summer/ early fall diatom abundance was relatively low, with the most abundant stations found in the south (Figure 5.1.3). *Pseudo-nitzschia* section. *Leptocylindrus danicus*, *Proboscia alata*, and *Cylindrotheca* were numerically important at some of the higher abundance stations within the *Vardø-Nord* section.

The combination of June and September sampling along the *Fugløya-Bjørnøya* transect allows us to describe seasonal differences in microplankton cell concentrations and community composition. Average cell concentrations measured were the same order of magnitude in June (6.25×10^5 ± 5.54×10^5 cells l^{-1}) and

September ($2.28\times10^5 \pm 1.15\times10^5$ cells l^{-1}), although June samples were characterized by greater intra-station variability with particularly high cell concentrations at fixed stations 11 and 16 in June (Figure 5.1.4). At the broad taxonomic group level, the June *Fugløya-Bjørnøya* section communities were less diverse than September communities, with three stations numerically dominated by either diatoms or haptophytes (Figure 5.1.4). Diatom communities had no overlapping, abundant (> 15%), taxa between June and September (Figure 5.1.5). *Chaetoceros*, *Corethron hystrix*, and *Thalassiosira* were found exclusively in the June samples. In contrast, *Cylindrotheca*, *Pseudo-nitzschia*, *Proboscia alata*, and *Guinardia delicatula* were found exclusively in September.

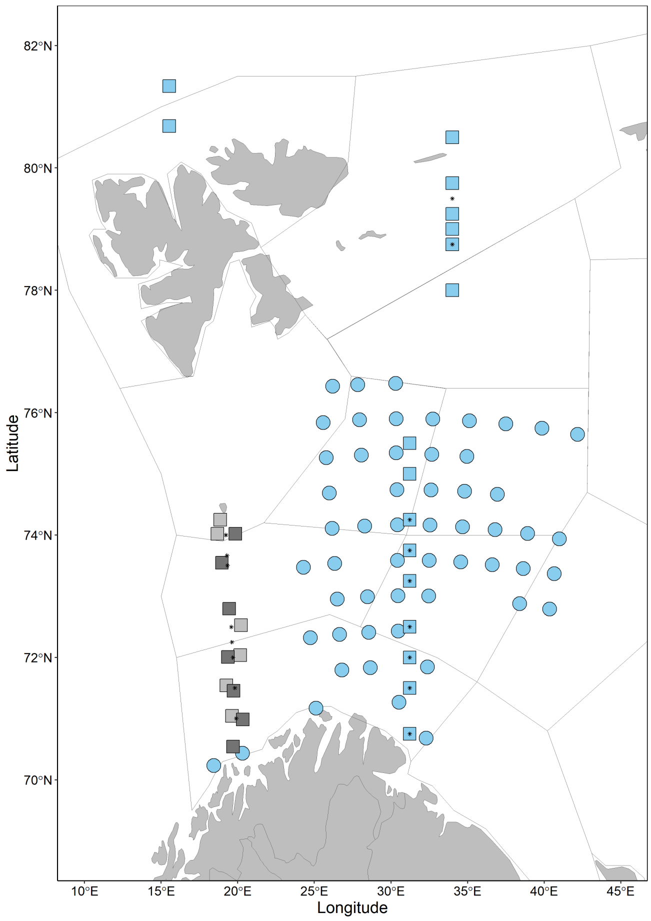


Figure 5.1.1. *Map showing stations where phytoplankton samples were collected. Shapes indicate sampling activities at a given station: circle- metabarcoding sample collection, square- microscopy sample collection and analysis, star: algae-net sample collection. Color indicates the cruise when sampling occurred, blue: ecosystem, dark gray: September transect cruise, light gray: June transect cruise. Italicized labels indicate fixed sections. Outlined and labeled areas indicate Barents Sea sub-regions. Station locations along Fugløya-Bjørnøya section are shifted to reduce overlap of samples collected during separate cruises.*

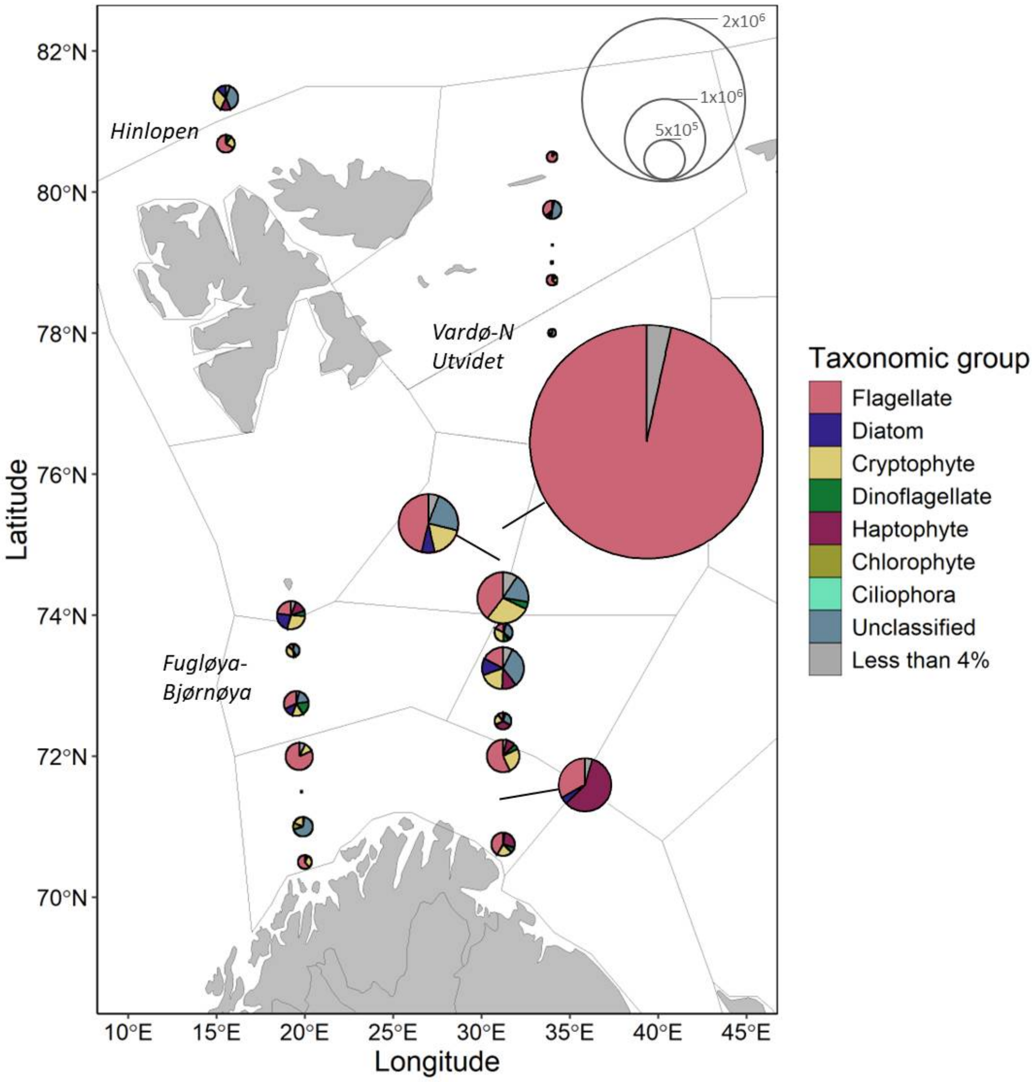


Figure 5.1.2. *Map showing microplankton community composition and abundance for samples collected August-October 2024. Pie chart radii scale to cell concentrations in cells per liter based on key. Divisions within pie charts show the contributions from broad taxonomic groups. Italicized labels indicate fixed sections. All groups which comprised < 4% of the community are summed.*

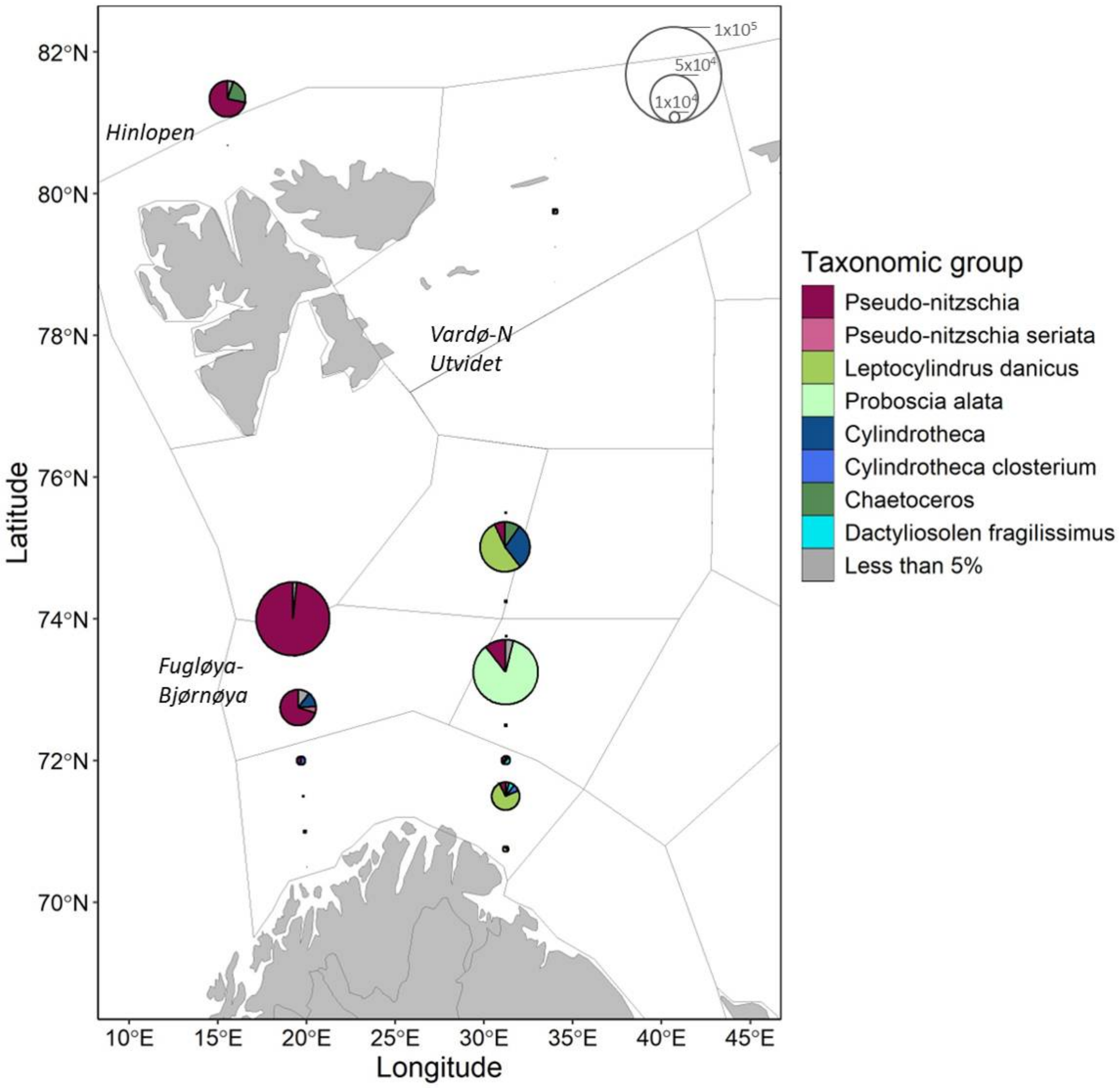


Figure 5.1.3. *Map showing diatom community composition and abundance for samples collected August-October 2024. Divisions within pie charts show taxonomic groups to the highest possible resolution. Pie chart radii scale to cell concentrations in cells per liter based on key. All groups which compromised < 5% of the community are summed.*

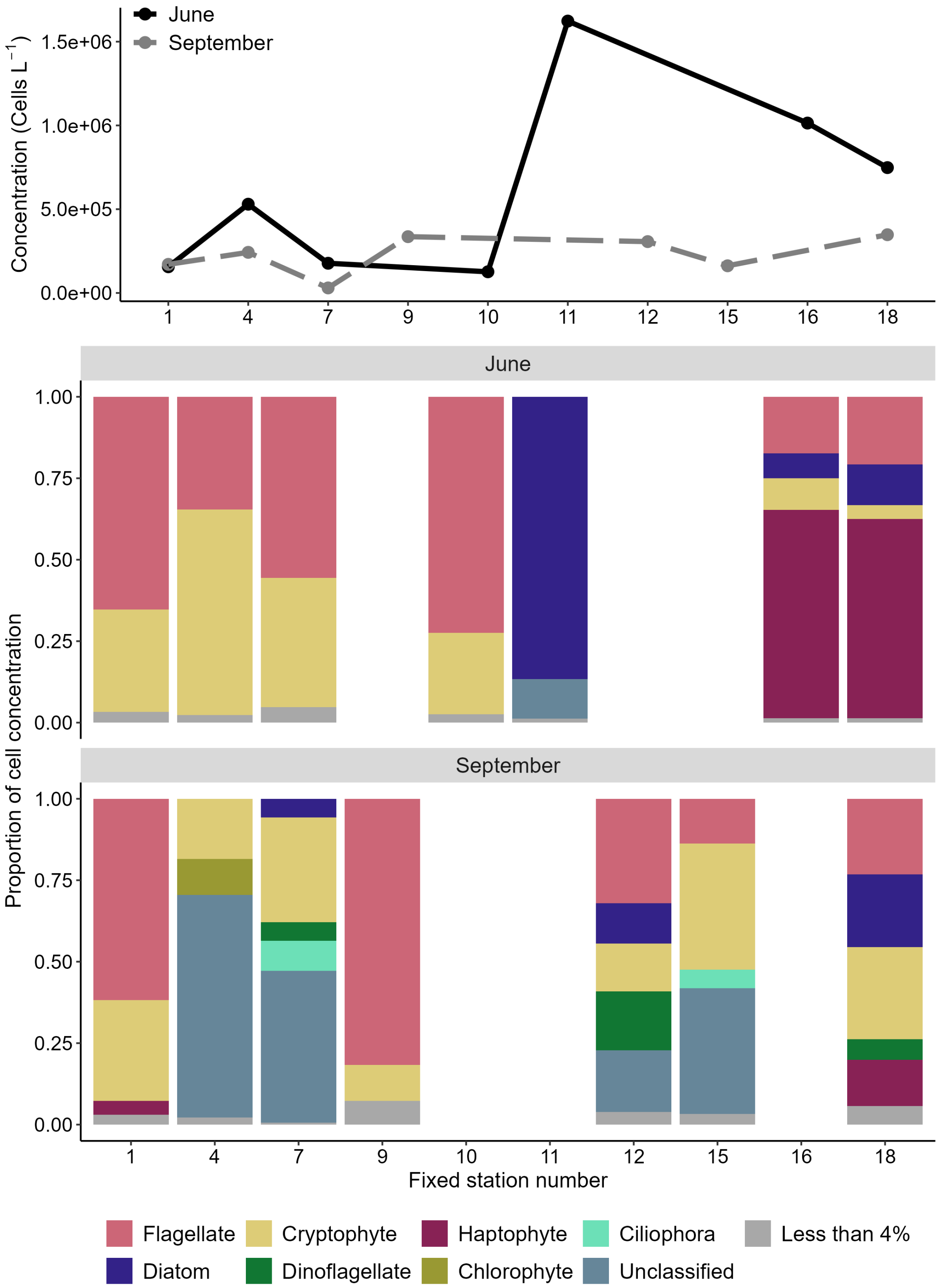


Figure 5.1.4. *Plots showing patterns in microplankton abundance (top) and community composition (bottom) along the Fugløya-Bjørnøya section during June and September in 2024. All groups which comprised < 4% of the community at a given station are summed for ease of visualization. Fixed station numbers increase as station locations move north.*

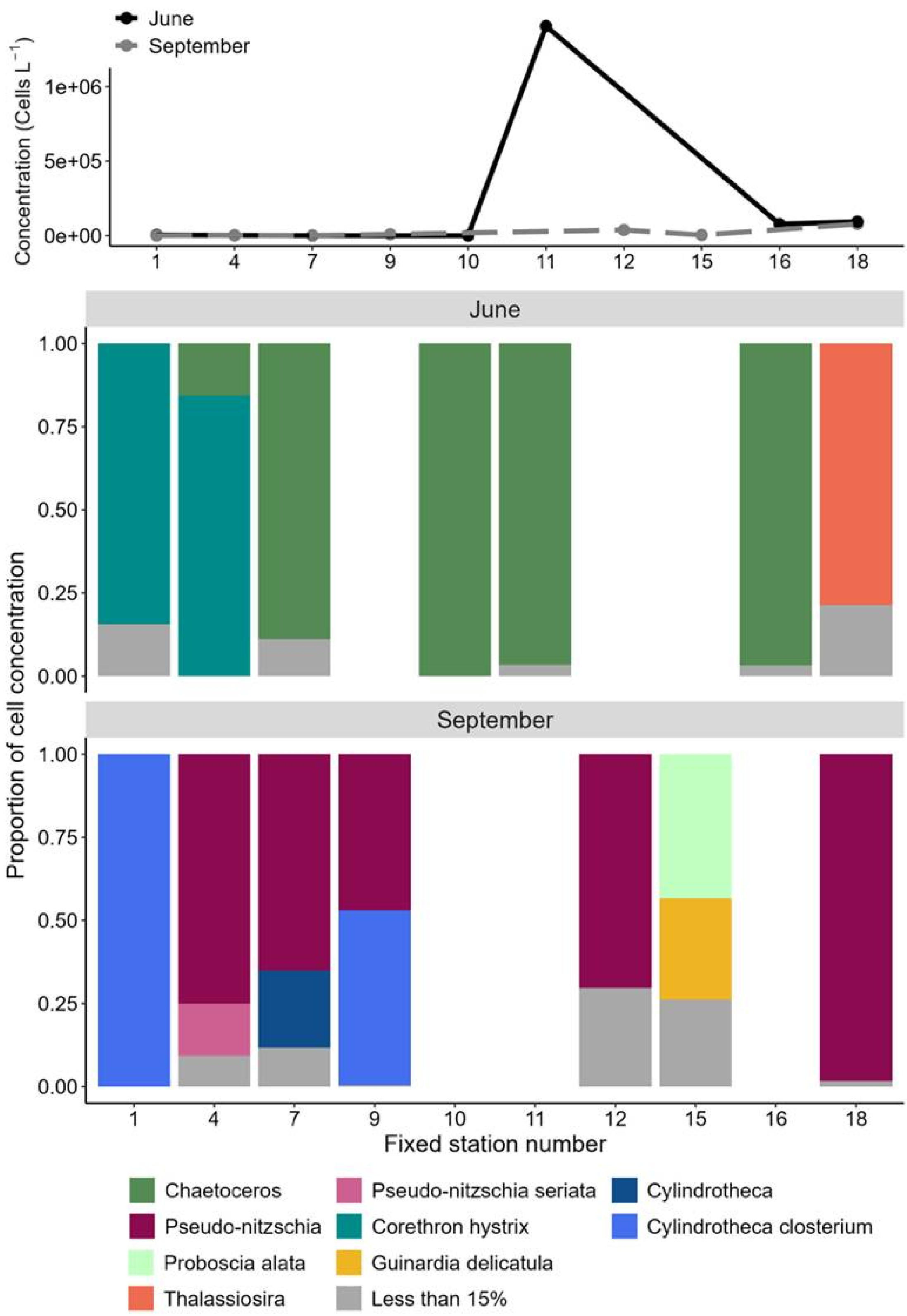


Figure 5.1.5. *Plots showing patterns in diatom abundance (top) and community composition (bottom) along the Fugløya-Bjørnøya section in June and September 2024. Taxonomy is shown at the highest possible resolution. All groups which compromised to < 15% of the community at a given station are summed for ease of visualization. Fixed station numbers increase as station locations move north.*

5.2. Mesozoplankton biomass and geographic distribution

Text by: Espen Bagøien and Irina Prokopchuk

Figures by: Espen Bagøien

5.2.1 Data collection

Mesozooplankton sampling stations during the BESS in 2024 are shown in Fig. 5.2.1. In the Norwegian sector the WP2 net (opening area ~ 0.25 m^2) was applied, while in the Russian sector the Juday net (opening area ~ 0.11 m2) was used. Both gears were rigged with nets of mesh-size 180 µm and hauled vertically from near the bottom to the surface. The WP2 and Juday nets provide roughly comparable results with respect to mesozooplankton biomass and species composition (Skjoldal et al., 2019). The Norwegian biomass samples are dried before weighing, while the Russian samples are preserved in 4% formalin and their wet weight determined. Dry-weight is then estimated by dividing the wet-weight with a factor of 5.

The time-periods for sampling in the Russian and Norwegian sectors were similar this year (Fig. 2.4).

The spatial distribution of total mesozooplankton biomass shown in Fig. 5.2.1 is based on a total of 293 stations, of which 161 were located in the Norwegian sector and 132 in the Russian sector. Within the Norwegian sector, the average biomass was 6.2 (± 4.8 SD) g dry-weight m^{-2}. The average zooplankton biomass for the samples within the Russian sector was 7.5 (± 4.5 SD) g dry-weight m^{-2}. All stations shown in Fig. 5.2.1 are included in the 2024 biomass averages here presented. Note that 10 stations in the central Barents Sea were sampled both by IMR and PINRO (not shown). In these specific cases the IMR data were excluded from Fig. 5.2.1 as well as the calculations of biomass given above.

Comparison of average biomasses across years is vulnerable to differing area coverages. Challenges in covering the same area over a series of years are inherent in such large-scale monitoring programs, and interannual variation in ice-cover and logistical issues are two of several reasons for this. To improve the regularity of the sampling grid across the survey area in 2024, stations belonging to the *Hinlopen*-section north of Svalbard/Spitsbergen as well as the *Vardø-North* section were omitted when calculating average biomass (excluded from Fig. 5.2.1). Differences in spatial coverage among years, as well as spatial variability in station density within the survey region will impact biomass estimates, and particularly so in an environment characterized by large-scale patterns in biomass distribution. Hence, the average biomasses for the Norwegian and Russian sectors as presented here are not directly comparable with those from other years.

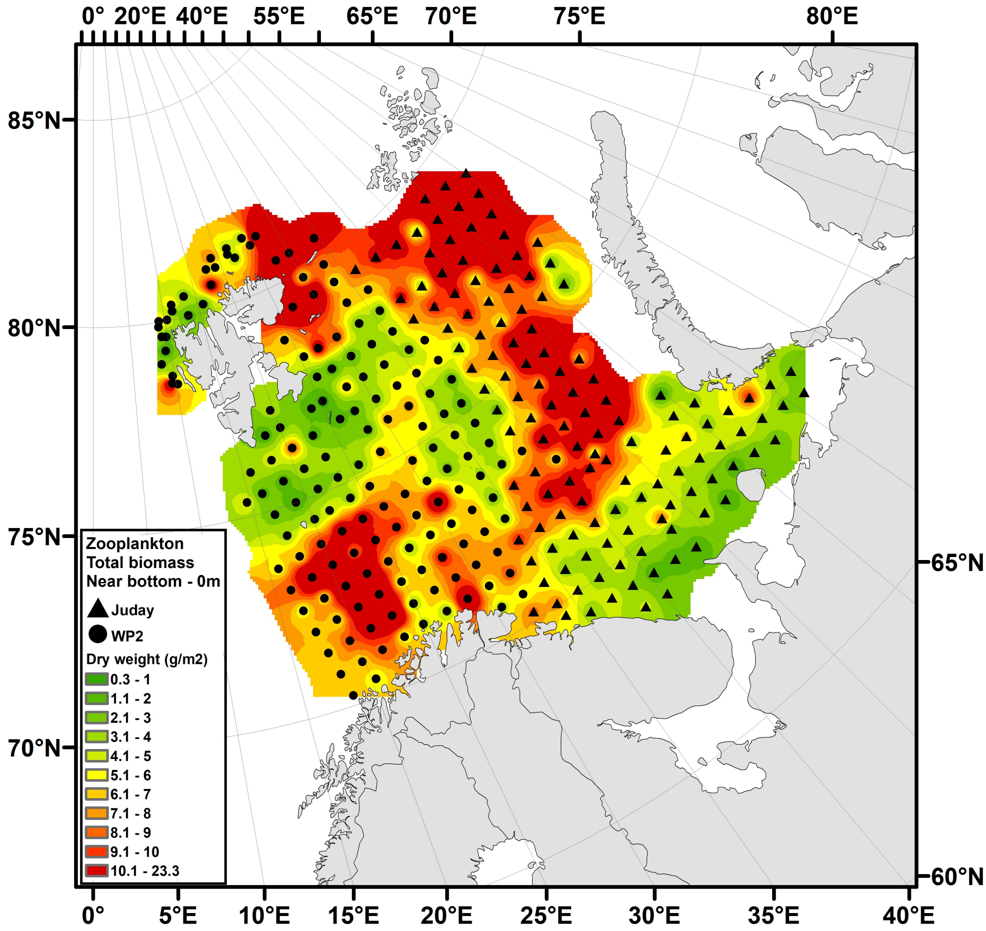


Figure 5.2.1. *Distribution of total zooplankton biomass (g dry-weight m^{-2}) from near-bottom to surface in the Barents Sea during BESS 2024 – based on a total of 293 stations. The data visualized were collected by WP2 and Juday nets with mesh-size 180 µm. Interpolation was made in ArcGIS v.10.8, module Spatial Analyst, using inverse distance weighting (IDW).*

Such challenges fall outside the scope of this cruise report, but are addressed in other fora, for instance by analysing time-series within spatially consistent sub-areas.

The overall distribution patterns show similarities across years, although some interannual variability is apparent. In 2024 we observed the familiar pattern of comparatively high biomasses in the southwestern region, and north and north-east of Svalbard/Spitsbergen, as well as the deeper parts of the southeastern region. The biomasses were relatively low in the central regions including the bank areas, and very low in the southeastern corner of the Barents Sea (Fig. 5.1.1).

Several factors may impact the levels of zooplankton biomass in the Barents Sea;

- Advective supply of zooplankton from the Norwegian Sea
- Local zooplankton production rates – which are linked to temperature, nutrient conditions and primary production rates
- Predation from carnivorous zooplankters (jellyfish, krill, hyperiids, chaetognaths, etc.)
- Predation from planktivorous fish including capelin, young herring, polar cod, juveniles of cod, saithe, haddock, and redfish
- Predation from marine mammals and seabirds

5.3.1 Distribution and biomass of euphausiids

Authors: E. Eriksen, A. Dolgov, D. Prozorkevich, S. Karlson and T. Prokhorova

Figures by: S. Karlson and Eriksen E.

Biomass estimates were calculated by different software during the last four decades: Excel (up to 2017) and R (since that). The new 15 subareas, based on similar environmental status, were used since 2018 (Fig. 5.3.1.1). These areas were used to get more detailed information about the distribution of the krill within the survey area.

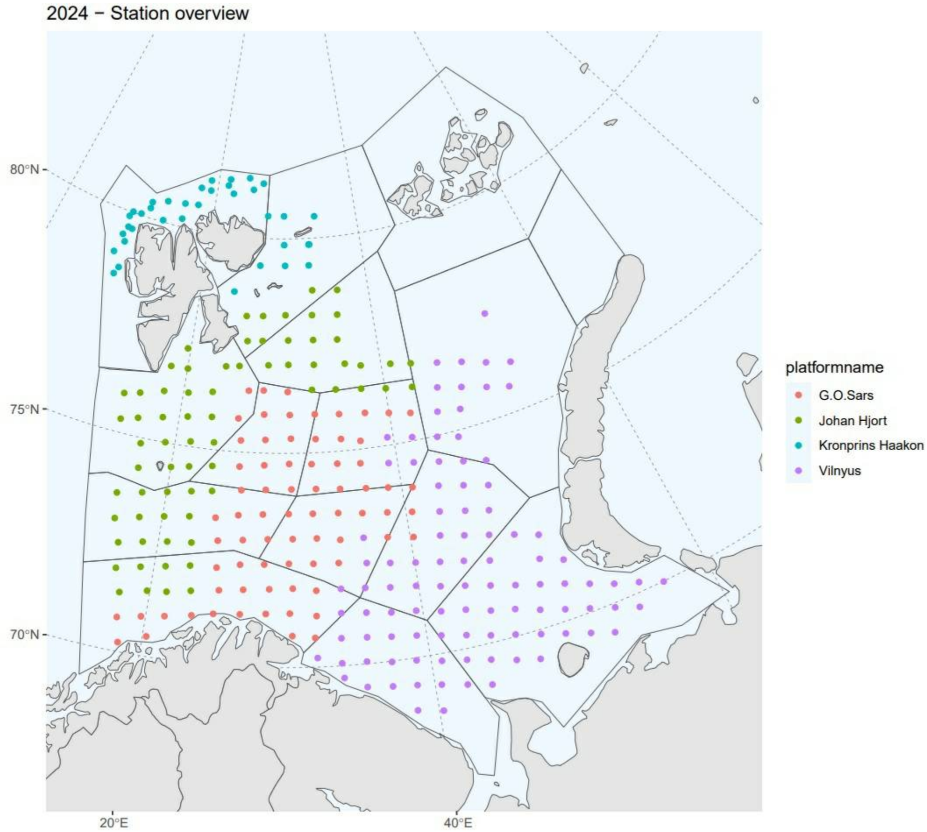


Figure 5.3.1.1. *Map showing subdivision of the Barents Sea into 15 subareas (polygons)and the BESS coverage in 2024.*

In 2024, euphausiids, also known as krill, were widely distributed in the Barents Sea (Fig. 5.3.1.2). The biomass values in the upper 60 m are presented as grams (wet weight) per square meter (g/m^2). In 2024, the night catches with an average of 1.71 g/m^2 were much lower than long term mean (7.1 g/m^2).

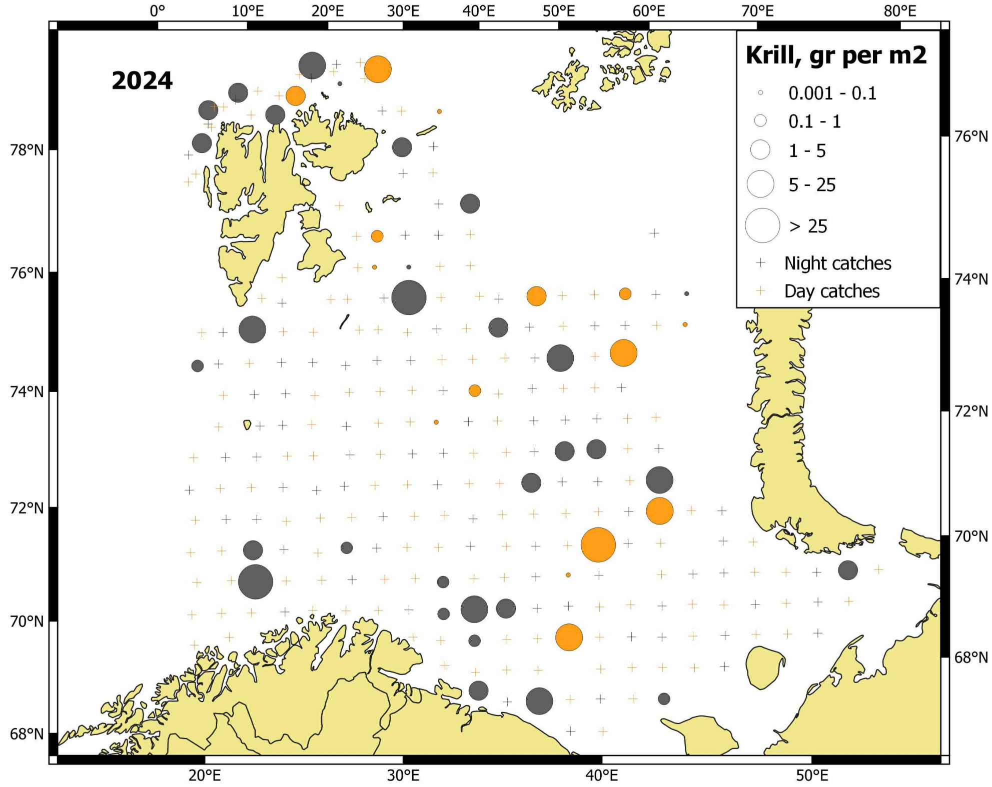


Figure 5.3.1.2. *Krill distribution, based on pelagic trawl stations covering the upper water layers (0-60 m) in August-October 2024.*

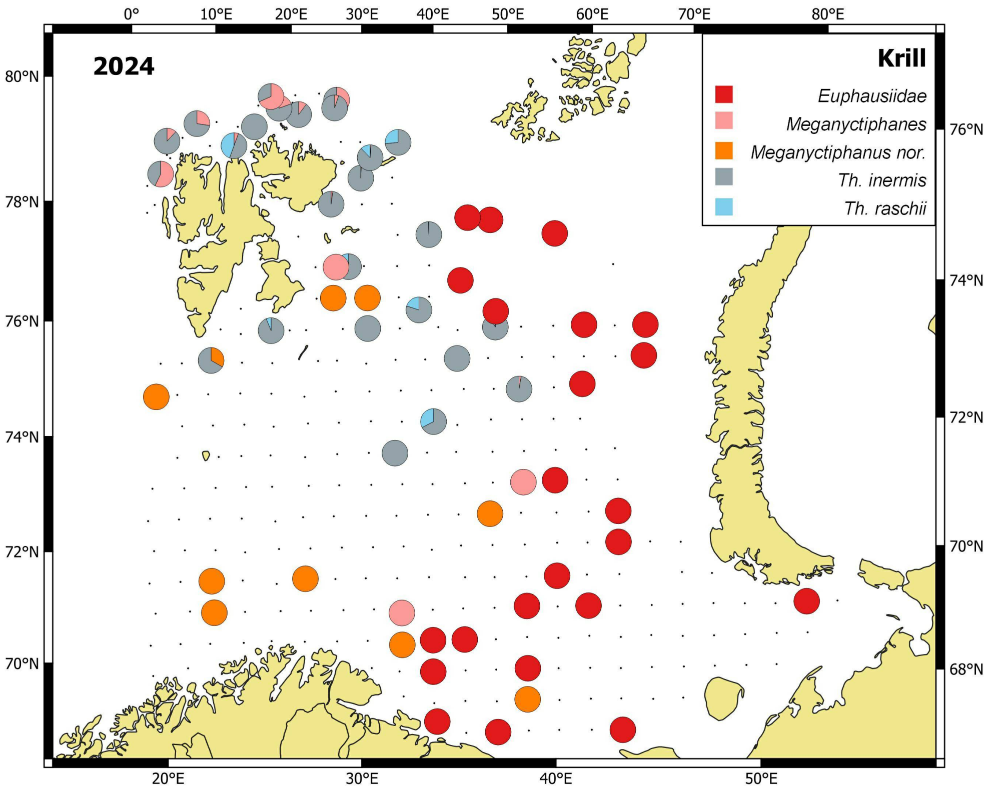


Figure 5.3.1.3. *Krill species distribution, based on pelagic trawl catches covering 0-60min August-October 2024.*

Based on the euphausiid species identification in 2024, *Meganyctiphanes norvegica* were widely distributed, while *Thysanoessa inermis* and *Thysanoessa raschii* were mainly observed in the northcentral and northern areas (Fig. 5.3.1.3). Similar to 2023, the smaller *T. longicaudata* were not found in 2024.

The number of night stations in 2024 was 155, while the number of day stations was 152. During the night, most krill migrate to the upper water layer for feeding and are therefore more available for the trawl. The calculated total biomass of krill was very low (1.9 million tonnes), that was 5 times lower than long term mean (10.5 million tonnes for the period 2003-2024).

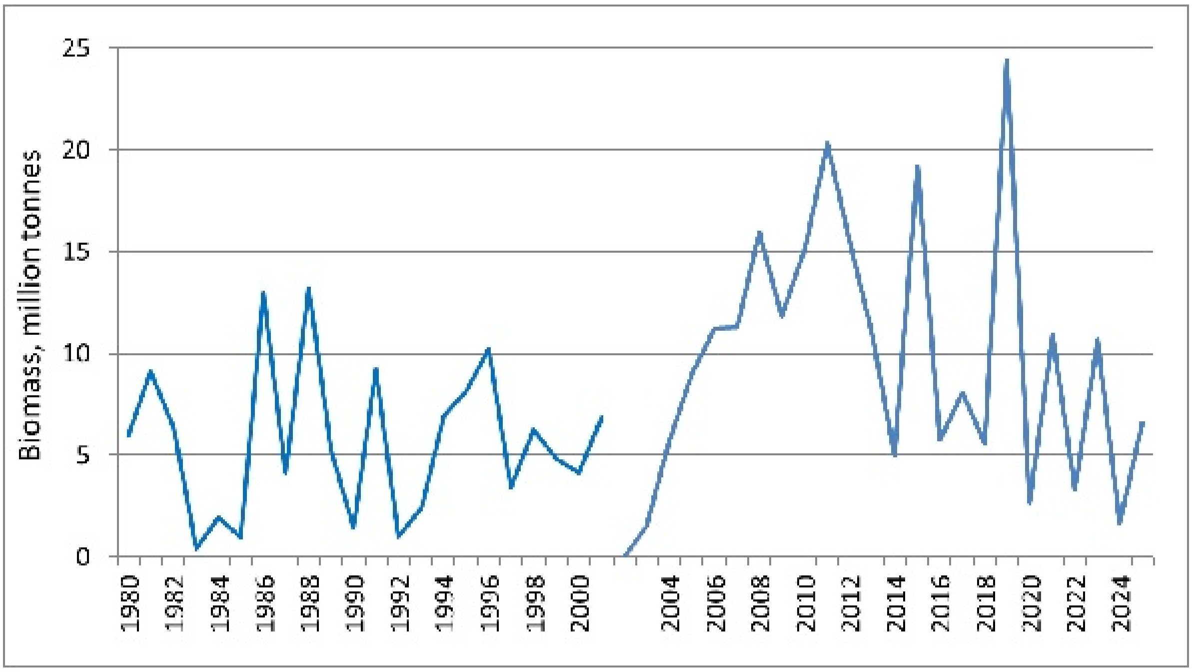


Figure 5.3.1.4. *Estimated total biomass of euphausiids in the Barents Sea in August-October 1980-2024 based on pelagic night trawl catches covering the upper water layers (0-60 m). Estimates for 2002 are missing due to mistakes with the weight of krill. Estimate in 2023 was strongly influenced by few very high catches and therefore overestimated.*

5.3.2 Distribution and biomass indices of pelagic amphipods (mainly Hyperiids)

Author(s): E. Eriksen, A. Dolgov, D. Prozorkevich, S. Karlson and T. Prokhorova

Figures by: S. Karlson and Eriksen E.

Estimation of pelagic amphipods biomass for the Barents Sea was performed in R (see above) and presented here for the period 2003-2024.

In 2024, amphipods were found near Svalbard/Spitsbergen and in southwestern area (Fig. 5.3.2.1).

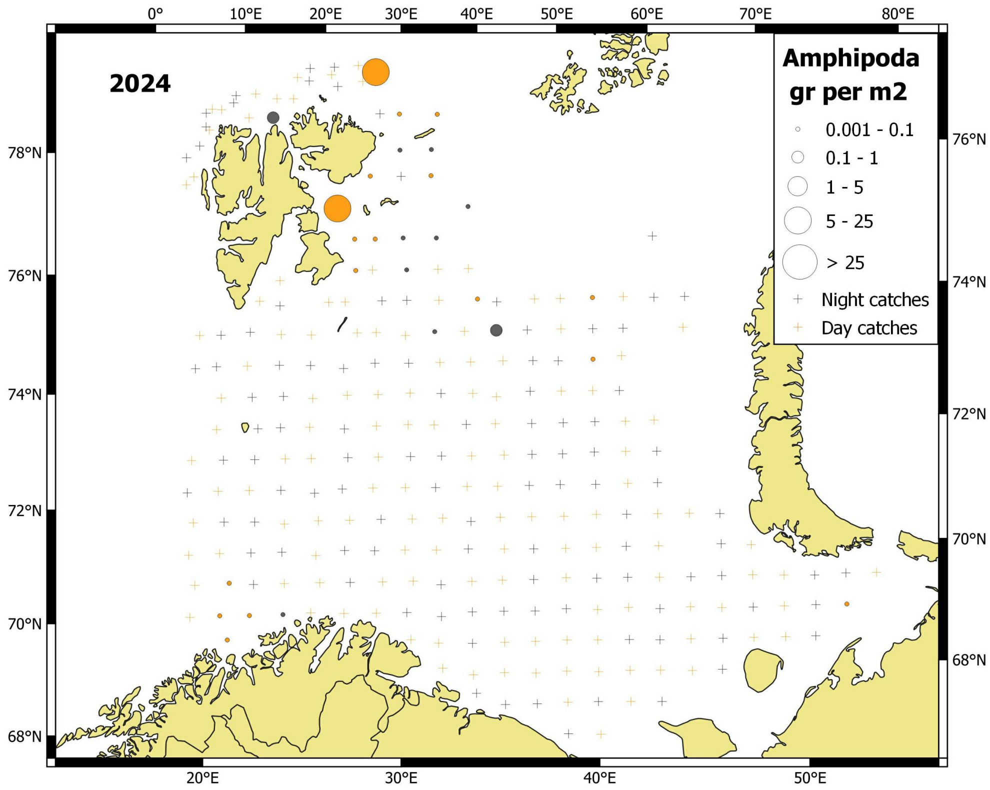


Figure 5.3.2.1. *Amphipods distribution, based on trawl stations covering the upper water layers (0-60 m), in the Barents Sea in August-October 2024.*

In 2024, amphipods were taken Svalbard/Spitsbergen were mostly represented by the Arctic species *Themisto* and subarctic *Themisto abyssorum* (Fig. 5.3.2.2). The cosmopolitan species *Hyperia galba* were found in both areas.

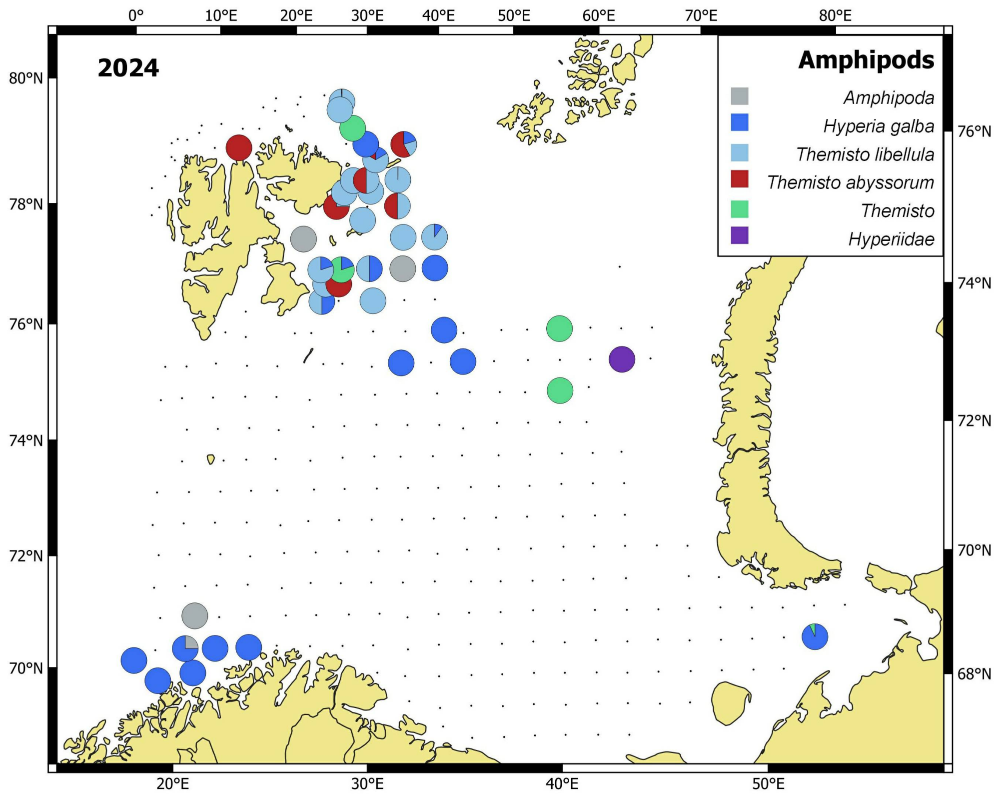


Figure 5.3.2.2 *Distribution of pelagic amphipod species, based on pelagic trawl catches covering 0-60m, in the Barents Sea in August-October 2024.*

The calculated total biomass of pelagic amphipods in 2024 in the upper 60 m was 60 thousand tonnes (Fig. 5.3.2.3).

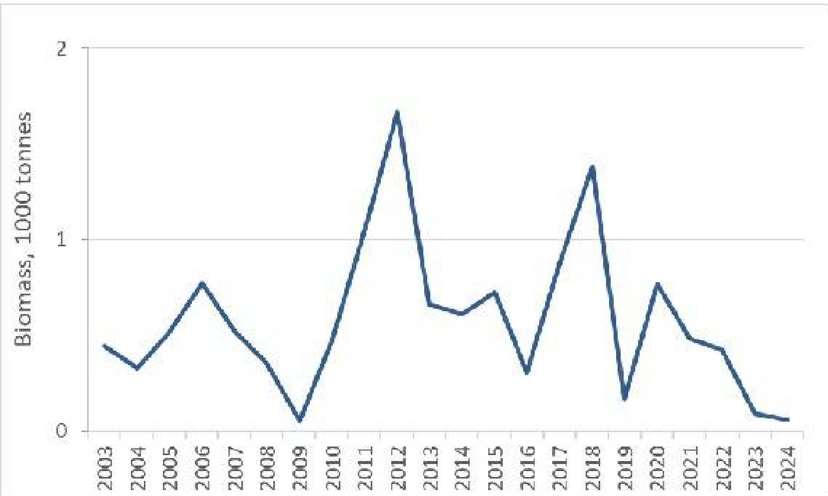


Figure 5.3.2.3 *Estimated total biomass of pelagic amphipods in the Barents Sea in August-October 2024 based on pelagic trawl catches covering the upper water layers (0-60 m). Estimates in 2003-2024 were calculated based on a subarea's average catches and covered area within the subarea (Fig. 5.3.1.1).*

5.3.3. Distribution and biomass indices of jellyfish

Text by E. Eriksen, D. Prozorkevich, T. Prokhorova and A. Dolgov

Figures by E. Eriksen and Stine Carlson

The biomass of gelatinous zooplankton was calculated using SAS (for the 23 fisheries subareas, 1980-2017). Since 2018 the 13 subareas, based on environmental status and bathymetry, were used to present spatial variation of jellyfish abundance and biomass (Fig. 5.3.3.1.). R-script has been developed for three years, and during the last year som faulty calculations were corrected. Thus, the biomass shown in previous reports may slightly differ from the latest one.

Here, we presented the time series for biomass indices calculated by SAS (1980-2017) and by R (2018-2025).

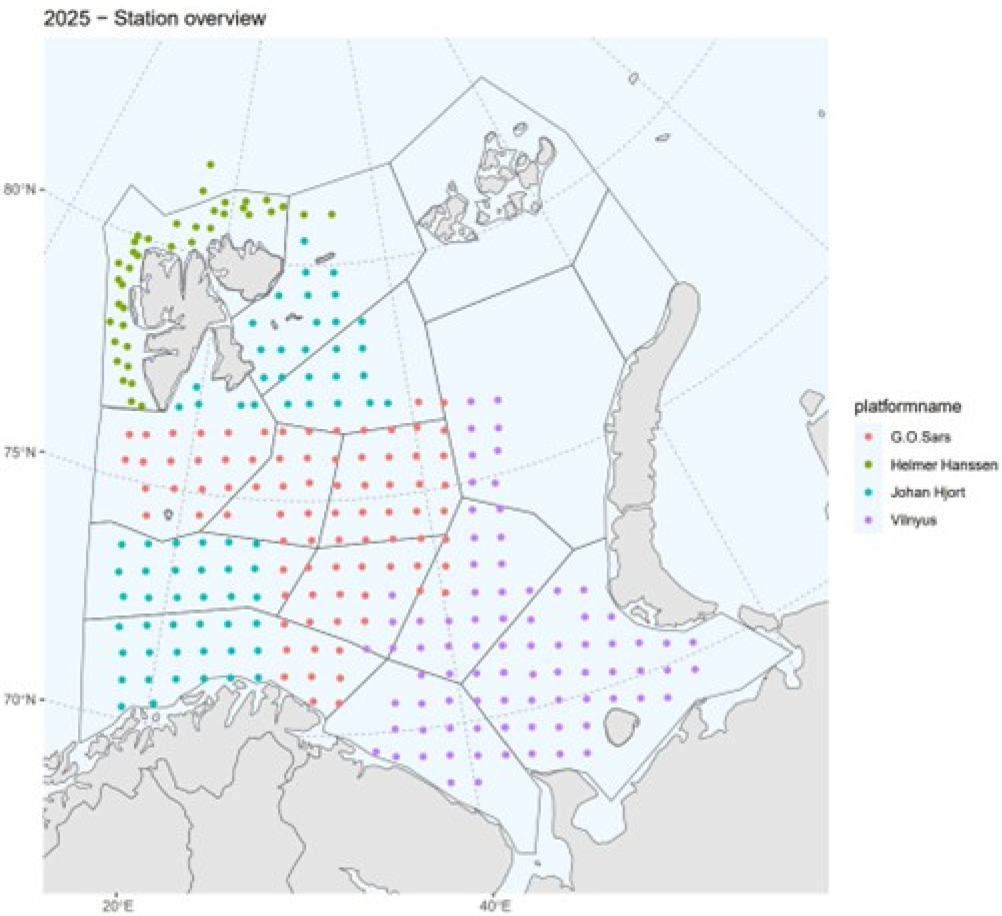


Figure 5.3.3.1. *Overview of strata and stations taken during the BESS 2025.*

In August-October 2025, lion's mane jellyfish (*Cyanea capillata*; Scyphozoa) was the most common jellyfish species that were found at 245 of 344 stations with an average biomass of 6.7 tonnes per sq. nmi (Fig. 5.3.3.2). Higher densities (> 10 tonnes per nmi) were found widely in the central and southern Barents Sea (Fig. 5.3.3.2).

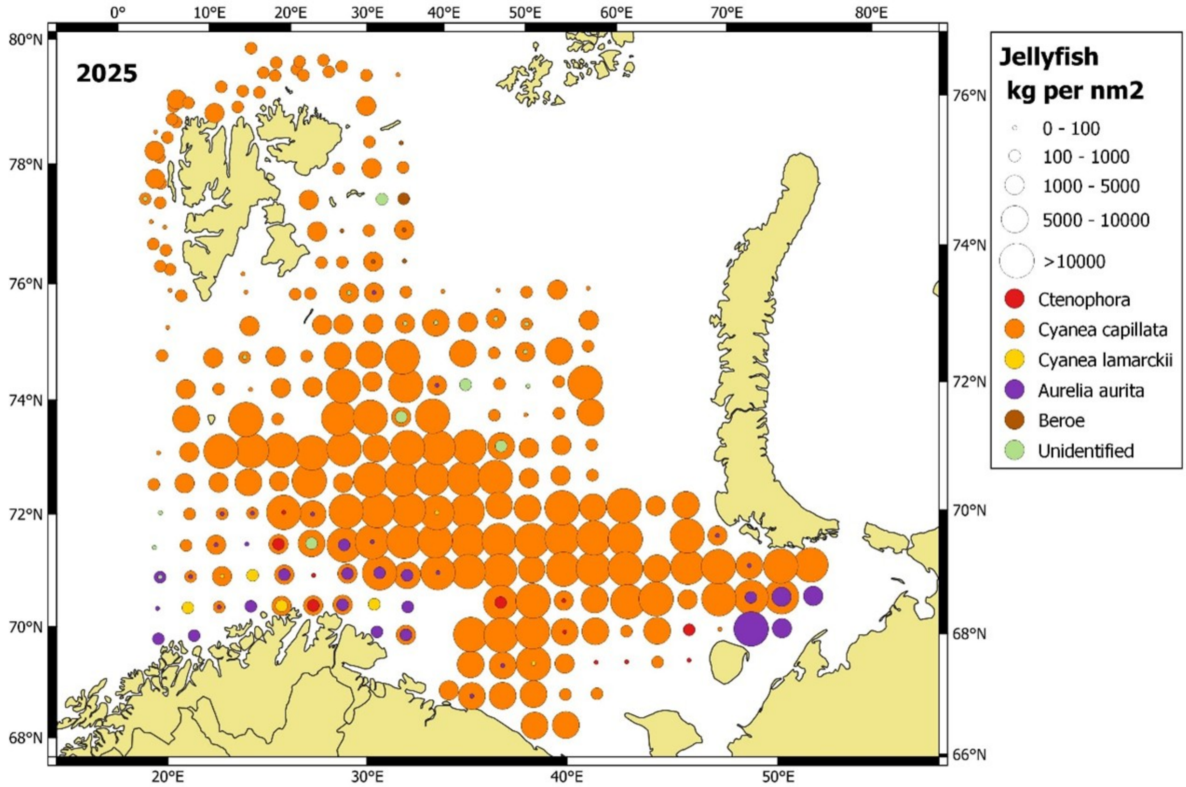


Figure 5.3.3.2. *Distribution of jellyfish species (wet weight; kg per sq nmi) in the Barents Sea, August-October 2025.*

The moon jellyfish (*Aurelia aurita*) was found at 39 stations in the southern Barents Sea with an average biomass of 14.6 tonnes per sq nmi (Fig. 5.3.3.2). Such a high biomass of A. aurita had not been observed before.

Blue stinging jellyfish, *Cyanea lamarckii*, was found at 25 stations in the southwestern Barents Sea with average biomass 72.4 kg per sq nmi. *C. lamarckii* has been observed regularly in the Barents Sea in recent years and the presence of this warm-temperate species may be linked to the inflow of Atlantic water masses.

Ctenophores were found at 18 stations in the southern Barents Sea, and at six of these stations the ctenophores were also identified to the genus level (*Beroe* sp.), commonly known as the cigar comb jellies. The average biomass was 60 kg pe sq nmi and at five of these stations the calculated biomass was between 77 and 348 kg per sq nmi, that was also unusual.

Biomass indices were calculated as total, for large jellyfish, dominating by *C. capillata*, small jellyfish dominating by *A. aurita* and undetermined jellyfish for the period 2004-2025. In 2025, total jellyfish biomass in the Barents Sea was much lower than in previously two years and was 2.746 million tonnes (Fig. 5.3.3.3). However, the proportion of small jellyfish increased from a few to 25% of the total jellyfish biomass index. Jellyfish biomasses dominated by biomasses of large jellyfish (2.0 million tonnes), although biomass of small jellyfish (dominated by *Aurelia aurita*) was the highest recorded (703 thousand tonnes, Fig. 5.3.3.3).

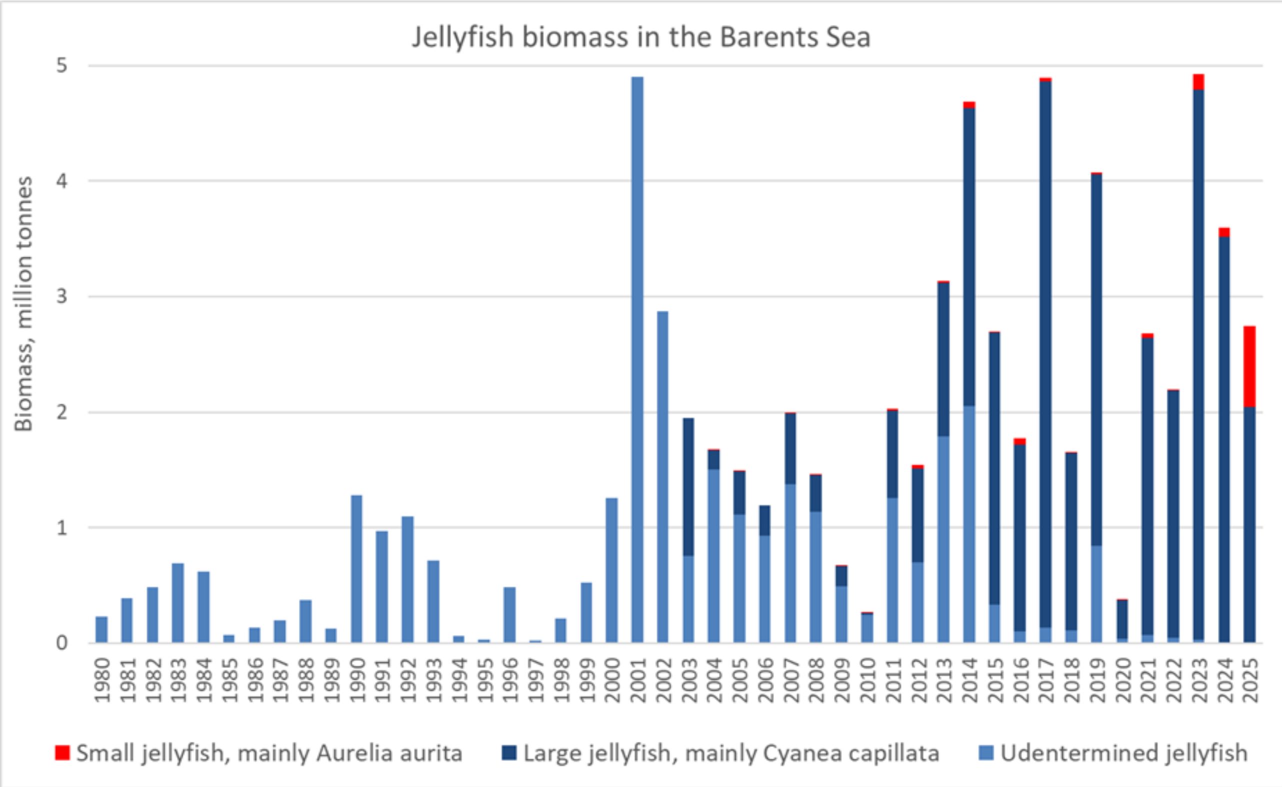


Figure 5.3.3.3. *Total biomass of jellyfish in the Barents Sea in August-September 1980-2025. Large jellyfish were dominating by C. capillata, small jellyfish dominated by A. aurita, and other jellyfish (found occasionally). Biomass estimates in 2018, 2020 and 2022 were underestimated due to lack of coverage.*

Geographical distribution of jellyfish, mainly *C. capillata*, showed decrease in all areas, except Bear Island Trench in 2025 (Fig. 5.3.3.4).

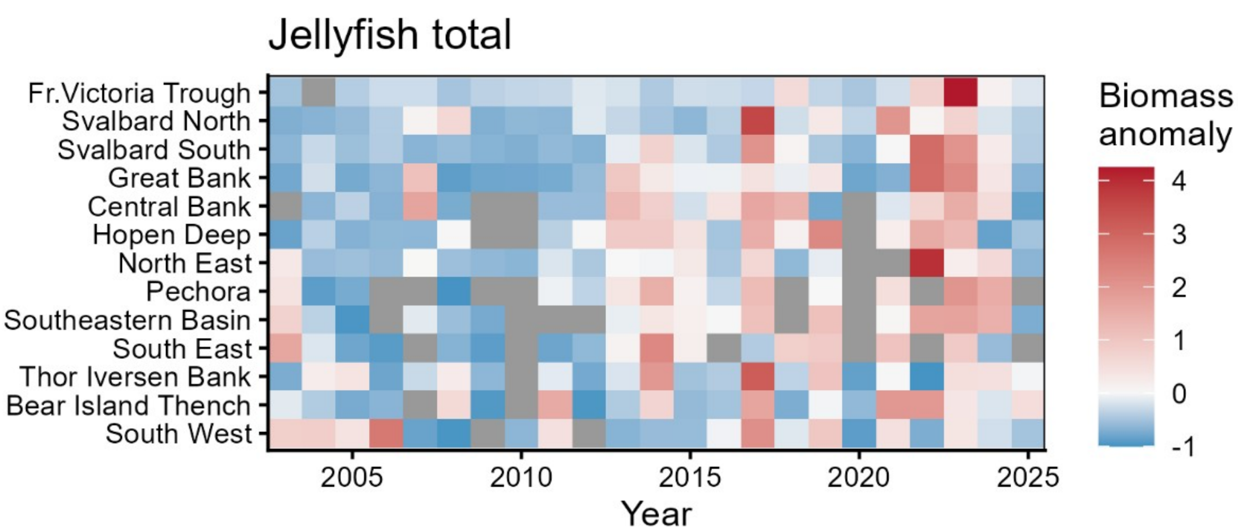


Figure 5.3.3.4. *Geographical distribution of jellyfish, mainly C. capillata in 13 polygons in August-September 2003-2025.*

6 - Fish Recruitment, ed. 2

Author(s): Elena Eriksen (IMR), Dmitry Prozorkevitch (VNIRO-PINRO) and Tatjana Prokhorova (VNIRO-PINRO)

Area coverage and estimation

In 2024, the coverage of the zero-group fish was suboptimal, particularly for polar cod due to insufficient coverage in parts of the eastern Barents Sea (Fig. 6.1). Incomplete coverage of the zero-group fish may impact the abundance and biomass of polar cod. The abundance and biomass of the zero-group fish were previously calculated using various software packages: SAS&MSAccsess, MatLab, and R. A calculation methodology using StoX software is currently being developed. The next report is expected to include results and new time series. This report shows time series for some important commercial species.

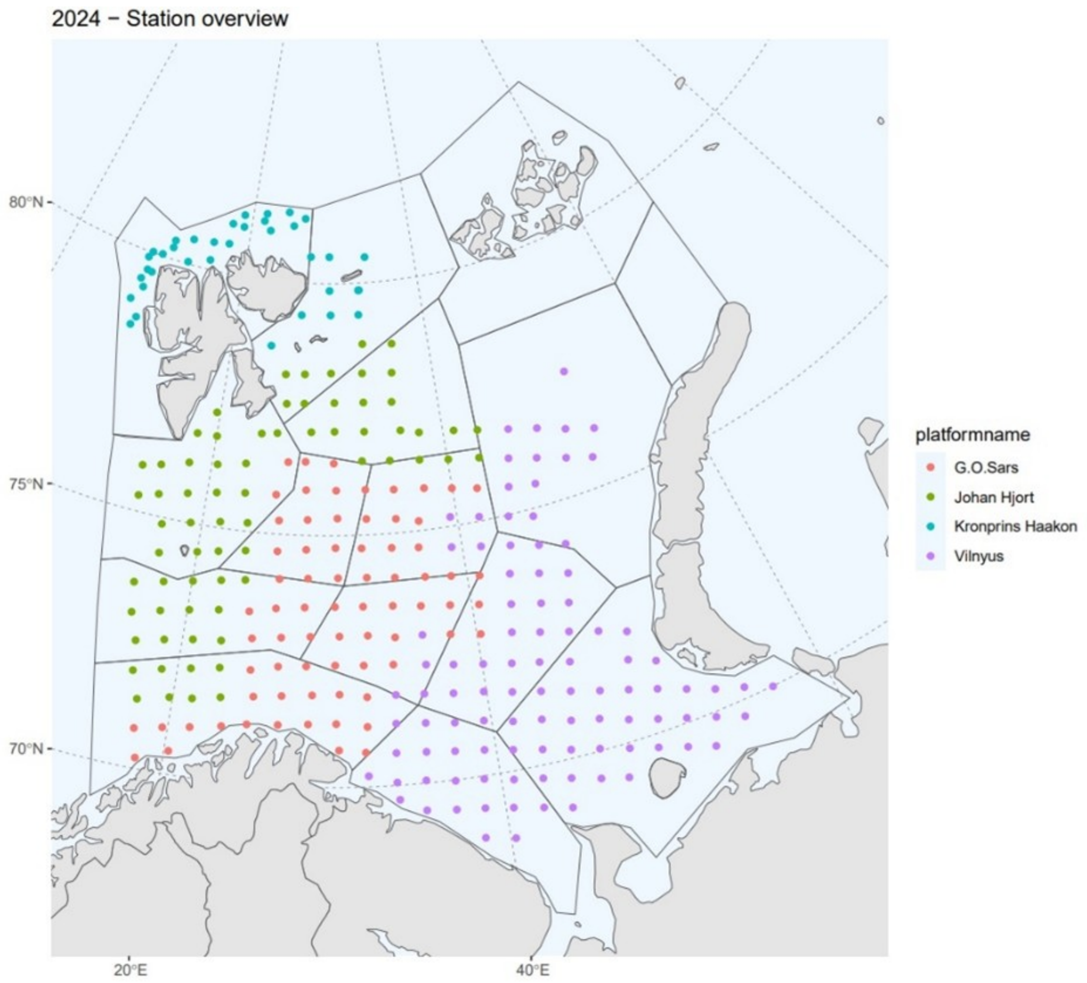


Figure 6.1. *Map showing spatial coverage of the 0-group fish in the Barents Sea in 2024. Colored dots indicated vessel coverage, while grey lines 15 subareas (regions) used in estimations.*

6.1 Capelin (*Mallotus villosus*)

Capelin were distributed widely at low densities (Fig. 6.1.1), which indicating a below average year class of capelin in 2024 (Fig.6.1.2). No capelin were observed in the central area.

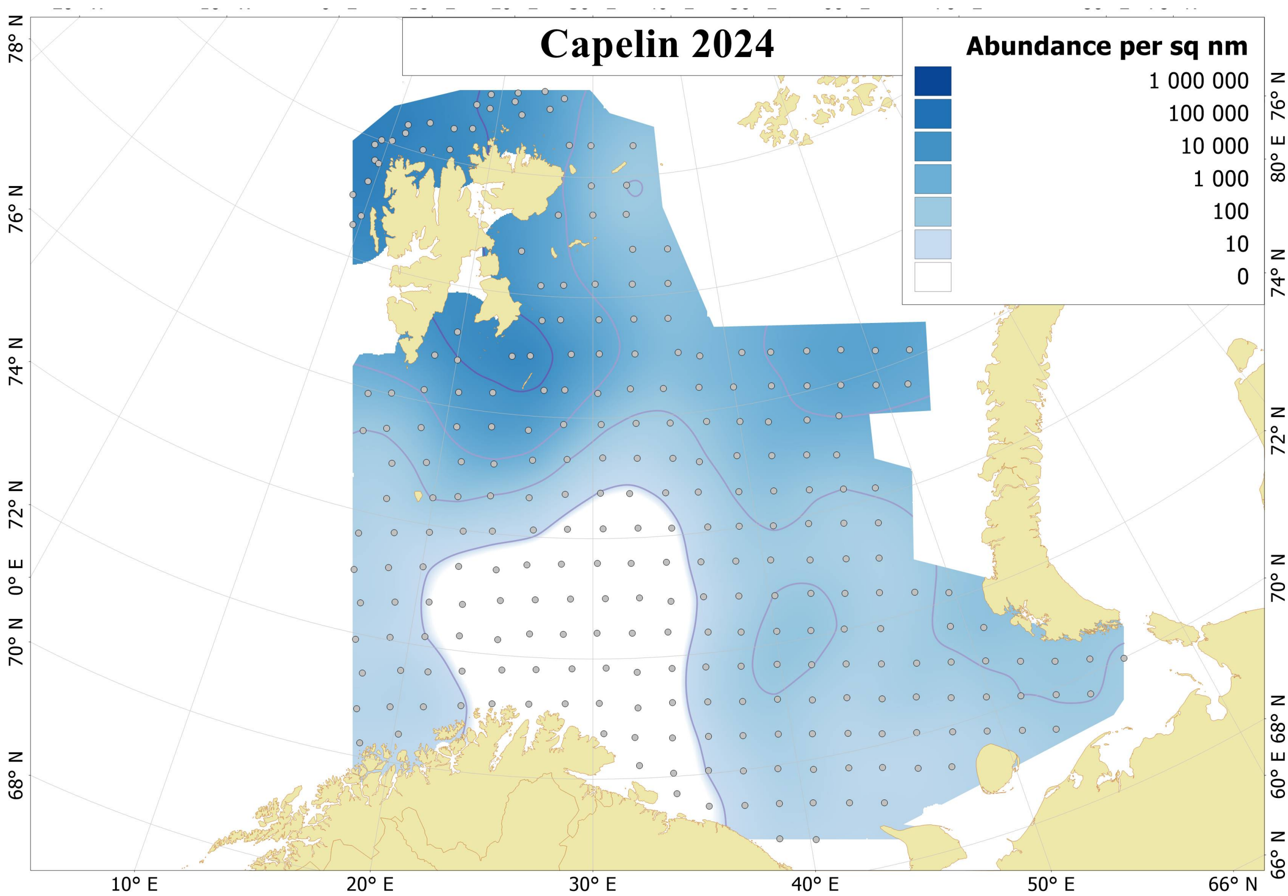
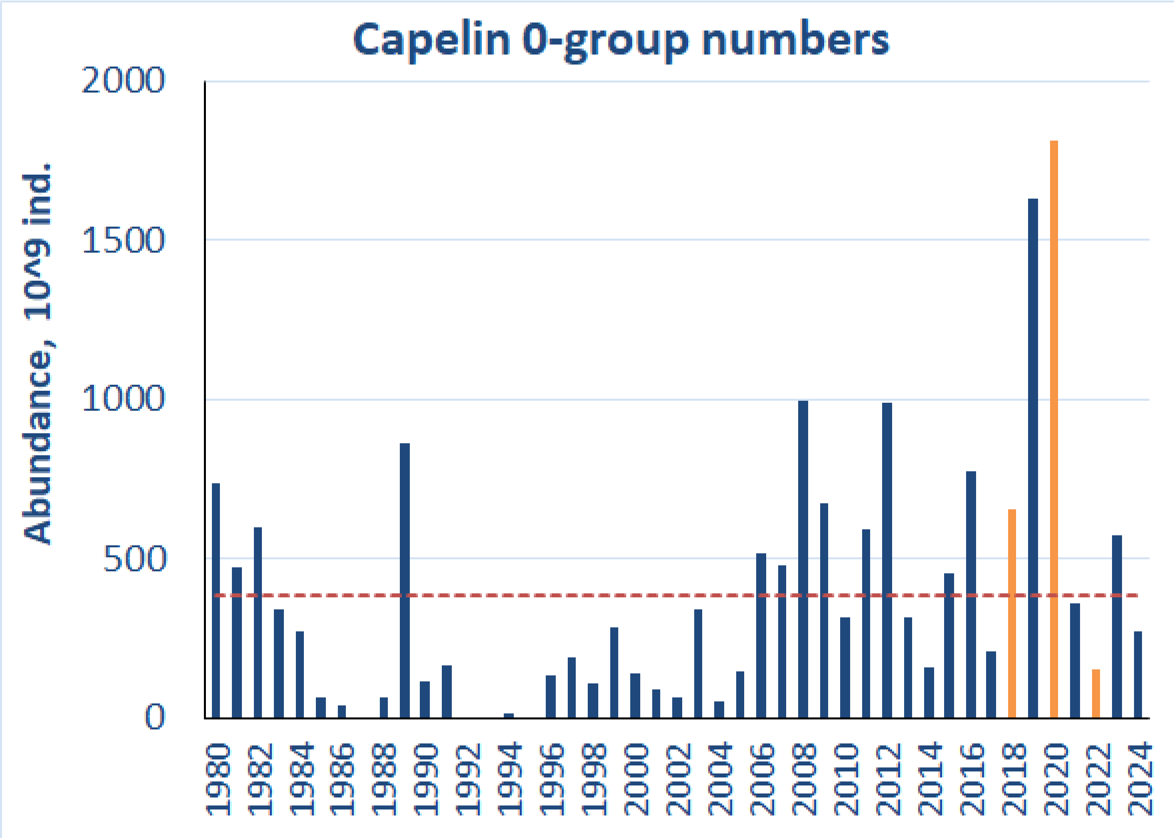


Figure 6.1.1. *Distribution of 0-group capelin, August-September 2024. Abundance is corrected for capture efficiency (Keff). Dots indicate sampling locations.*



igure 6.1.2. *Estimated abundance of 0-group capelin corrected for capture efficiency (Keff) for the period 1980-2024. Red dotted line shows the long-term average. The abundance indices for 2018, 2020 and 2022 were adjusted due to lack of survey coverage and are shown in orange color.*

6.2 Cod (*Gadus morhua*)

Cod were widely distributed in the Barents Sea with highest densities in the central Barents Sea (Fig. 6.2.1). Densities and size of the distribution area indicated a low year class of cod in 2024 (Fig.6.2.2).

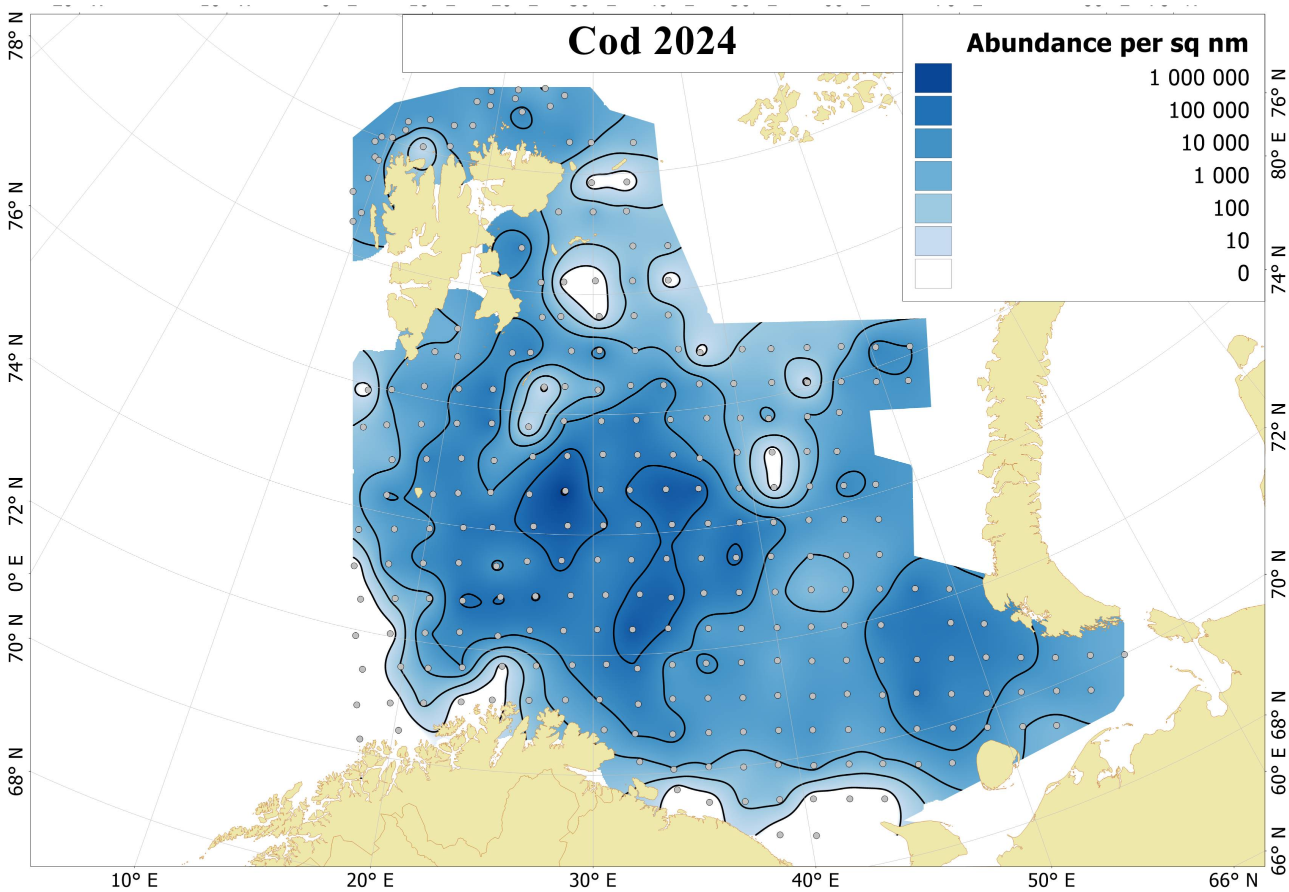


Figure 6.2.1. *Distribution of 0-group cod, August-September 2024. Abundance is corrected for capture efficiency (Keff). Dots indicate sampling locations.*

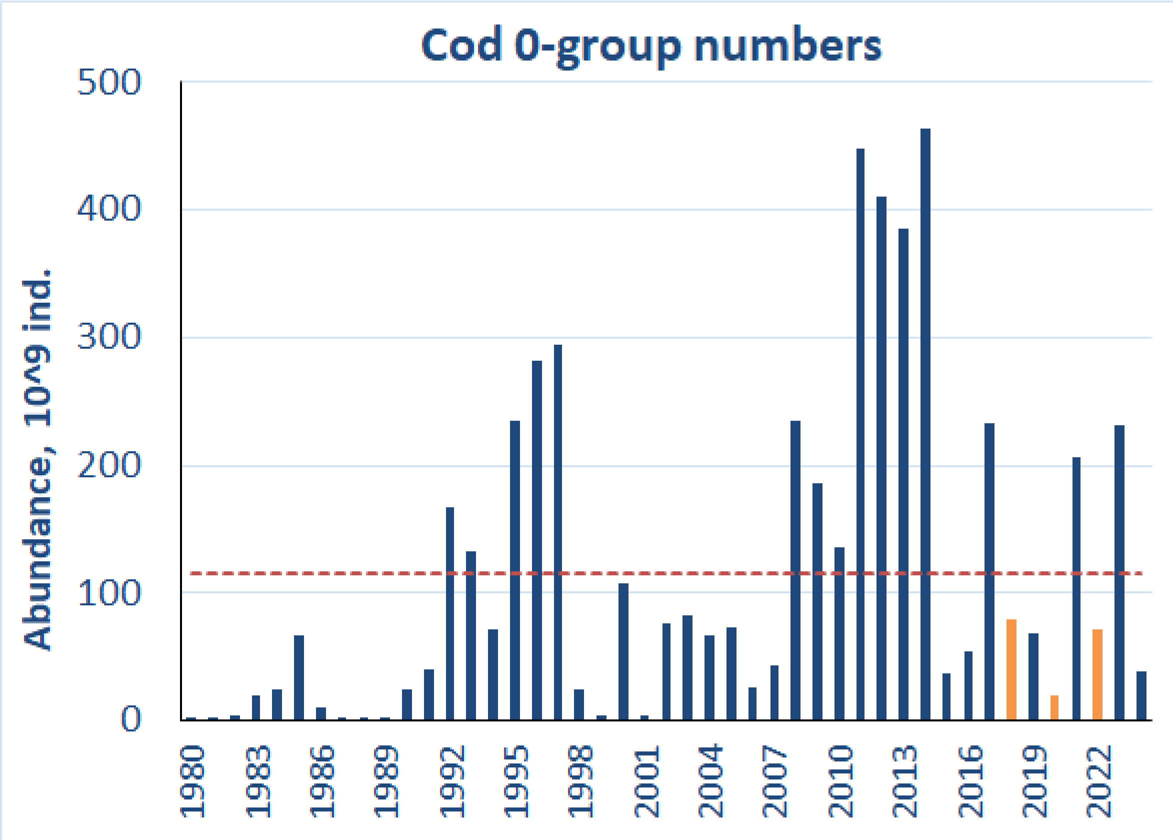


Figure 6.2.2. *0-group cod abundance estimates corrected for capture efficiency (Keff) for the period 1980-2021. Red line shows the long-term average. Abundance indices for 2018, 2020 and 2024 were corrected for lack of coverage and shown by orange columns.*

6.3 Haddock (*Melanogrammus aeglefinus*)

Haddock were distributed in the western Barents Sea at very high densities (Fig. 6.3.1). A very strong year class occurred in 2024 (Fig.6.3.2).

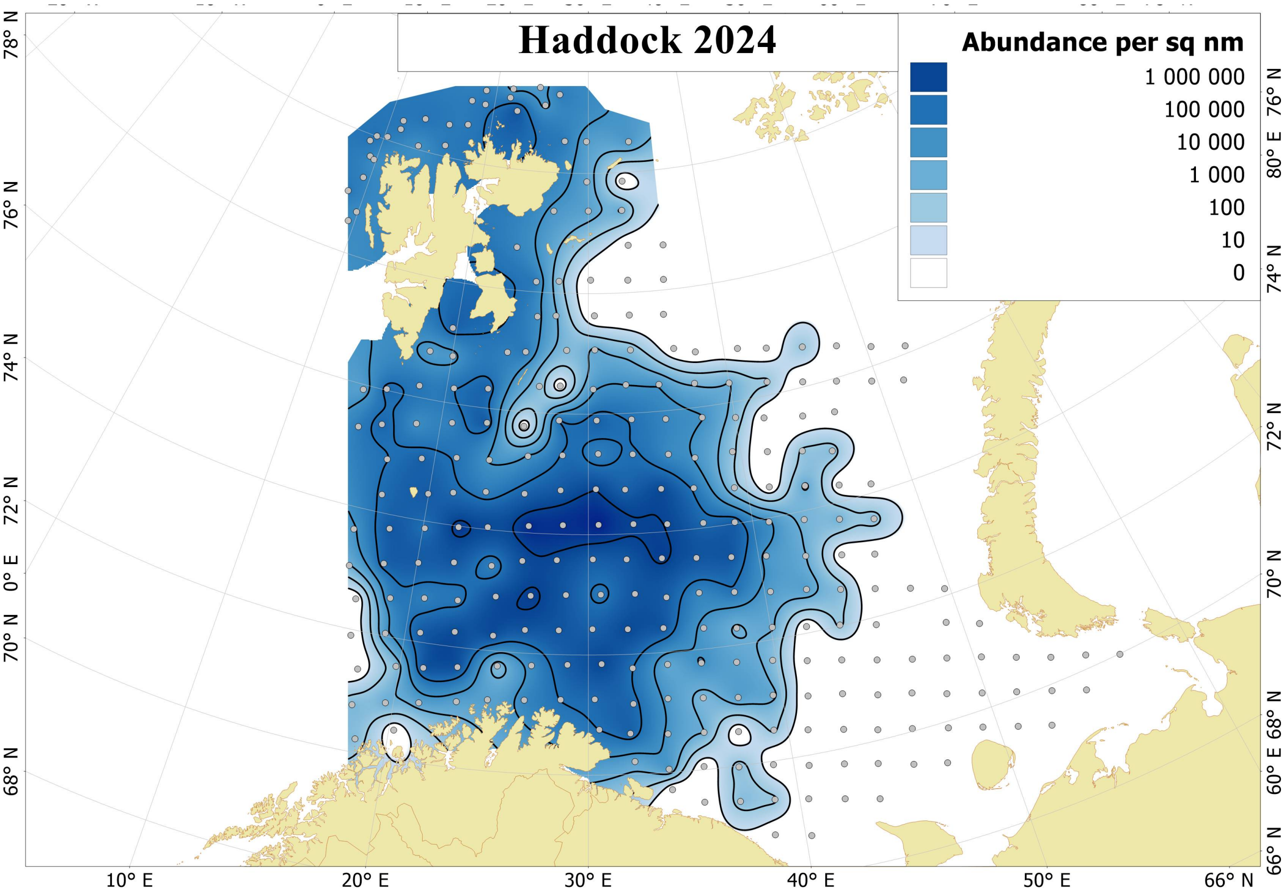


Figure 6.3.1. *Distribution of 0-group haddock, August-September 2024. Abundance is corrected for capture efficiency (Keff). Abundance are corrected for capture efficiency (Keff). Dots indicate sampling locations.*

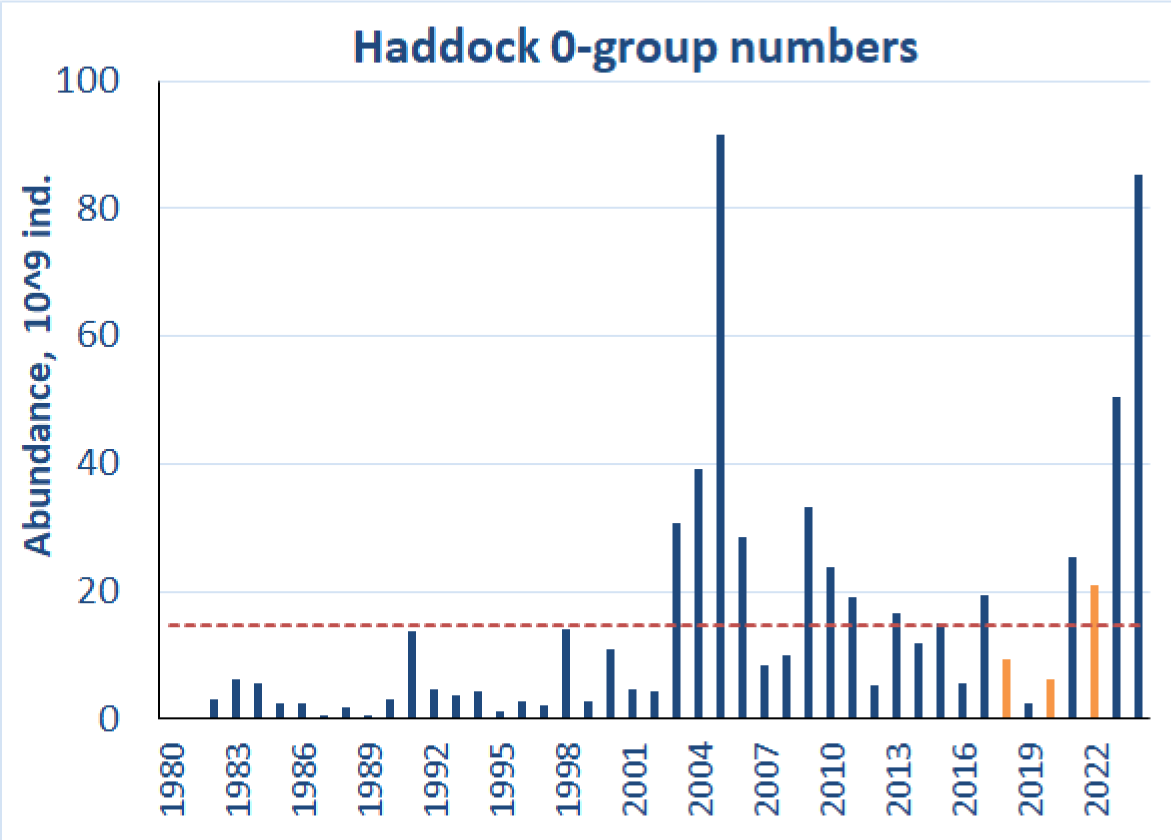


Figure 6.3.2. *0-group haddock estimates corrected for capture efficiency (Keff) for the period 1980-2024. Red line shows the long-term average. Abundance indices for 2018, 2020 and 2022 were corrected for lack of coverage and shown by orange columns.*

6.4 Herring (*Clupea harengus*)

0-group herring were distributed in the western Barents Sea, higher densities were found in northwestern area of the Barents Sea (Fig. 6.4.1). After two high abundance year-classes (Fig.6.4.2), densities and size of the distribution area indicating a below average year class of herring in 2024.

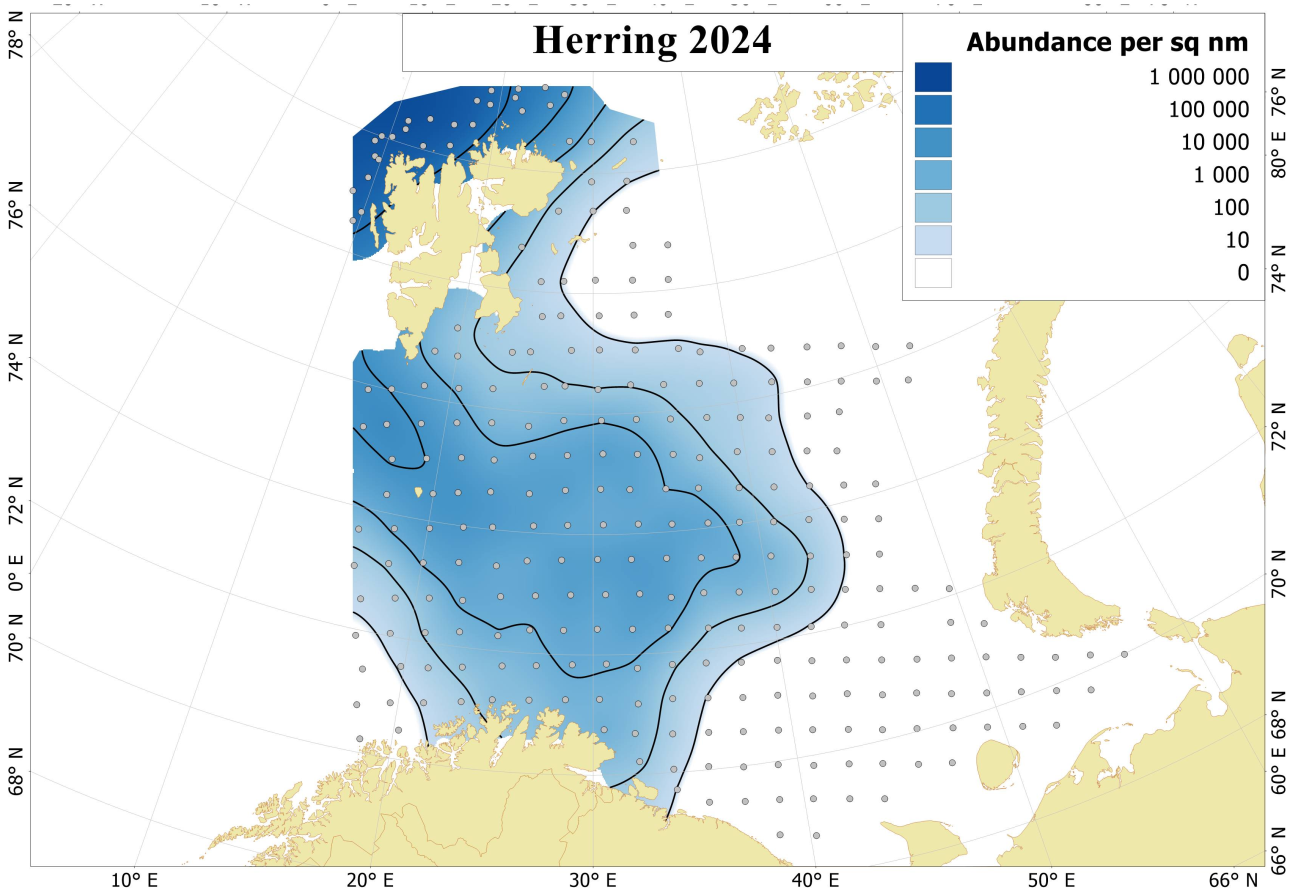


Figure 6.4.1. *Distribution of 0-group herring, August-September 2024. Abundance is corrected for capture efficiency (Keff). Abundance are corrected for capture efficiency (Keff). Dots indicate sampling locations.*

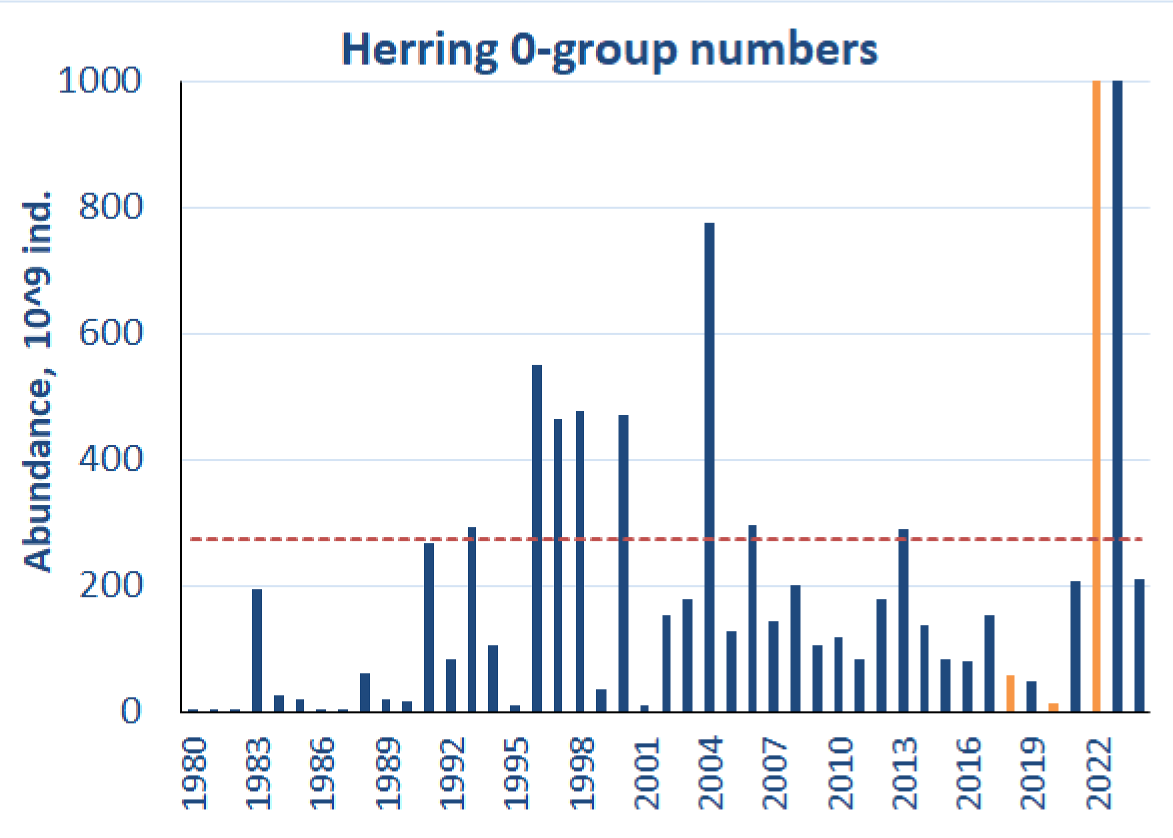


Figure 6.4.2. *0-group herring abundance estimates corrected for capture efficiency (Keff) for the period 1980-2024. Red line shows the long-term average. Abundance indices for 2018, 2020 and 2022 were corrected for lack of coverage and shown by orange column.*

6.5 Polar cod (*Boreogadus saida*)

Polar cod were found around the Svalbard/Spitsbergen and in the eastern Barents Sea in 2024 (Fig. 6.5.1). Coverage of the 0-group polar cod was not complete, especially in the eastern parts of the Barents Sea (Fig. 6.1), and thus south-eastern component of polar cod could not fully be presented here. A higher concentration and size of the distribution area indicated an above-average or possibly, strong year class of polar cod in 2024.

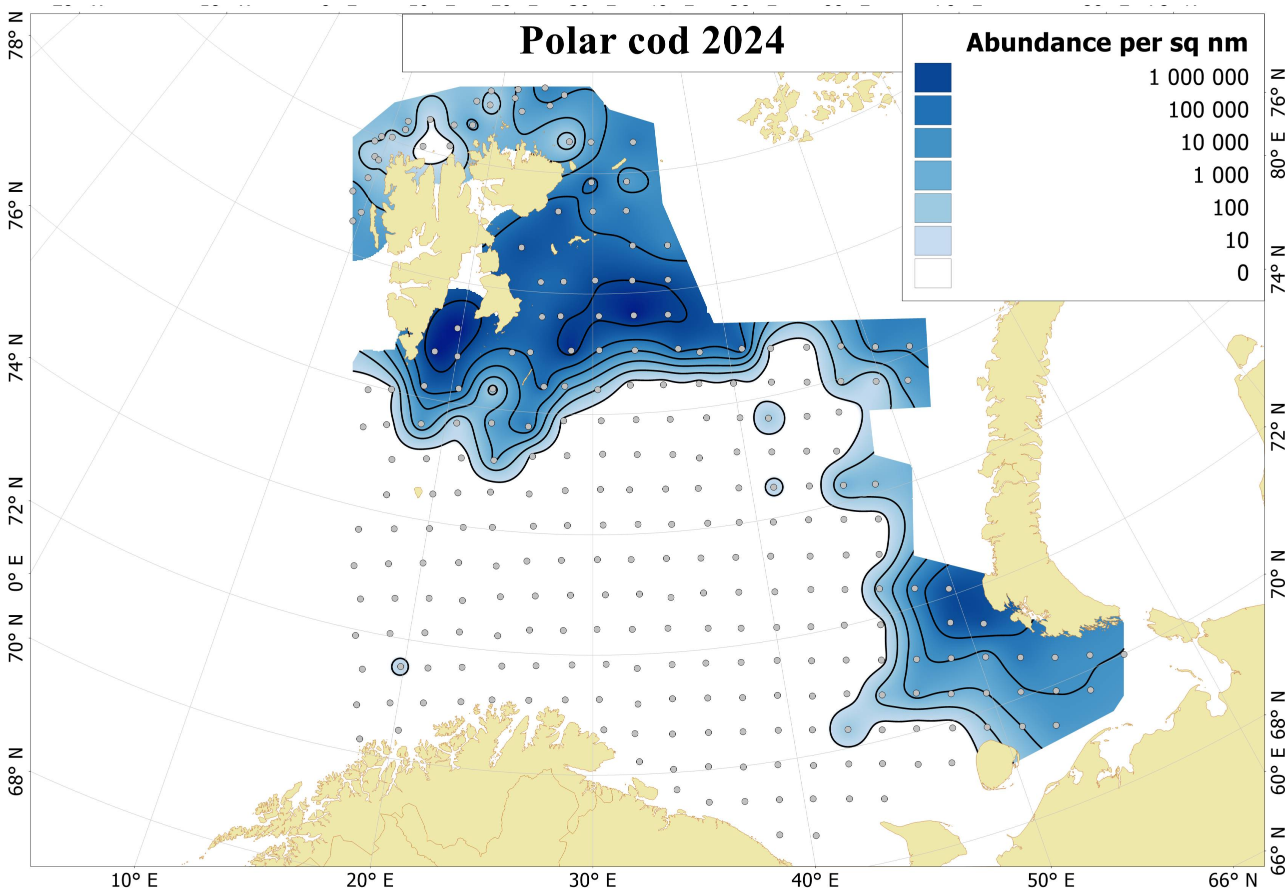


Figure 6.5.1. *Distribution of 0-group polar cod, August-September 2024. Abundance is corrected for capture efficiency (Keff). Dots indicate sampling locations.*

6.6 Saithe (*Pollachius virens*)

Saithe distribution was relatively large in 2024, with a higher concentration in the central part of their distribution (Fig. 6.6.1).

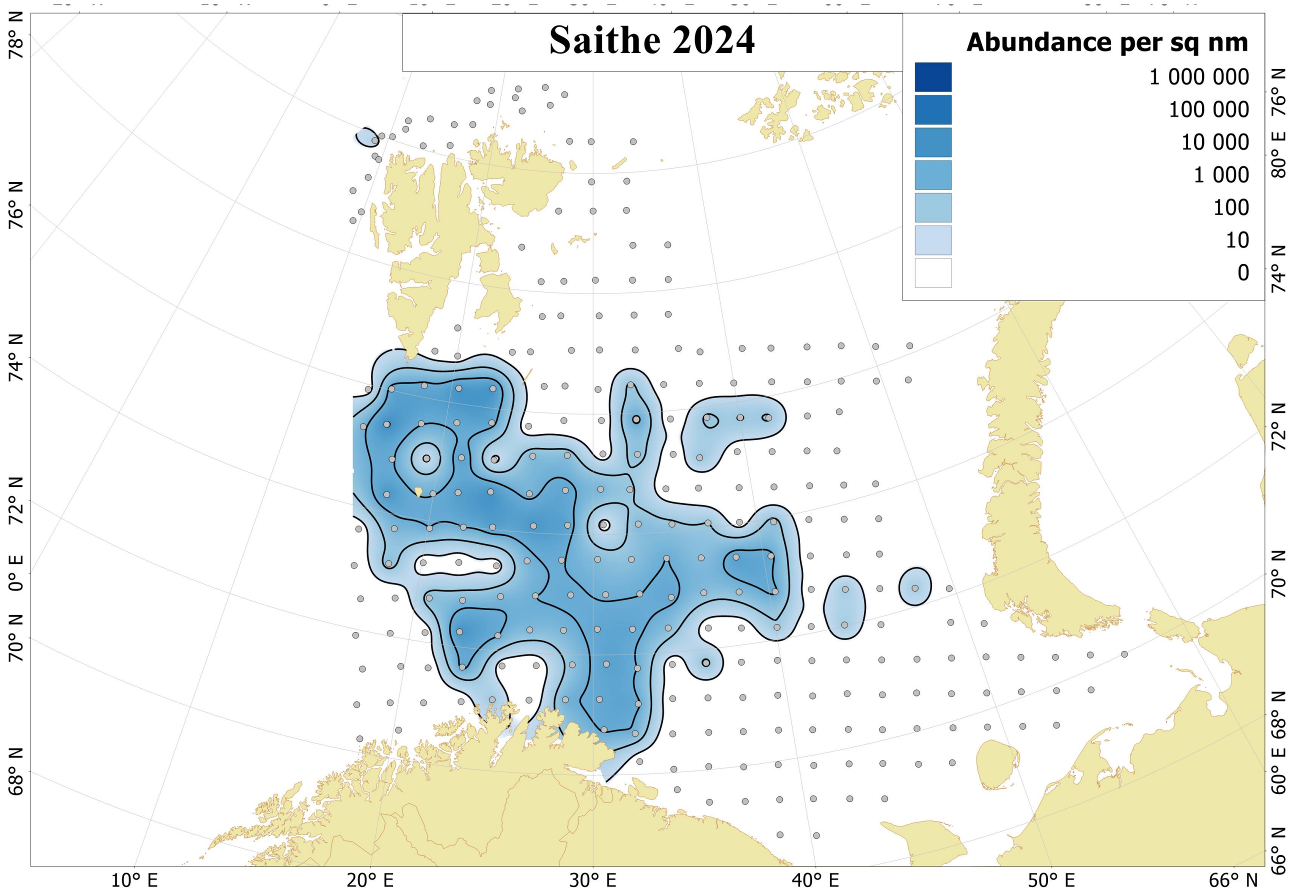


***Figure 6.6.1**. Distribution of 0-group saithe in August-September 2024. Abundance was not corrected for capture efficiency. Dots indicate sampling locations.*

6.7 Redfish (mostly *Sebastes mentella*)

0-group redfish were found close to the Norwegian coast and around the Svalbard/Spitsbergen in 2024 (Fig. 6.7.1). Densities and size of the distribution area indicating a below average year class of redfish in 2024.

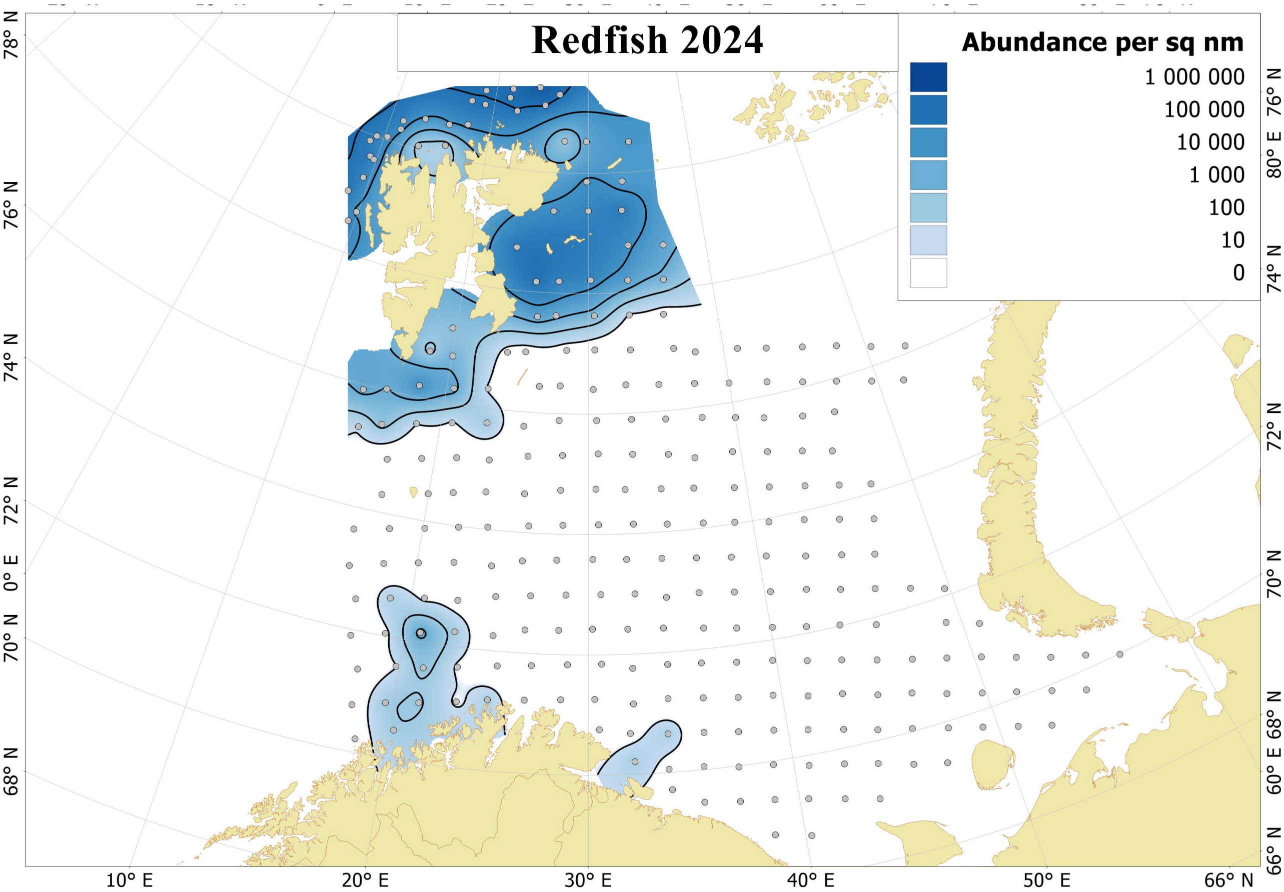


Figure 6.7.1. *Distribution of 0-group redfishes (mostly Sebastes mentella) in August-September 2024. Abundance was not corrected for capture efficiency. Dots indicate sampling locations.*

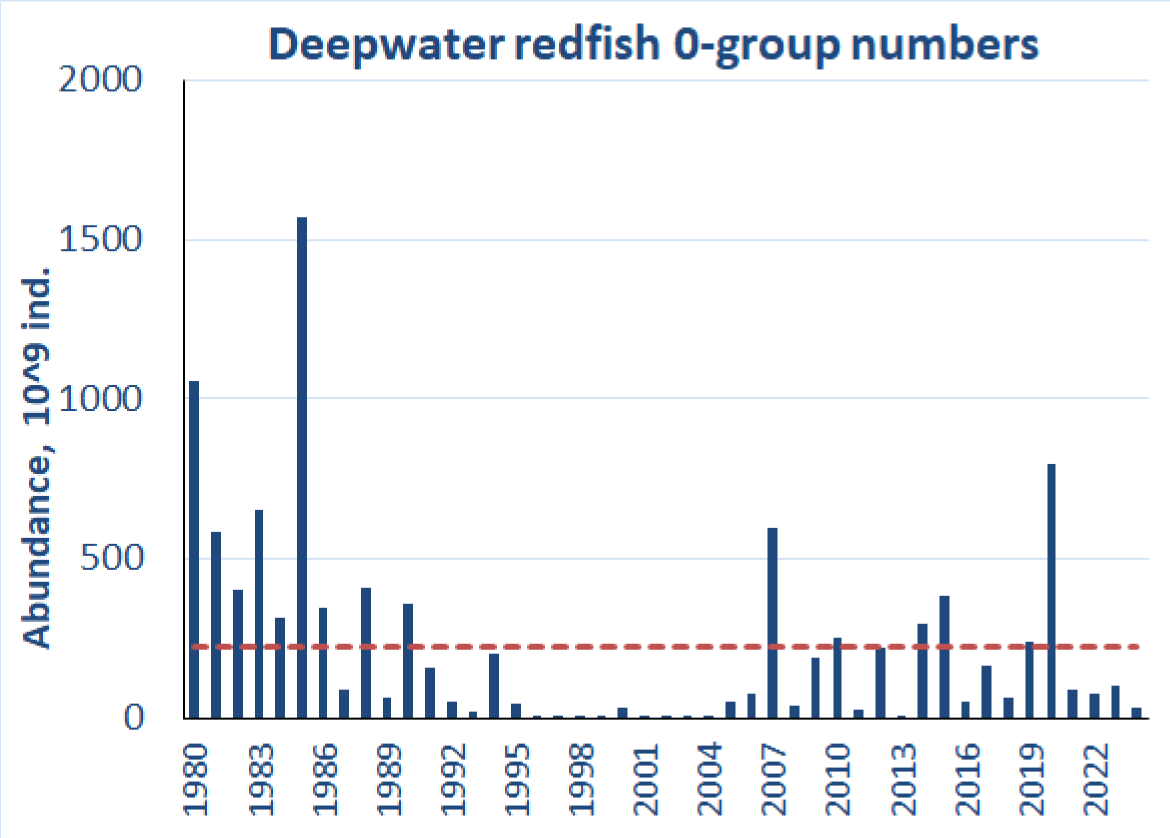


Figure 6.7.2. *0-group deepwater redfish abundance (corrected for trawl efficiency) in the Barents Sea during 1980-2024. Red line shows the long-term average.*

6.8 Greenland haliibut (*Reinhardtius hippoglossoides*)

0-group Greenland halibut was found at one station east of Svalbard/Spitsbergen)\ in 2024 (Figure 6.8.1), indicating an extremely low year class.

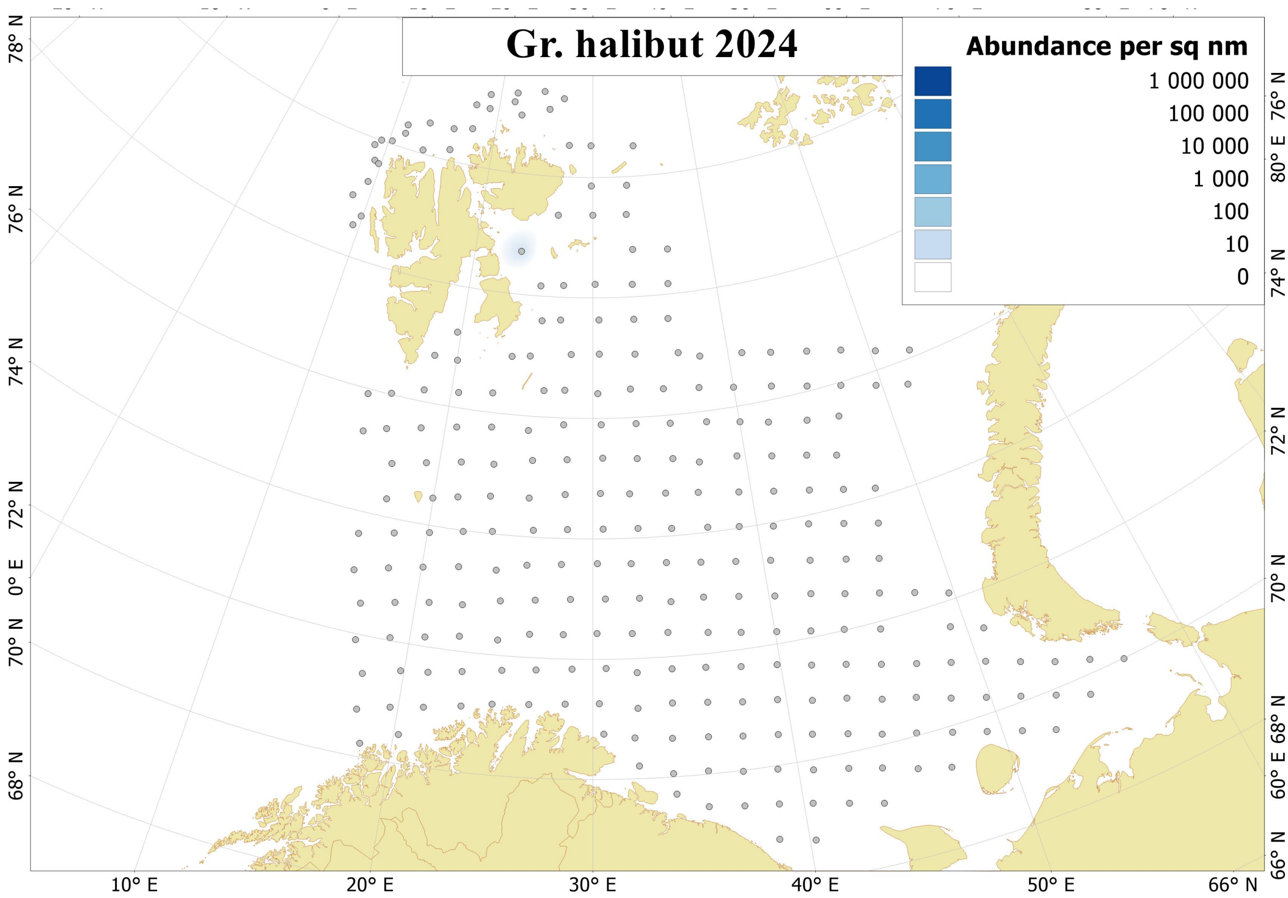


Figure 6.8.1 *Distribution of 0-group Greenland halibut, August-September 2024. Dots indicate sampling locations.*

6.9 Long rough dab (*Hippoglossoides platessoides*)

In 2024, 0-group long rough dab were mainly distributed from the north and southeast Barents Sea (Fig. 6.9.1). Densities and size of the distribution area indicating a below average year class of long rough dab in 2024.

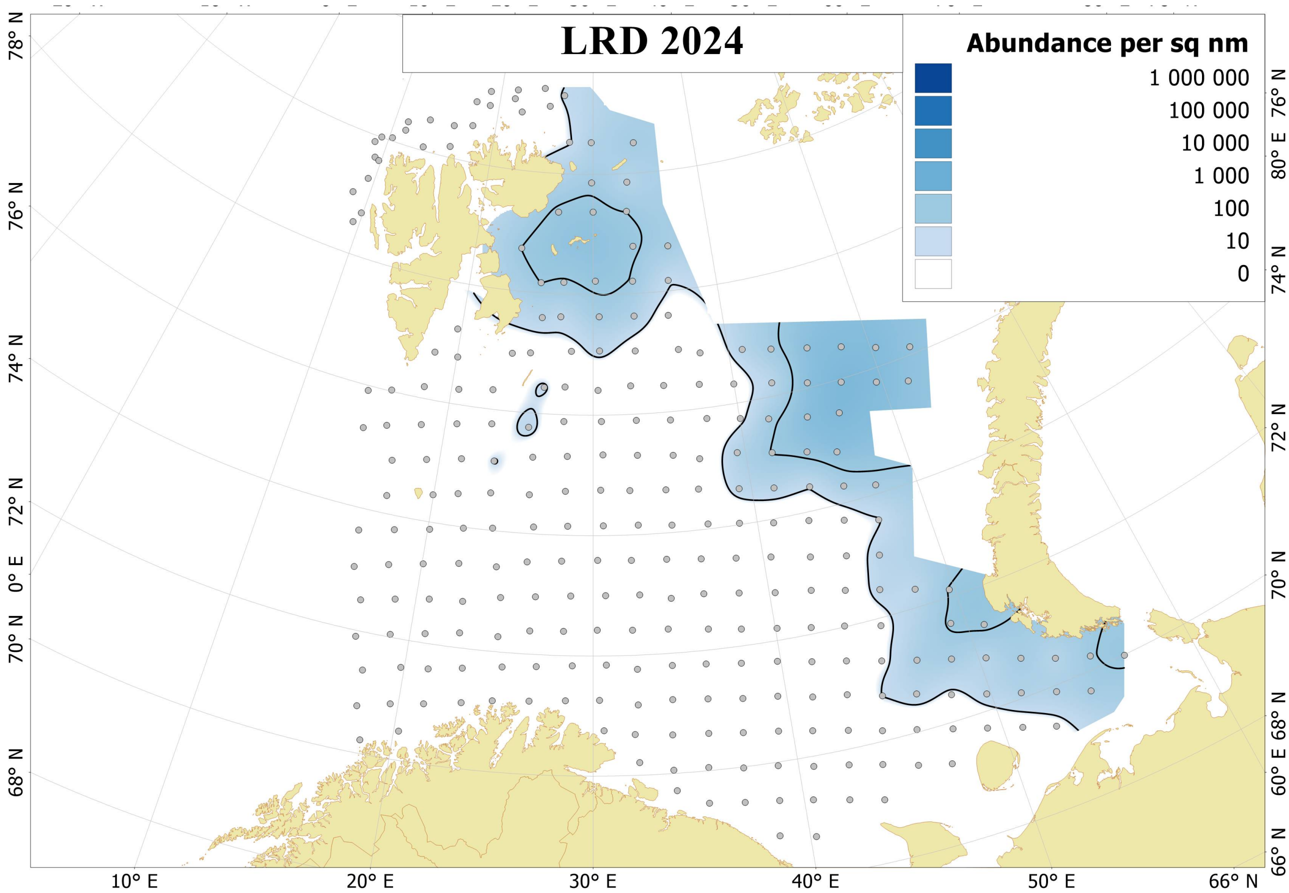


Figure 6.9.1 *Distribution of 0-group long rough dab, August-September 2024. Dots indicate sampling locations.*

7 - Commercial Pelagic Fish

Author(s): Georg Skaret (IMR) and Dmitry Prozorkevich (VNIRO-PINRO)

Figures by S. Karlson, F. Rist, G. Skaret

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7.1 Capelin (*Mallotus villosus*)

The coverage of the capelin distribution was synoptic with very high effort allocated to the important bank areas. The capelin coverage was considered to be close to complete for 2024 (see Figure 7.1.1.1), even though the south-western part of the shelf west of Svalbard/Spitsbergen was not covered. This west shelf is normally not an area with important amounts of capelin. A summary of the capelin stock assessment for 2024 is given in Barents Sea capelin advice sheet 2024 with more details provided in Barents Sea capelin assessment report 2024.

7.1.1 Geographical distribution

The geographical distribution of capelin recorded acoustically is shown in Figure 7.1.1.1. The capelin was distributed quite far north, but not as far north as last year when the population size was much higher. The main distribution area was the Great Bank which is the normal core area at this time of the year. Some recordings were also made north of Svalbard/Spitsbergen which was also observed last year.

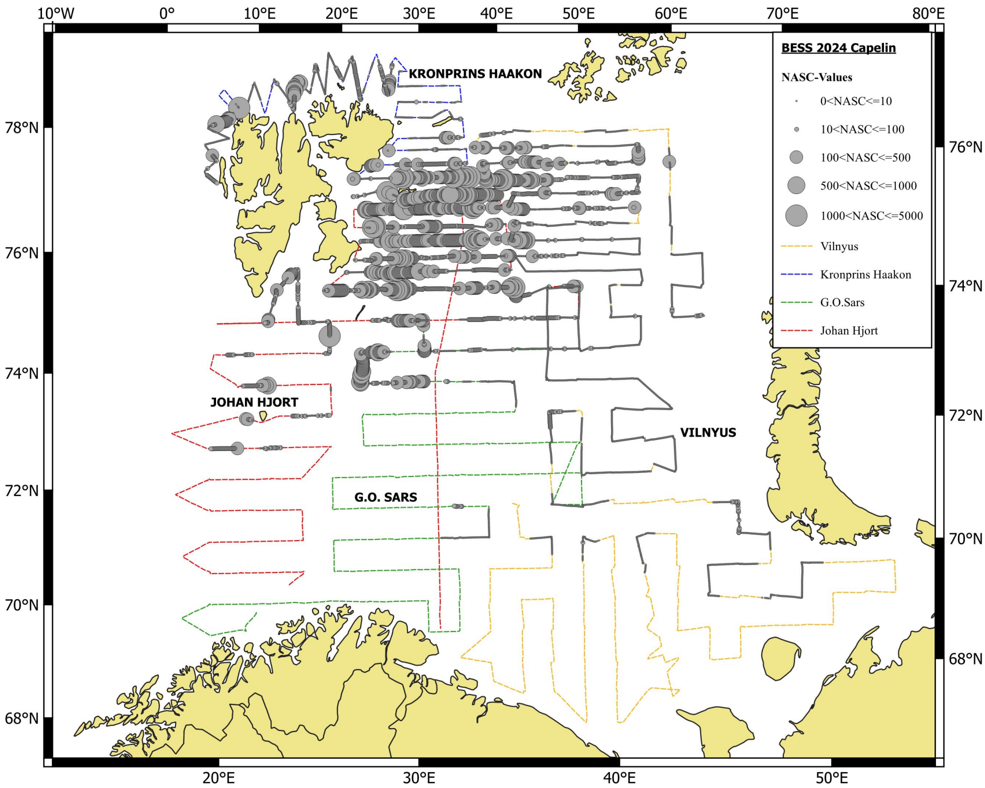

Figure. 7.1.1.1 *Geographical distribution of capelin in autumn 2024 based on acoustic recordings. Circle sizes correspond to NASC values (m^2/nm^2) per nm.*

7.1.2 Abundance by size and age

A detailed summary of the acoustic stock estimate is given in tab. 7.1.2.1, and the time series of abundance estimates is summarized in tab. 7.1.2.2. A comparison between the estimates in 2024 and 2023 is given in tab. 7.1.2.3 with the 2023 estimate shown on a shaded background.

The total stock in the covered area was estimated to about 887 thousand t, which is only about a third of the long-term average level (2.79 million t). About 60 % (534 thousand t) of the 2024 stock had length above 14 cm and was therefore considered to be maturing. In terms of biomass, the contribution to the total was quite equal for 1, 2, 3 and 4 year-olds (tab. 7.1.2.1). The abundance of 1 and 3 year-olds was less than a third of the long term average and 2-year-olds less than a sixth of the long term average. Only the abundance of 4 year-olds (2020-yearclass) and 5 year-olds (2019-yearclass) were stronger than the long-term average.

Average weight at age increased compared to last year for the age groups 2-4. For 3 and 4 year-olds it was still well below the long term average, whereas it was above the long term average for 1 and 2-year-olds (fig. 7.1.2.1 and tab. 7.1.2.2).

Table 7.1.2.1. *Barents Sea capelin. Summary of results from the acoustic estimate in August-September 2024. The table is generated from the mean of 1000 bootstrap replicates based on calculations in StoX 4.0. TSN: Total stock number. TSB: Total stock biomass. MSN: Maturing stock number. MSB: Maturing stock biomass. (Footnote attached after table).*

Length (cm)	Age/year class						Sum (10^9)	Biomass (10^3 t)	Mean weight (g)
	1	2	3	4	5	6			
	2023	2022	2021	2020	2019	2018			
6.5-7.0	0.434						0.434	0.099	1.25
7.0-7.5	2.008						2.008	2.131	1.26
7.5-8.0	4.859						4.859	7.281	1.74
8.0-8.5	5.469						5.469	9.720	2.11
8.5-9.0	8.887						8.887	19.094	2.54
9.0-9.5	7.793						7.793	20.755	3.11
9.5-10.0	8.836						8.837	27.217	3.64
10.0-10.5	7.589	0.052					7.641	32.441	4.33
10.5-11.0	5.493	0.086					5.578	27.135	4.89
11.0-11.5	3.902	0.117					4.019	22.483	5.70
11.5-12.0	2.241	0.793					3.034	20.655	6.87
12.0-12.5	0.390	1.407	0.051				1.848	14.581	7.94
12.5-13.0	0.599	2.671	0.066				3.336	29.409	8.90
13.0-13.5	0.058	4.534	0.346	0.127			5.066	52.743	10.37
13.5-14.0		3.947	1.255	0.527			5.729	67.374	11.74
14.0-14.5		2.136	1.896	0.828	0.211		5.071	66.915	13.24
14.5-15.0		2.067	2.725	2.205	0.091		7.089	105.034	14.85
15.0-15.5		1.218	3.310	2.210	0.342	0.023	7.103	119.925	16.83
15.5-16.0		0.515	1.638	1.575	0.161		3.889	74.262	19.29
16.0-16.5		0.207	1.233	1.179	0.391		3.010	62.802	20.99
16.5-17.0		0.066	0.421	1.041	0.090	0.001	1.618	40.243	24.91
17.0-17.5		0.022	0.281	0.744	0.158		1.205	33.617	27.84
17.5-18.0			0.172	0.396	0.069		0.637	19.946	31.48
18.0-18.5			0.040	0.232			0.272	9.444	35.45
18.5-19.0				0.019			0.019	0.730	39.00
19.0-19.5				0.002			0.002	0.047	31.00
19.5-20.0									
20.0-20.5					0.019		0.019	0.576	31.00
TSN (10^9)	58.560	19.837	13.434	11.084	1.534	0.024	104.473		
TSB (10^3 t)	190.690	233.120	220.203	212.774	29.479	0.395		886.661	
Mean length (cm)	9.55	13.47	14.85	15.37	15.52	15.75			
Mean weight (g)	3.96	11.90	16.19	18.97	18.04	20.33			8.49
SSN (10^9)		6.230	11.716	10.430	1.534	0.024	29.933		
SSB (10^3 t)		97.708	201.022	204.937	29.479	0.395		533.541	

Estimates based on Target strength (TS) Length (L) relationship : TS= 19.1 log (L) – 74.0

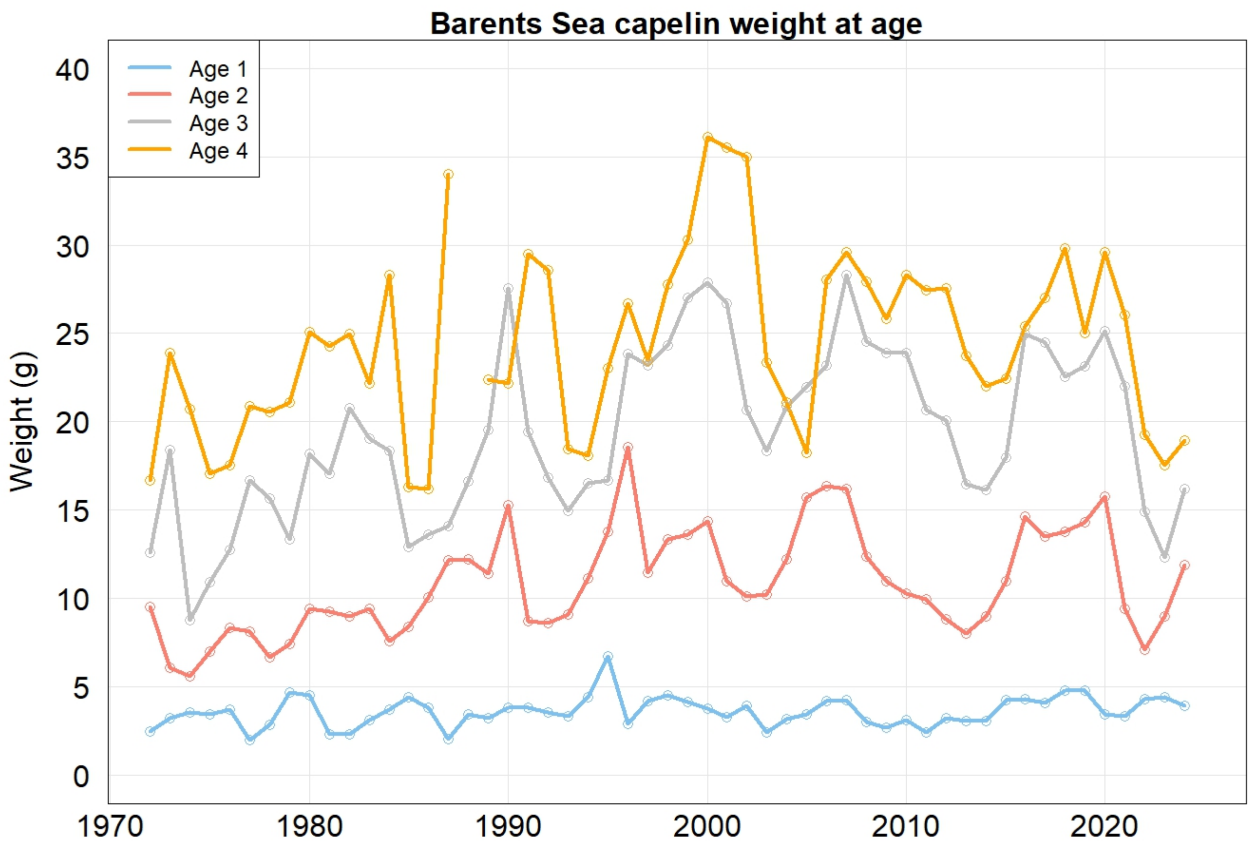

Figure 7.1.2.1. *Weight at age for capelin from capelin surveys (prior to 2003) and BESS.*

Table 7.1.2.2. *Barents Sea capelin. Summary of acoustic estimates by age in autumn 1973- 2024. Biomass (B) in million t and average weight (AW) in grams. Note that the numbers for 2004-2022 were updated following the re-estimation in StoX for the capelin benchmark in 2022. The numbers are means from 1000 bootstrap replicates.*

Year	Age										Sum
	1		2		3		4		5		
	BM1	W1	BM2	W2	BM3	W3	BM4	W4	BM5	W5	TSB
1973	1.71	3.2	2.29	6.1	0.73	18.4	0.41	23.9	+	27.3	5.15
1974	1.08	3.6	3.06	5.6	1.52	8.8	0.07	20.7	+	25.1	5.74
1975	0.66	3.4	2.44	7.0	3.24	10.9	1.48	17.1	0.01	28.1	7.82
1976	0.79	3.7	1.95	8.4	2.08	12.8	1.34	17.5	0.26	21.3	6.42
1977	0.72	2.0	1.43	8.2	1.64	16.7	0.84	20.9	0.17	23.3	4.80
1978	0.24	2.9	2.62	6.7	1.19	15.7	0.18	20.6	0.02	25.7	4.25
1979	0.06	4.7	2.48	7.4	1.52	13.3	0.10	21.1	+	24.1	4.16
1980	1.22	4.5	1.84	9.4	2.82	18.2	0.83	25.1	0.01	21.8	6.72
1981	0.92	2.3	1.81	9.2	0.82	17.1	0.33	24.2	0.01	29.1	3.89
1982	1.22	2.3	1.33	9.0	1.18	20.8	0.05	25.0			3.78
1983	1.61	3.1	1.89	9.4	0.73	19.0	0.01	22.2			4.23
1984	0.57	3.7	1.42	7.6	0.89	18.4	0.09	28.3			2.96
1985	0.17	4.4	0.40	8.4	0.27	12.9	0.01	16.3			0.86
1986	0.02	3.8	0.05	10.1	0.05	13.6	+	16.2			0.12
1987	0.08	2.1	0.02	12.2	+	14.1	+	34.0			0.10
1988	0.07	3.4	0.35	12.2	+	16.6					0.43
1989	0.62	3.3	0.20	11.4	0.05	19.5	+	22.4			0.87
1990	2.67	3.8	2.71	15.3	0.45	27.6	+	22.2			5.84
1991	1.53	3.8	5.07	8.7	0.64	19.4	0.04	29.5			7.28
1992	1.25	3.6	1.70	8.6	2.17	16.8	0.04	28.6			5.16
1993	0.01	3.4	0.49	9.1	0.26	14.9	0.04	18.5			0.80
1994	0.09	4.4	0.04	11.1	0.07	16.5	+	18.1			0.20
1995	0.05	6.7	0.11	13.8	0.03	16.7	0.01	23.0			0.19
1996	0.24	2.9	0.21	18.6	0.05	23.8	+	26.7			0.50
1997	0.41	4.2	0.45	11.5	0.04	23.2	+	23.5			0.91
1998	0.81	4.5	0.97	13.3	0.26	24.3	0.02	27.8	+	29.9	2.05
1999	0.65	4.2	1.38	13.6	0.72	27.0	0.03	30.3			2.77
2000	1.71	3.8	1.59	14.3	0.95	27.9	0.03	36.1	+	20.1	4.27
2001	0.38	3.3	2.40	11.0	0.81	26.7	0.04	35.5	+	41.3	3.63
2002	0.23	3.9	0.92	10.1	1.04	20.7	0.02	35.0			2.21
2003	0.20	2.4	0.10	10.2	0.20	18.3	0.03	23.3			0.53
2004	0.20	3.2	0.21	12.2	0.09	20.9	0.01	21.1	+	25.4	0.51
2005	0.08	3.4	0.33	15.7	0.08	22.0	0.01	18.2	+	19.6	0.50
2006	0.24	4.2	0.27	16.4	0.12	23.2	+	28.0	+	25.4	0.64

Year	Age										Sum
	1		2		3		4		5		
	BM1	W1	BM2	W2	BM3	W3	BM4	W4	BM5	W5	TSB
2007	0.83	4.3	0.81	16.2	0.16	28.3	0.01	29.6			1.82
2008	0.89	3.0	2.46	12.4	0.59	24.6	0.01	27.9			3.95
2009	0.47	2.7	1.63	11.0	1.15	23.9	+	25.9			3.25
2010	0.76	3.1	1.41	10.3	1.60	23.9	0.05	28.3			3.82
2011	0.47	2.4	1.72	9.9	1.19	20.7	0.21	27.5			3.60
2012	0.57	3.2	1.03	8.8	1.77	20.1	0.08	27.5			3.46
2013	0.99	3.1	1.58	8.0	1.11	16.5	0.28	23.7	+	28.7	3.97
2014	0.32	3.1	0.73	9.0	0.60	16.1	0.04	22.0			1.69
2015	0.16	4.3	0.46	11.0	0.23	18.0	0.02	22.4			0.88
2016	0.14	4.3	0.12	14.6	0.06	24.9	+	25.4			0.32
2017	0.47	4.1	1.61	13.5	0.34	24.5	0.01	27.0			2.43
2018	0.28	4.8	0.84	13.8	0.51	22.6	0.01	29.8	+	34.0	1.64
2019	0.09	4.8	0.14	14.3	0.16	23.2	0.03	25.0	+	18.9	0.41
2020	1.27	3.4	0.49	15.8	0.10	25.1	0.02	29.6	+	23.3	1.89
2021	0.75	3.4	3.07	9.4	0.16	22.0	+	26.0			3.99
2022	0.32	4.3	0.96	7.1	0.86	14.9	0.02	19.2	+	24.0	2.17
2023	0.48	4.4	0.72	9.0	1.32	12.3	0.42	17.6	+	20.5	2.95
2024	0.19	4.0	0.23	11.9	0.22	16.2	0.21	19.0	0.03	18.0	0.89
Average	**0.61**	**3.6**	**1.24**	**10.9**	**0.75**	**19.5**	**0.14**	**24.6**	**0.01**	**25.2**	**2.76**

Note:«+» <0.005*million t

Table 7.1.2.3. *Summary of acoustic stock size estimates for capelin in 2023-2024. A comparison between the estimates this year and last year (shaded background).*

Year class		Age	Numbers (10^6)		Mean weight (g)		Biomass (10^3 t)	
2023	2022	1	58.6	108.5	3.96	4.43	190.7	480.6
2022	2021	2	19.8	80.3	11.90	9.01	233.1	723.4
2021	2020	3	13.4	107.4	16.19	12.33	220.2	1324.2
2020	2019	4	11.1	23.9	18.97	17.56	212.8	419.4
Total stock in:								
2024	**2023**	**1-4**	**104.5**	**320.3**	**8.49**	**9.21**	**886.7**	**2951.7**

7.2 Polar cod (*Boreogadus saida*)

7.2.1 Geographical distribution

The acoustic recordings of polar cod are shown in fig. 7.2.1.1. There were no areas with really high concentrations of polar cod, but the concentrations adjacent to the Great Bank dominated. Only small concentrations of polar cod were found to the south near the Kara Strait where huge concentrations were found in 2023. There were significant recordings of polar cod along the north-easternmost of transects which indicate that parts of the polar cod stock were distributed east and possibly north of the covered area.

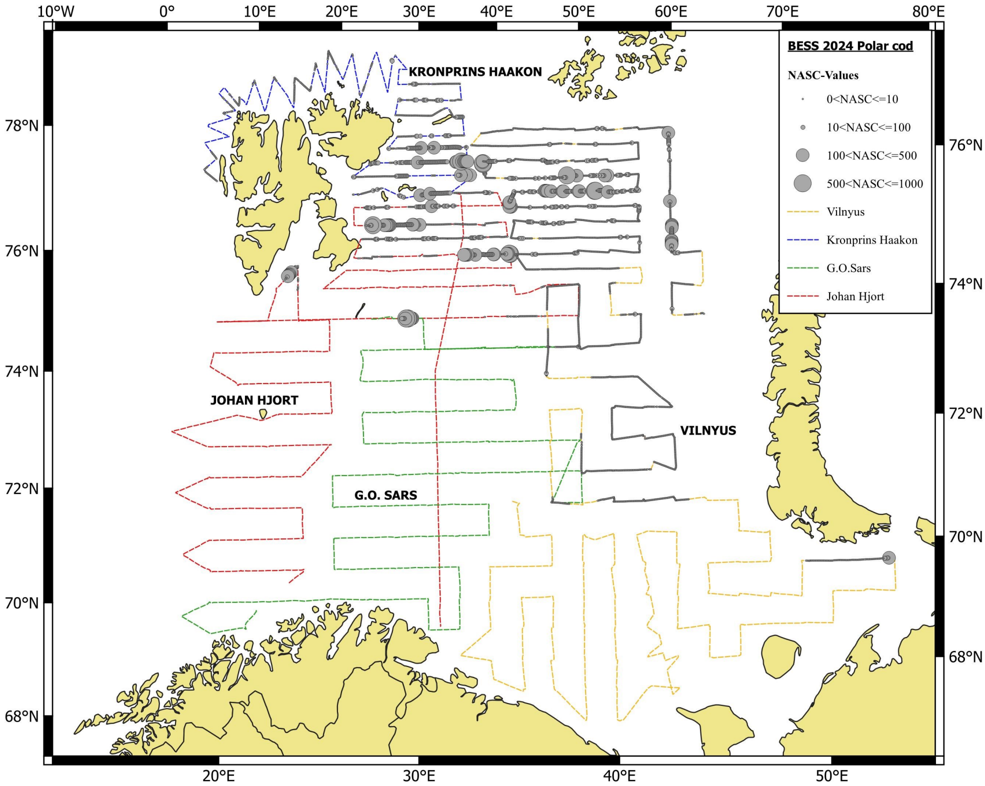

Figure 7.2.1.1 *Geographical distribution of polar cod in autumn 2024 based on acoustic data. Circle sizes correspond to NASC values (m^2/nm^2) per nm.*

7.2.2. Abundance estimation

The stock abundance estimates of polar cod by age, number and weight in 2024 is given in tab. 7 .2. 2 .1 and the time series of abundance estimates is summarized in tab. 7 .2. 2 .2. The estimated means are from 500 bootstrap replicas made in StoX 4.1.1.

The total estimated abundance of polar cod in 2024 was low, less than 15% of the estimate from 2023. Age group 1 dominated the abundance while age group 2 dominated biomass, but the abundance of all age groups was well below the levels in 2023.

The north-east part of the Barents Sea where polar cod is often distributed has not been covered since 2020. There are also indications of a northwards distribution change in polar cod, so the survey results must be interpreted with caution. However, the estimates indicate that there has been a very strong dynamic in the Barents Sea polar cod stock abundance during the past decade, especially compared to the period 1991-2013.

Table 7.2.2.1. *Barents Sea polar cod. Summary of results from the acoustic estimate in August- October 2024. All values in the table are derived from average number and biomass at length and age from 500 bootstrap runs in StoX 4.1.1.*

Length (cm)	Age/year class						Sum (10^9)	Biomass (10^3)	Mean weight (g)
	1	2	3	4	5	6			
	2023	2022	2021	2020	2019	2018			
7.0-8.0	0.001						0.001	0.002	2.12
8.0-9.0	0.093						0.093	0.375	4.17
9.0-10.0	0.089						0.089	0.518	5.83
10.0-11.0	0.307	0.006					0.313	2.489	7.87
11.0-12.0	0.644	0.019					0.663	7.111	10.75
12.0-13.0	0.379	0.038	0.005				0.422	5.780	13.54
13.0-14.0	0.188	0.139	0.013	0.005			0.346	6.194	17.82
14.0-15.0	0.018	0.202	0.050	0.002	0.004		0.276	6.194	22.32
15.0-16.0	0.005	0.283	0.116	0.012	0.005		0.420	11.315	26.82
16.0-17.0		0.230	0.062	0.023	0.002		0.317	10.158	32.03
17.0-18.0		0.070	0.053	0.006	0.002		0.130	4.961	38.54
18.0-19.0		0.030	0.040	0.006			0.076	3.455	46.17
19.0-20.0		0.005	0.037	0.004			0.046	2.381	52.71
20.0-21.0			0.005	0.025			0.029	1.835	62.03
21.0-22.0			0.003	0.007	0.003		0.013	0.904	77.79
22.0-23.0				0.003	0.002		0.006	0.422	76.54
23.0-24.0						0.002	0.002	0.190	93.94
24.0-25.0				0.001			0.001	0.113	79.99

Length (cm)	Age/year class						Sum (10^9)	Biomass (10^3)	Mean weight (g)
	1	2	3	4	5	6			
	2023	2022	2021	2020	2019	2018			
25.0-26.0				0.001			0.001	0.081	96.44
TSN (10^9)	1.725	1.022	0.383	0.096	0.018	0.002	3.252		
TSB (10^3 t)	19.243	26.961	12.923	4.392	0.767	0.190		64.668	
Mean length (cm)	11.13	14.88	16.09	17.93	17.59	23.00	13.79		
Mean weight (g)	11.32	26.71	34.67	47.19	46.12	91.80			23.06

Estimates based on Target strength (TS) Length (L) relationship : TS= 21.8 log (L) – 72.7

Table 7.2.2.2. *Barents Sea polar cod. Summary of acoustic estimates by age in August-October 2024. TSN and TSB are total stock numbers (hundred million) and total stock biomass (thousand t) respectively.*

Year	Age 1		Age 2		Age 3		Age 4+		Total	
	TSN	TSB	TSN	TSB	TSN	TSB	TSN	TSB	TSN	TSB
1986	24.038	169.6	6.263	104.3	1.058	31.5	0.082	3.4	31.441	308.8
1987	15.041	125.1	10.142	184.2	3.111	72.2	0.039	1.2	28.333	382.8
1988	4.314	37.1	1.469	27.1	0.727	20.1	0.052	1.7	6.562	86.0
1989	13.540	154.9	1.777	41.7	0.236	8.6	0.060	2.6	15.613	207.8
1990	3.834	39.3	2.221	56.8	0.650	25.3	0.094	6.9	6.799	127.3
1991	23.670	214.2	4.159	93.8	1.922	67.0	0.152	6.4	29.903	381.5
1992	22.902	194.4	13.992	376.5	0.832	20.9	0.064	2.9	37.790	594.9
1993	16.269	131.6	18.919	367.1	2.965	103.3	0.147	7.7	38.300	609.7
1994	27.466	189.7	9.297	161.0	5.044	154.0	0.790	35.8	42.597	540.5
1995	30.697	249.6	6.493	127.8	1.610	41.0	0.175	7.9	38.975	426.2
1996	19.438	144.9	10.056	230.6	3.287	103.1	0.212	8.0	33.012	487.4
1997	15.848	136.7	7.755	124.5	3.139	86.4	0.992	39.3	28.012	400.7
1998	89.947	505.5	7.634	174.5	3.965	119.3	0.598	23.0	102.435	839.5
1999	59.434	399.6	22.760	426.0	8.803	286.8	0.435	25.9	91.463	1141.9
2000	33.825	269.4	19.999	432.4	14.598	597.6	0.840	48.4	69.262	1347.8
2001	77.144	709.0	15.694	434.5	12.499	589.3	2.271	132.1	107.713	1869.6
2002	8.431	56.8	34.824	875.9	6.350	282.2	2.322	143.2	52.218	1377.2
2003*	32.804	242.7	3.255	59.9	15.374	481.2	1.739	87.6	53.172	871.4
2004	99.404	627.1	22.777	404.9	2.627	82.2	0.510	32.7	125.319	1143.8
2005	71.675	626.6	57.053	1028.2	3.703	120.2	0.407	28.3	132.859	1803.0
2006	16.190	180.8	45.063	1277.4	12.083	445.9	0.698	37.2	74.033	1941.2

Year	Age 1		Age 2		Age 3		Age 4+		Total	
	TSN	TSB	TSN	TSB	TSN	TSB	TSN	TSB	TSN	TSB
2007	29.483	321.2	25.778	743.4	3.230	145.8	0.315	19.8	58.807	1230.1
2008	41.693	421.8	18.114	522.0	5.905	247.8	0.415	27.8	66.127	1219.4
2009	13.276	100.2	22.213	492.5	8.265	280.0	0.336	16.6	44.090	889.3
2010	27.285	234.2	18.257	543.1	12.982	594.6	1.253	58.6	59.777	1430.5
2011	34.460	282.3	14.455	304.4	4.728	237.1	0.514	36.7	54.158	860.5
2012	13.521	113.6	4.696	104.3	2.121	93.0	0.119	8.0	20.457	318.9
2013	2.216	18.1	4.317	102.2	5.243	210.3	0.180	9.9	11.956	340.5
2014	0.687	6.5	4.439	110.0	3.196	121.0	0.080	5.3	8.402	243.2
2015	10.866	97.1	1.995	45.1	0.167	5.3	0.008	0.5	13.036	148.0
2016	95.919	792.7	6.380	139.1	0.207	6.9	0.023	0.7	102.529	939.4
2017	13.810	121.8	8.269	200.8	1.112	34.3	0.003	0.1	23.195	357.1
2018**	1.900	16.4	0.980	23.1	0.240	9.4	0.014	0.6	3.124	49.6
2019**	6.109	49.8	1.217	30.3	0.214	6.3	0.014	0.8	7.555	87.2
2020	115.139	988.3	20.133	386.8	8.217	299.3	0.647	42.8	144.171	1720.8
2021**	45.340	375.5	44.020	819.9	2.190	90.4	0.210	13.3	91.760	1299.0
2022**	No data									
2023**	9.640	75.9	3.465	54.9	6.240	221.9	2.983	137.7	22.328	490.4
2024**	1.725	19.2	1.022	27.0	0.383	12.9	0.114	5.2	3.252	64.7
Average	30.760	248.4	13.720	306.8	4.450	167.2	0.520	28.1	49.490	752.0

* numbers partly based on VPA estimates

** incomplete survey coverage

7.3 Herring (*Clupea harengus*)

7.3.1 Geographical distribution

Young Norwegian spring spawning herring (NSSH) was distributed over large parts of the southern Barents Sea (Figure 7.3.1.1).

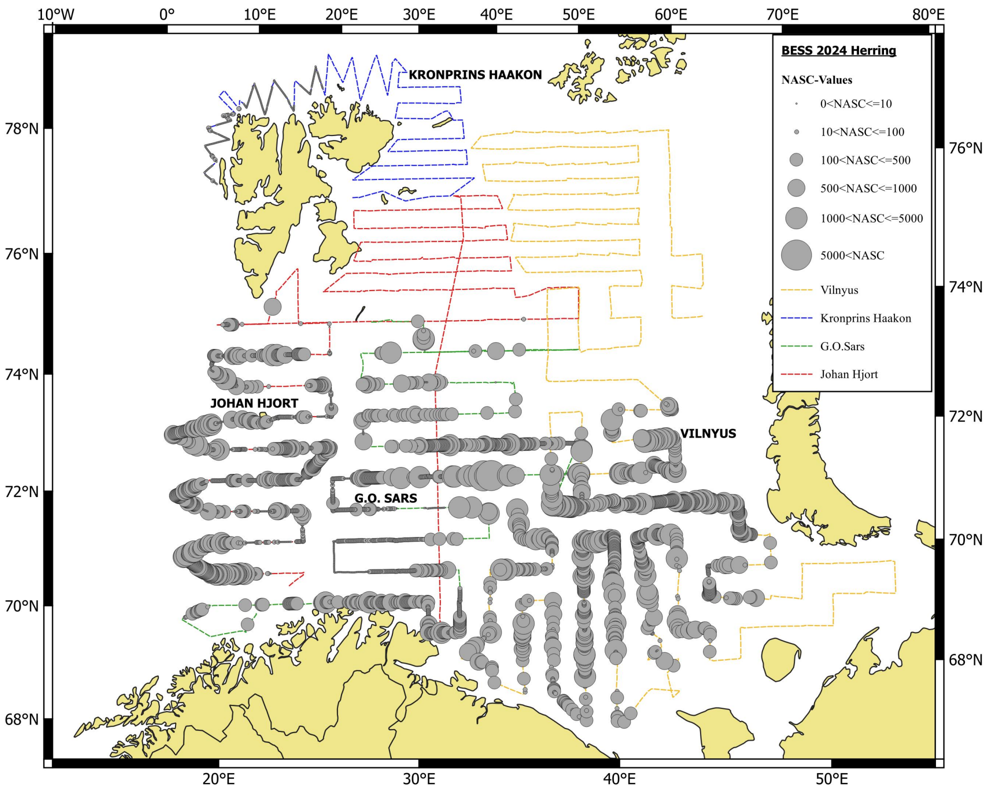

Figure 7.3.1.1 *Geographical distribution of herring in autumn 2024 based on acoustic recordings. Circle sizes correspond to NASC values (m^2/nm^2) per nm.*

7.3.2 Abundance estimation

The estimated total number and biomass of NSSH in the Barents Sea in the autumn 2024 is shown in tab. 7.3.2.1, and the time series of abundance estimates is summarized in tab. 7 .3. 2 .2. Total numbers in 2024 were estimated at ca. 72 billion individuals (tab. 7.3.2.1). This is the third highest on record and ca. 2.5 times higher than the long-term average (tab. 7.3.2.2). Abundance of age group 1 was low, while abundance of age group 2 (2022 year class) was >5 times higher than the long-term average and abundance of age group 3 (2021 year class) was >6 times higher. The abundances of both 2 and 3-year-olds were the highest on record. Also abundance of age group 4+ was above the long-term average. The very high abundances of 2 and 3-year-olds were expected given the very high abundances of 1 and 2-year-olds in 2023. The total biomass of NSS-herring in the Barents Sea, which is dominated by biomass of 2 and 3-year-olds is the highest that has been measured since 1999.

Table 7.3.2.1. *NSSH. Acoustic estimate in the Barents Sea in August-October 2024. All values in the table are derived from average number and biomass at length and age from 1000 bootstrap runs in StoX 4.0.*

Length (cm)	Age/year class									Sum (10^9)	Biomass (10^3 t)	Mean weight (g)
	1	2	3	4	5	6	7	8	9			
	2023	2022	2021	2020	2019	2018	2017	2016	2015			
10.0-11.0	0.004									0.004	0.028	6.83
11.0-12.0	0.075									0.075	0.760	9.54
12.0-13.0	1.194									1.194	15.353	12.38
13.0-14.0	1.020									1.020	15.317	15.29
14.0-15.0	0.269	0.146								0.415	7.846	18.90
15.0-16.0	0.080	1.577								1.657	41.317	24.92
16.0-17.0	0.240	9.481								9.721	282.643	29.07
17.0-18.0	0.176	10.613								10.789	374.855	34.99
18.0-19.0	0.039	7.451								7.490	312.536	41.99
19.0-20.0	0.012	5.938	0.240							6.191	302.748	49.52
20.0-21.0		3.604	0.790							4.394	255.483	58.14
21.0-22.0		1.898	3.099							4.997	348.415	68.75
22.0-23.0		0.968	5.163							6.132	496.857	79.97
23.0-24.0		1.288	5.936							7.224	659.783	91.00
24.0-25.0		0.485	3.535							4.020	425.111	106.75
25.0-26.0		0.500	2.128							2.628	324.159	122.22
26.0-27.0		0.045	0.853	0.052						0.950	132.731	138.86
27.0-28.0			0.262	0.047						0.309	49.073	156.65
28.0-29.0			0.043	0.148						0.191	39.034	203.19
29.0-30.0			0.060	0.043						0.103	22.626	217.40

Length (cm)	Age/year class									Sum (10^9)	Biomass (10^3 t)	Mean weight (g)
	1	2	3	4	5	6	7	8	9			
	2023	2022	2021	2020	2019	2018	2017	2016	2015			
30.0-31.0				0.117						0.117	28.084	237.69
31.0-32.0				0.018				0.077		0.095	26.542	278.02
32.0-33.0					0.021	0.180	0.059	0.414		0.674	205.013	304.32
33.0-34.0						0.143	0.061	1.024		1.229	397.241	323.00
34.0-35.0							0.056	0.465	0.014	0.535	181.439	340.52
35.0-36.0								0.068		0.068	24.542	357.42
TSN (10^9)	3.109	43.995	22.109	0.424	0.021	0.323	0.176	2.048	0.014	72.321		
TSB (10^3 t)	53.788	1943.005	2055.332	87.421	6.173	97.890	57.020	663.762	5.144		4984.863	
Mean length (cm)	12.50	18.70	23.12	28.42	32.00	32.46	33.06	33.08	34.00	20.14		
Mean weight (g)	14.93	49.94	95.95	204.02	292.00	303.70	325.34	324.99	364.00			75.27

Estimates based on Target strength (TS) Length (L) relationship: TS= 20.0 log (L) – 71.9

Year	Age 1		Age 2		Age 3		Age 4+		Total	
	TSN	TSB	TSN	TSB	TSN	TSB	TSN	TSB	TSN	TSB
1999	48.759	716.0	0.986	31.0	0.051	2.0			49.795	749.0
2000	14.731	383.0	11.499	560.0					26.230	943.0
2001	0.525	12.0	10.544	604.0	1.714	160.0			12.783	776.0
2002	No data									
2003	99.786	3090.0	4.336	220.0	2.476	326.0			106.597	3636.0
2004	14.265	406.0	36.495	2725.0	0.901	107.0			51.717	3252.0
2005	46.380	984.0	16.167	1055.0	6.973	795.0			69.520	2833.0
2006	1.618	34.0	5.535	398.0	1.620	211.0			8.773	643.0
2007	3.941	148.0	2.595	218.0	6.378	810.0	0.250	46.0	13.164	1221.0
2008	0.030	1.0	1.626	77.0	3.987*	287*	3.223*	373*	8.866*	738*
2009	1.538	48.0	0.433	52.0	1.807	287.0	1.686	393.0	5.577	815.0
2010	1.047	35.0	0.315	34.0	0.234	37.0	0.428	104.0	2.025	207.0
2011	0.095	3.0	1.504	106.0	0.006	1.0			1.605	109.0
2012	2.031	36.0	1.078	66.0	1.285	195.0			4.394	296.0
2013	7.657	202.0	5.029	322.0	0.092	13.0	0.057	9.0	12.835	546.0
2014	4.188	62.0	1.822	126.0	6.825	842.0	0.162	25.0	13.011	1058.0
2015	1.183	6.0	9.023	530.0	3.214	285.0	0.149	24.0	13.569	845.0
2016	7.760	131.0	1.573	126.0	3.089	389.0	0.029	6.0	12.452	652.0
2017	34.950	820.0	2.138	141.0	3.465	412.0	0.982	210.0	41.537	1583.0
2018**	0.530	22.6	6.035	526.0	1.299	165.5	0.897	171.7	1.165	482.5
2019	13.650	172.0	0.209	15.1	6.000	756.0	1.600	487.0	21.460	1430.0
2020			0.231	13.0	1.816	189.0	11.59*	2796*	13.636*	2998*
2021	1.410	80.8	0.120	10.1	0.360	39.5	0.720	144.7	2.610	275.1
2022**	4.442	155.2	0.882	76.6	0.000	0.0	1.459	412.3	6.783	645.7
2023	64.115	925.2	32.920	1558.1	4.443	546.7	2.458	752.9	103.935	3783.0
2024	3.109	53.8	43.995	1943.0	22.109	2055.3	2.993	912.3	72.321	4984.9
Average	15.740	355.3	7.880	461.3	3.340	371.3	1.790	429.2	27.050	1420.0

*in mix with Kanin herring in the south-eastern part of the coverage area

**survey coverage only on Norwegian (western) side

7.4 Blue whiting (*Micromesistius poutassou*)

7.4.1 Geographical distribution

Blue whiting contributes to make up the mid-trophic pelagic component in the south-western part of the Barents Sea ecosystem. The Barents Sea is on the border of the distribution area for the blue whiting, but with incoming strong year-classes, increased abundance of young blue whiting in the Barents Sea is normally observed. The distribution of blue whiting from the BESS 2024 is shown in fig. 7.4.1.1. The distribution was similar to last year following the shelf edge north to Svalbard/Spitsbergen and with some recordings stretching north of Svalbard/Spitsbergen.

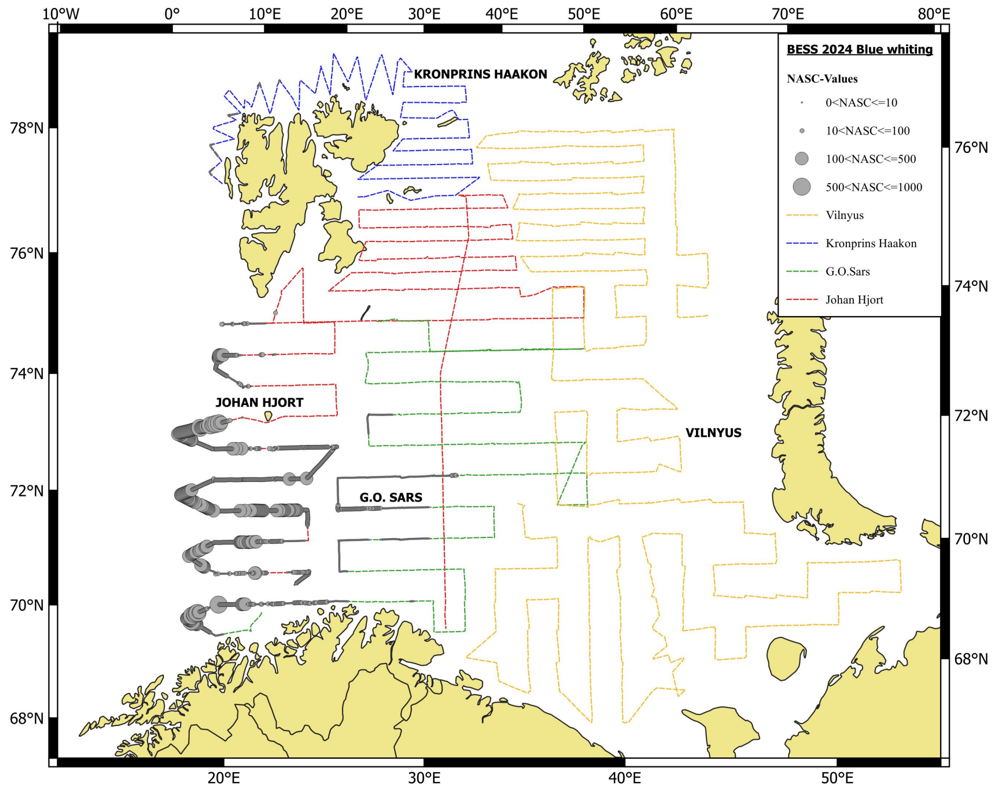

Figure 7.4.1.1. *Geographical distribution of blue whiting in autumn 2024 based on acoustic recordings. Circle sizes correspond to NASC values (m^2/nm^2) per nm.*

7.4.2 Abundance by size and age

The estimated total number and biomass of blue whiting in the Barents Sea in the autumn 2024 is shown in tab. 7.4.2.1, and the time series of abundance estimates is summarized in tab. 7 .4. 2 .2.

The total abundance and biomass are higher than last year but below the long-term average (tab. 7.4.2.2). The 3 and 4-year-olds (2021 and 2020 year classes) dominate both the abundance and biomass (tab. 7.4.2.1).

Table 7.4.2.1 *Blue whiting. Acoustic estimate in the Barents Sea in August-October 2024. All values in the table are derived from average number and biomass at length and age from 500 bootstrap runs in StoX 4.0.0.*

Length (cm)	Age/year class													Sum (10^6)	Biomass (10^3 t)	Mean weight (g)
	1	2	3	4	5	6	7	8	9	10	11	12	15			
	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2009			
20.0-21.0	0.6													0.6	0.0	44.33
21.0-22.0	2.5													2.5	0.1	54.96
22.0-23.0	3.6	5.8												9.4	0.6	62.12
23.0-24.0	14.2	0.7	0.9											15.9	1.1	73.05
24.0-25.0	1.1	5.2	3.4	0.7										10.4	0.9	86.04
25.0-26.0			19.4											19.4	2.0	101.47
26.0-27.0		2.4	19.0	15.3										36.7	4.1	112.29
27.0-28.0			36.8	25.1	9.9									71.7	9.0	126.09
28.0-29.0			32.3	54.9	6.9									94.0	13.4	142.51
29.0-30.0		1.0	19.2	7.5	27.0									54.7	8.5	156.99
30.0-31.0			11.2	22.0	8.9	11.0	5.5			3.9				62.3	10.7	170.68

Length (cm)	Age/year class													Sum (10^6)	Biomass (10^3 t)	Mean weight (g)
	1	2	3	4	5	6	7	8	9	10	11	12	15			
	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2009			
31.0-32.0			2.9	5.9	8.2		1.8	1.7	1.8					22.3	4.2	189.94
32.0-33.0				3.7	6.9		5.8	2.8		3.3	3.9			26.3	5.2	199.15
33.0-34.0				4.1							5.4			9.5	2.1	220.59
34.0-35.0						3.2	4.0	3.6				3.1		13.8	3.5	250.26
35.0-36.0						3.6	1.4	3.4	1.5	1.9				11.9	3.3	270.30
36.0-37.0							0.1	4.0		0.1				4.3	1.3	300.24
37.0-38.0										0.2				0.2	0.1	243.00
38.0-39.0																
39.0-40.0																
40.0-41.0																
41.0-42.0																
42.0-43.0													0.1	0.1	0.0	402.00

Length (cm)	Age/year class													Sum (10^6)	Biomass (10^3 t)	Mean weight (g)
	1	2	3	4	5	6	7	8	9	10	11	12	15			
	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2009			
43.0-44.0																
TSN (10^6)	22.0	15.2	144.9	139.2	67.6	17.8	18.6	15.5	3.3	9.4	9.2	3.1	0.1	499.0		
TSB (10^3 t)	1.5	1.3	19.1	20.2	10.9	3.9	3.9	3.8	0.8	1.9	2.0	0.8	0.0		70.8	
Mean length (cm)	22.30	24.50	27.10	28.20	29.10	31.10	32.20	33.10	33.00	32.10	32.50	34.00	42.00	28.00		
Mean weight (g)	66.70	92.60	128.90	143.90	159.00	202.20	214.20	224.00	217.80	196.30	216.60	257.20	402.00			143.77

Estimates based on Target strength (TS) Length (L) relationship: TS= 20 log (L) - 65.2

Table 7.4.2.2 *Blue whiting. Acoustic estimates by age in autumn 2004-2024. TSN and TSB are total stock numbers (10^6) and total stock biomass (10^3 tons).*

Year	Age 1		Age 2		Age 3		Age 4+		Total	
	TSN	TSB	TSN	TSB	TSN	TSB	TSN	TSB	TSN	TSB
2004	669	26	439	33	1056	98	1211	159	3575	327
2005	649	20	523	36	1051	86	809	102	3039	244
2006	47	2	478	34	730	70	922	129	2177	235
2007	+	+	116	11	892	92	743	107	1757	210
2008	+	+	+	+	10	1	238	36	247	37
2009	1	+	+	+	6	1	359	637	366	65
2010			2		5	1	155	31	163	33
2011	2	+	2	+	13	2	93	22	109	25
2012	583	27	64	8	58	9	321	77	1025	121
2013	1		349	28	135	13	175	42	664	84
2014	111	5	19	2	185	20	127	28	443	55
2015	1768	71	340	29	134	15	286	44	2529	159
2016	277	13	1224	82	588	48	216	36	2351	188
2017	43	2	253	22	503	49	269	38	1143	115
2018			18	1	74	8	215	29	332	40
2019	54	2	64	5	66	8	162	27	347	43
2020	110	5	19	2	11	1	56	11	196	18
2021	406	17	58	5	39	5	67	13	584	40
2022	195	8	143	12	41	4	58	10	437	34
2023	29	2	61	5	84	10	100	17	275	34
2024	22	1	15	1	145	19	284	48	499	71
Average	292	14	220	19	277	27	327	78	1060	104

Estimates based on Target strength (TS) Length (L) relationship : TS = 20 log (L) - 65.2 (Recalculation by Åge Høines, IMR 2017)

Note:«+» <0.5

Table 7.4.2.3 *Summary of stock size estimates for blue whiting in 2023-2024.*

Year class		Age	Numbers (10^6)		Mean weight (g)		Biomass (10^3 t)	
2023	2022	1	22.0	29.3	66.73	56.52	1.5	1.7
2022	2021	2	15.2	61.3	92.61	88.57	1.3	5.4
2021	2020	3	144.9	84.0	128.93	118.40	19.1	9.9
2020	2019	4+	283.8	100.2	166.41	136.44	48.1	17.4
Total stock in:								
2024	2023	Total	499.0	274.8	143.77	125.37	70.8	34.5

8 - Commercial Demersal Fish

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Maps by: IMR, Demersal fish section

Indices calculated from the ecosystem survey bottom trawl data (not shown here) are used in annual assessments of cod, haddock, beaked redfish and Greenland halibut. Data from the ecosystem survey is currently evaluated as part of the process of establishing an assessment model for the wolffish species. The maps shown are based on bottom trawl catches. For cod and haddock, we provide swept area estimates as numbers per nm^2, with length dependent sweep width corrections. The parameters for the length dependent sweep width correction are given in tab. 8.1.

Table 8.1 *The parameters for the length dependent sweep width, with correction.*

Species	***a***	***b***	l_{min}	l_{max}
Cod	5.91	0.43	15 cm	62 cm
Haddock	2.08	0.75	15 cm	48 cm

The maps for cod and haddock are provided for four length groups: > 20 cm, 20-34 cm, 35-49 cm and ≥50cm.

The maps showing the distribution of the other species are given as total catch in kg per nm.

Note that projections of the maps in chapter 8 in the current report differ from maps previous years.

8.1 Cod (*Gadus morhua*)

At the time of survey cod usually reaches the northern and eastern limits of its feeding area. In general, the cod was distributed over the entire area surveyed except the far northeastern part, with the highest concentrations on the shallower bank areas (figs. 8.1.1-8.1.4) Smaller cod (< 20 cm) was hardly found in the southeastern area, and cod 20-34 cm was not found in the southwestern part.

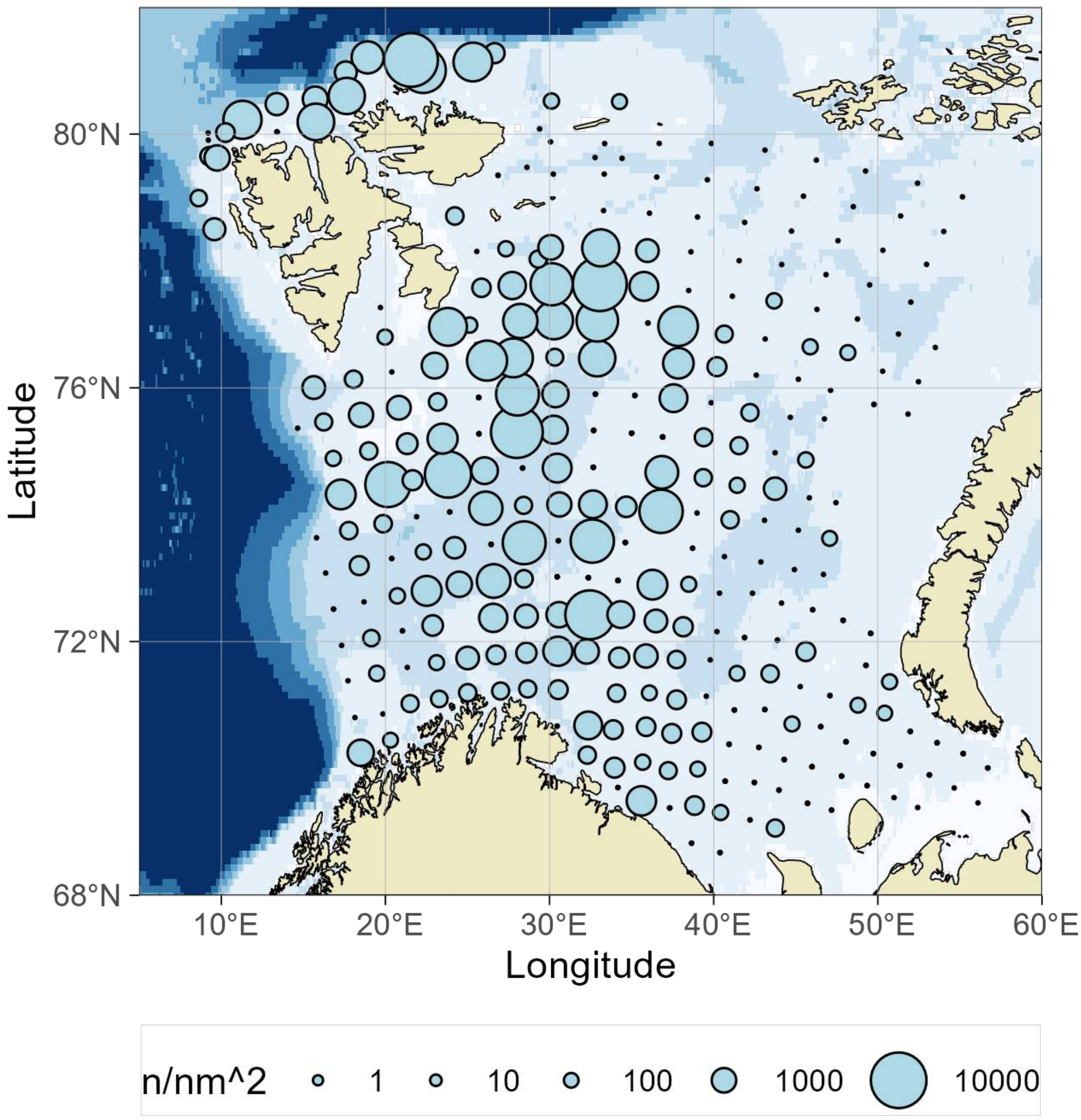

Figure 8.1.1 *Distribution of cod <20 cm, August-October 2024.*

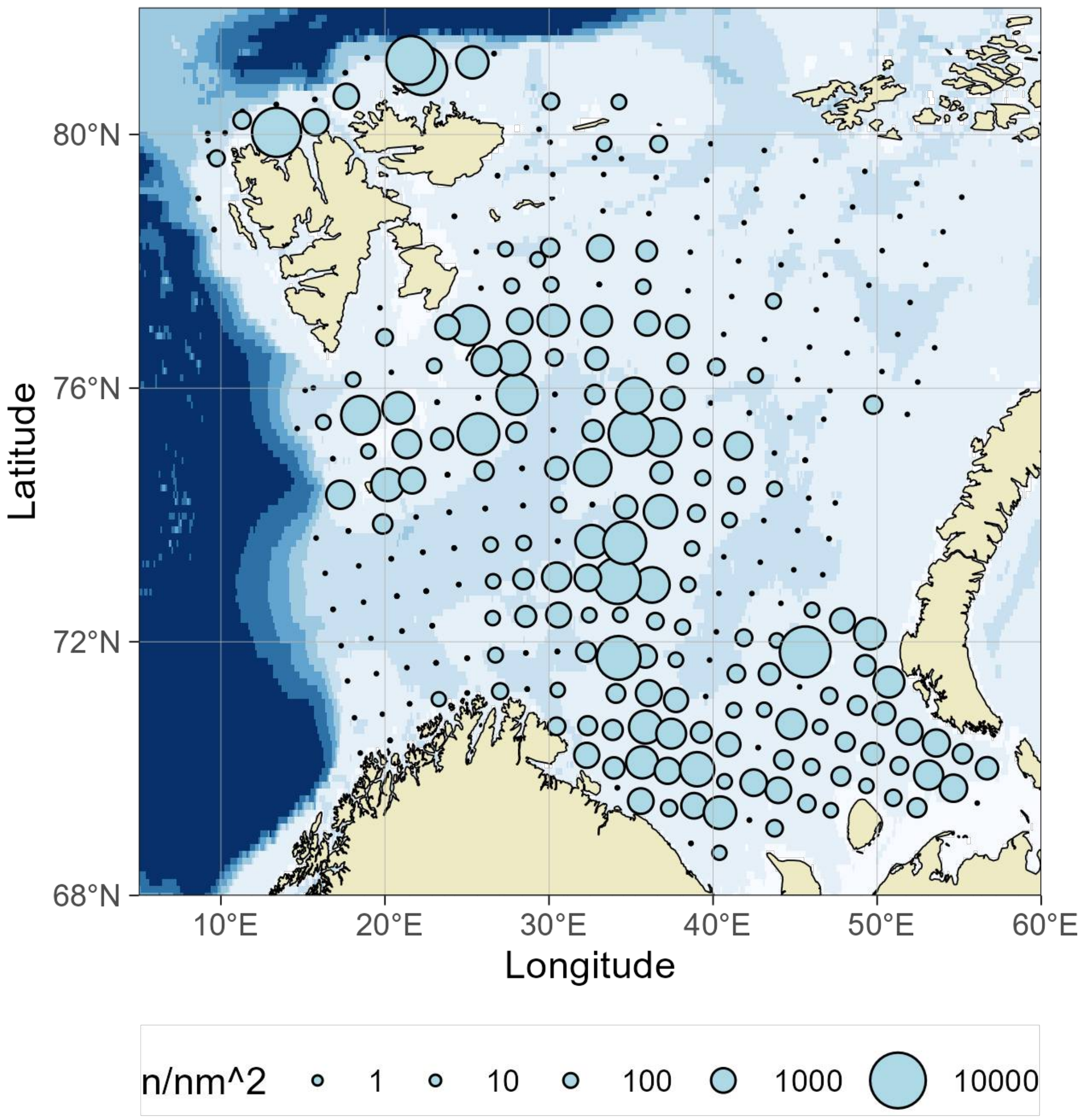

Figure 8.1.2 *Distribution of cod 20-34 cm, August-October 2024.*

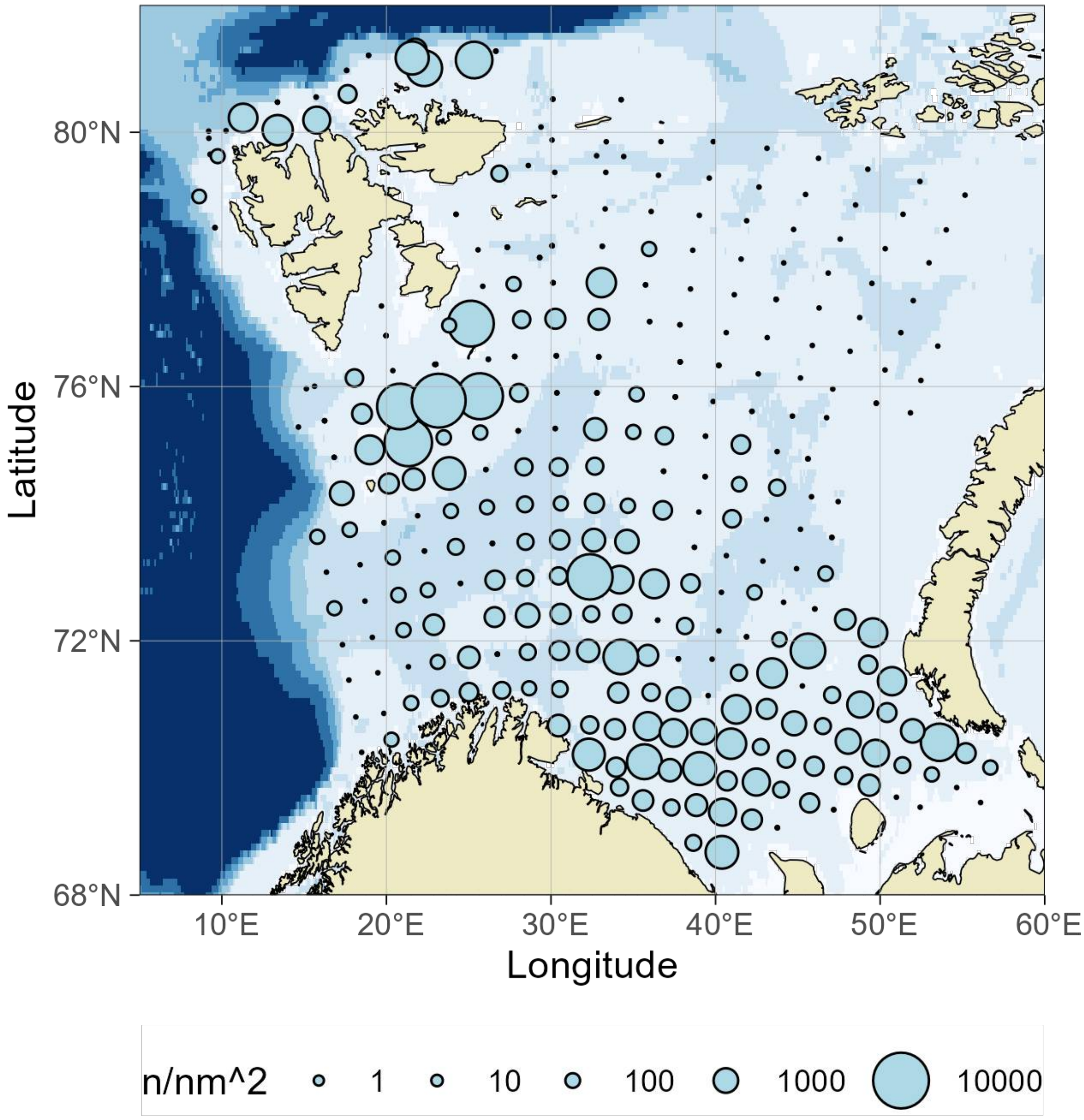

Figure 8.1.3 *Distribution of cod 35-49 cm, August-October 2024.*

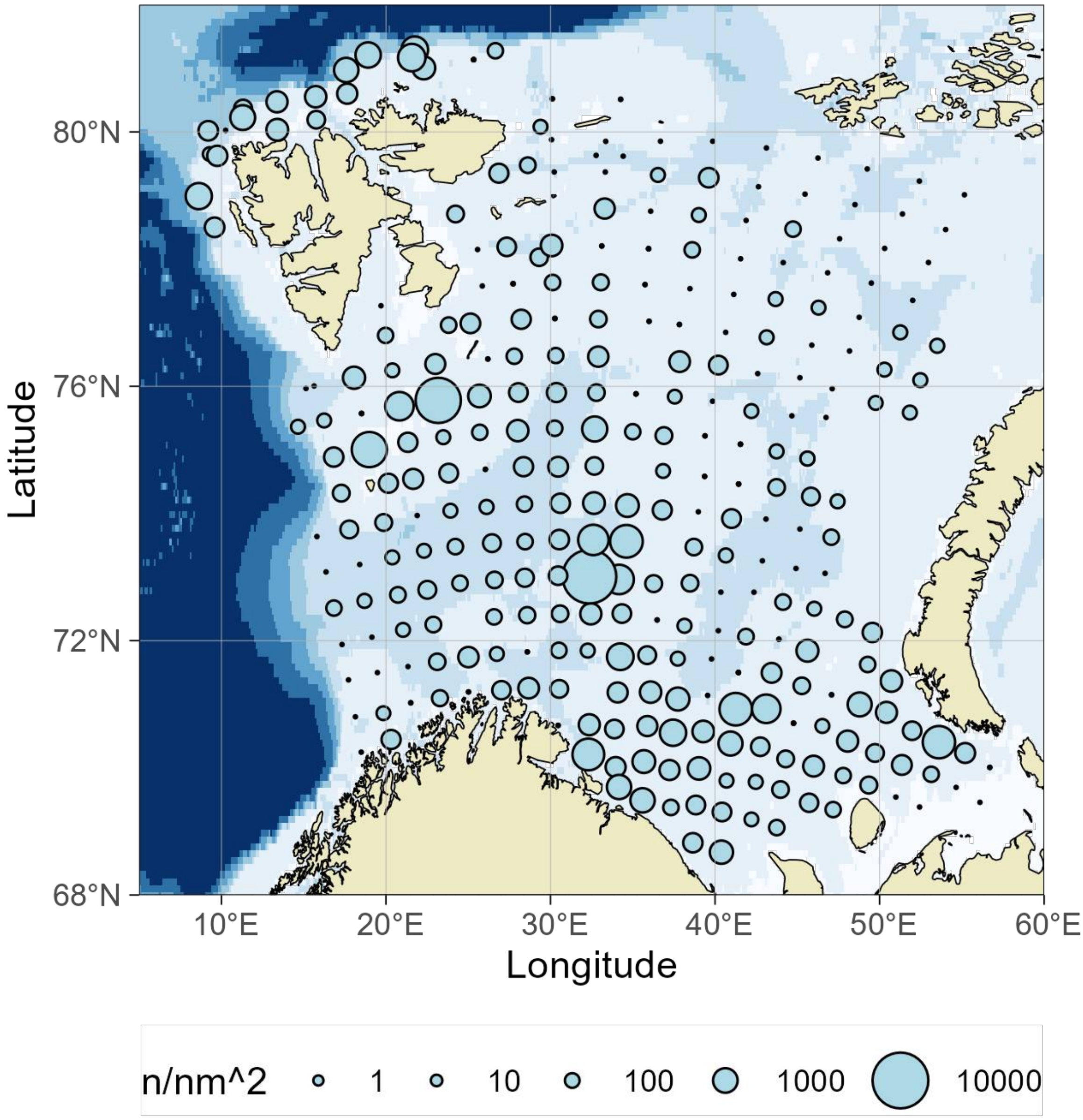

Figure 8.1.4 *Distribution of cod >= 50 cm, August-October 2024.*

8.2 Haddock (*Melanogrammus aeglefinus*)

Haddock was found mainly in shallower areas in the western and south-eastern Barents Sea. Smaller haddock (<20cm, Fig. 8.2a), had a wider distribution than the larger individuals. Haddock < 20 cm are mainly 0-group and 1-group haddock. Some of these smaller individuals were caught north of Svalbard/Spitsbergen. The larger and older haddock (Figs. 8.2.1-8.2.4) were mainly found in the south-eastern Barents Sea, along the coast of Northern Norway and on the shallower bank areas, and along the bank-edges both north and south of Bear Island Trough and Hopen Trench.

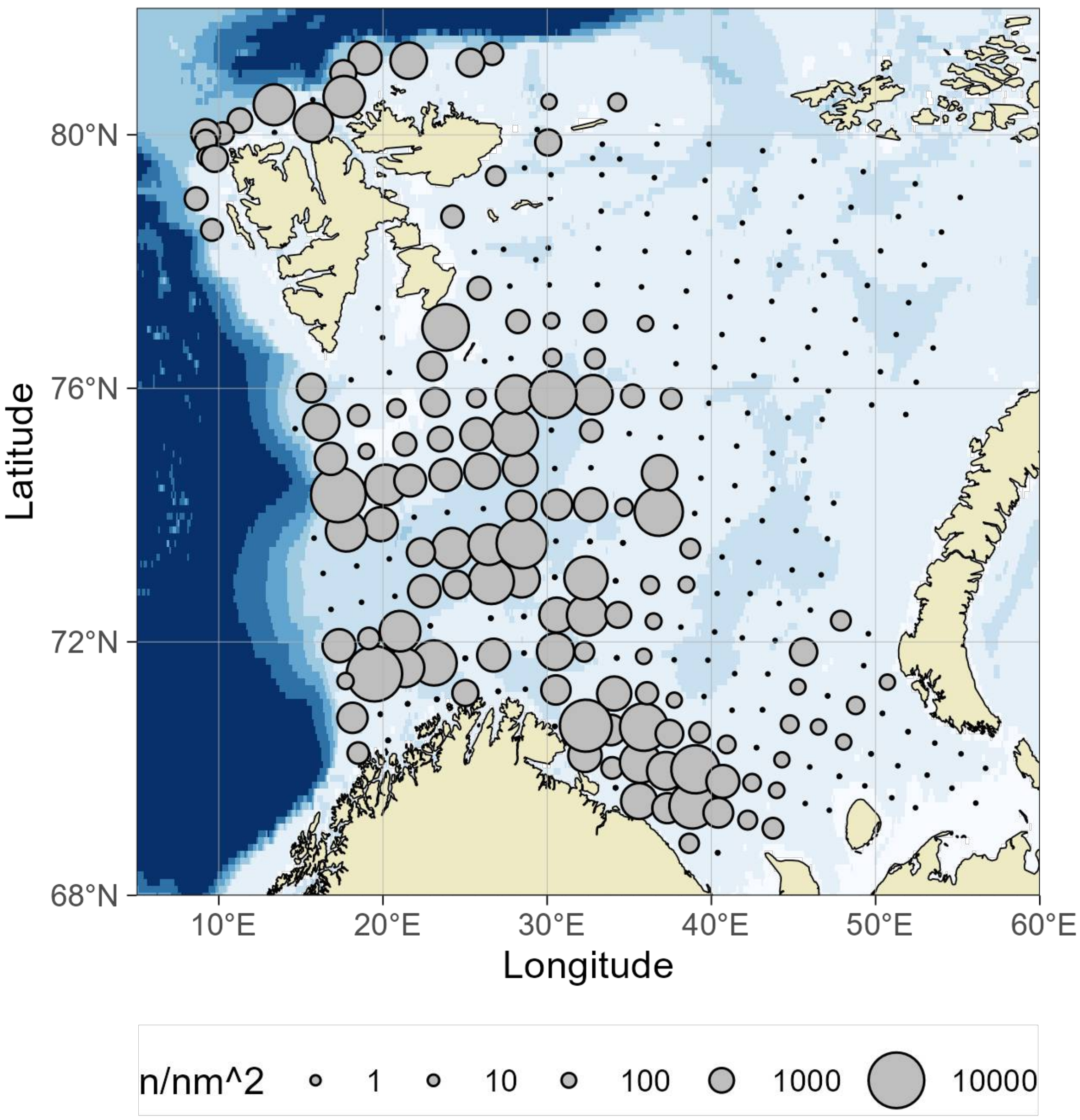

Figure 8.2.1 *Distribution of haddock < 20 cm, August-October 2024.*

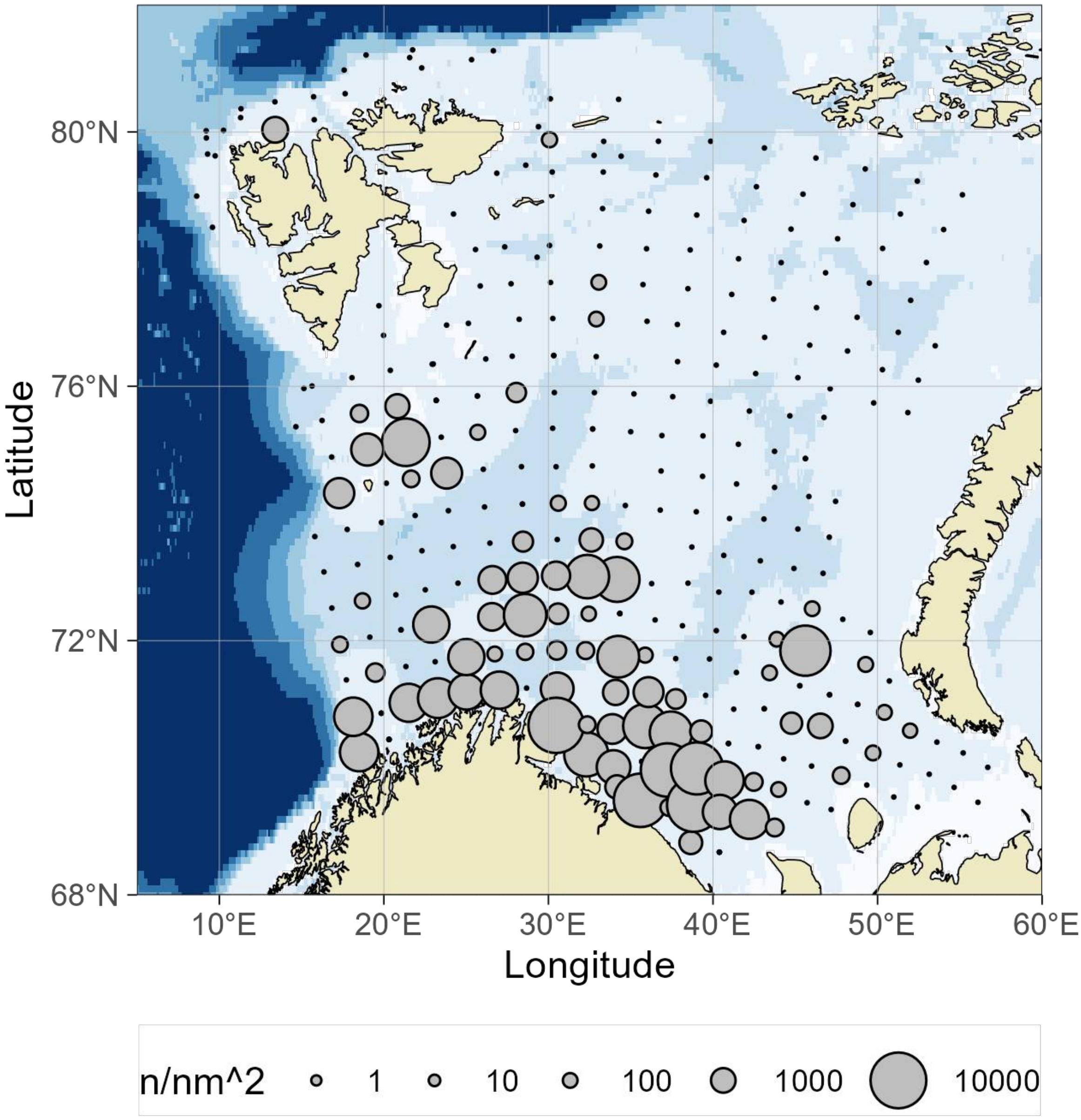

Figure 8.2.2 *Distribution of haddock 20-34 cm, August-October 2024.*

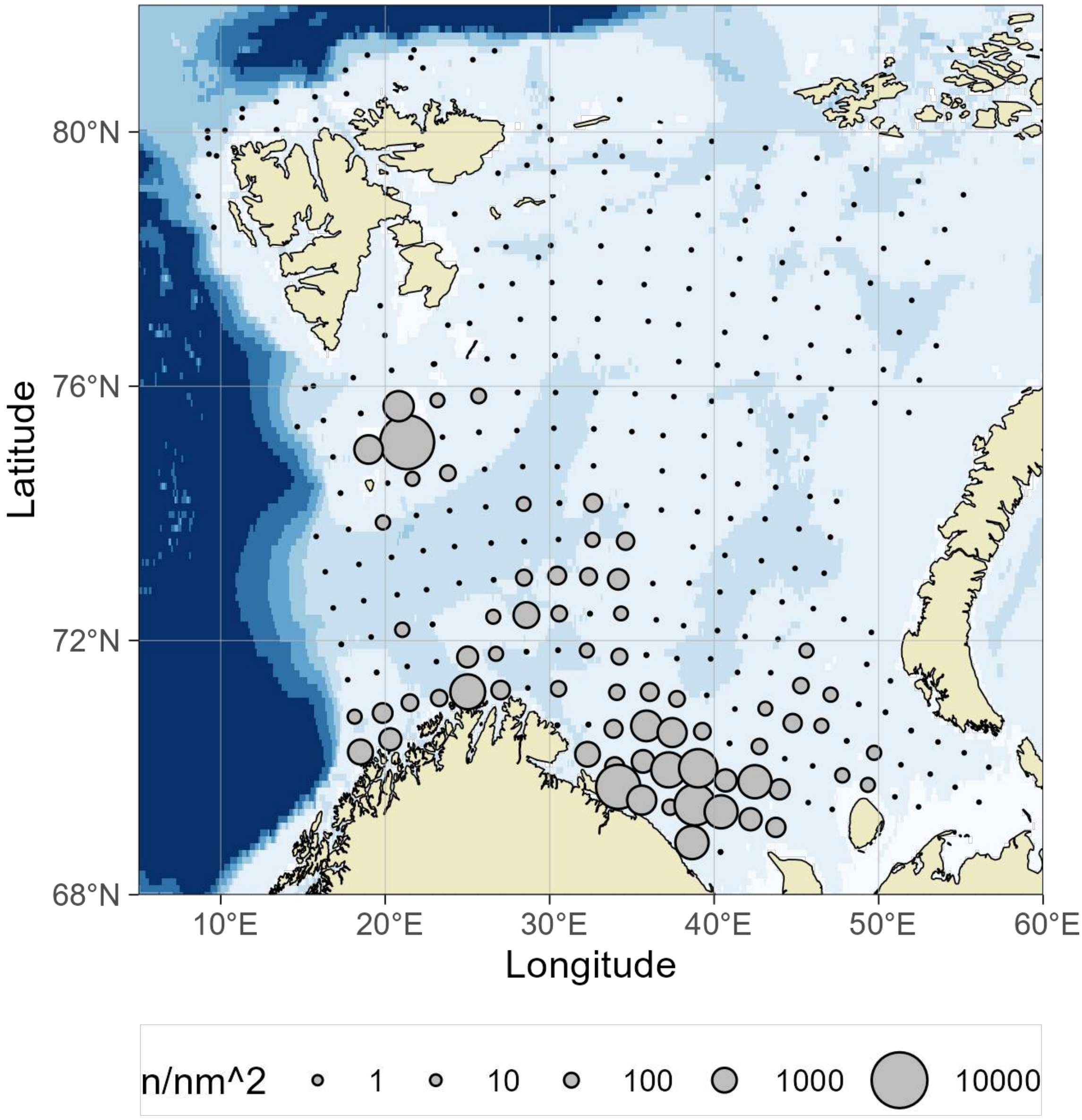

***Figure 8.2.3** Distribution of haddock 35-49 cm, August-October 2024.*

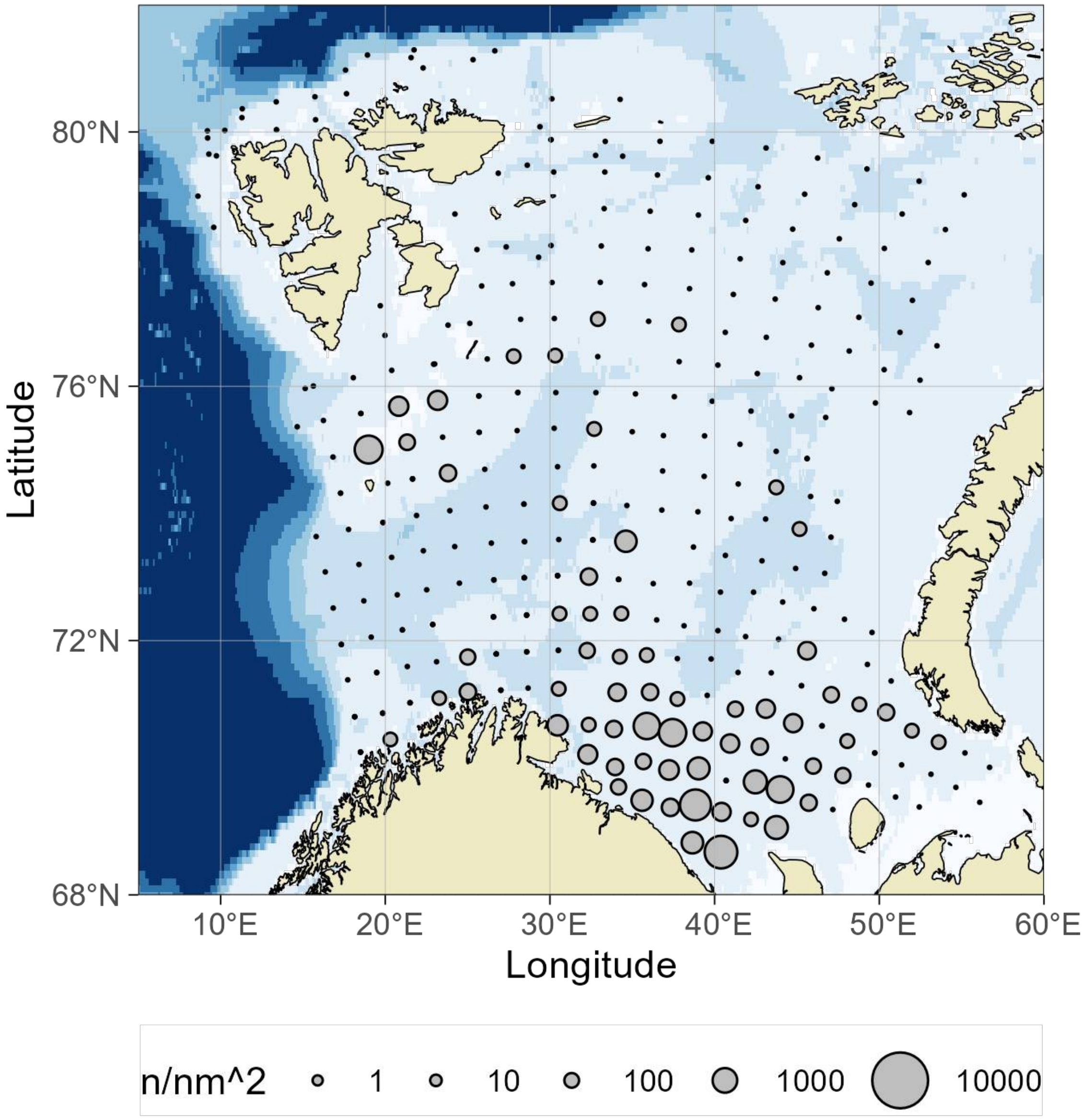

Figure 8.2.4 *Distribution of haddock >= 50 cm, August-October 2024.*

8.3 Greenland halibut (*Reinhardtius hippoglossoides*)

BESS covers an area where mainly younger Greenland halibut is found, with nursery areas in the northernmost part. In recent years there has been a noticeable increase in the number of fish between 20-40 cm. As in previous years, Greenland halibut was observed in most catches in the deep areas of the Barents Sea (fig. 8.3). The distribution pattern was similar to previous years, with main concentrations observed around Svalbard/Spitsbergen, to the west of Franz Josef Land, and in the Bear Island Trench.

The BESS registrations result in three indices, one for fish up to 17 cm, one for fish between 18 and 27 cm, and one for fish above 28 cm. Moreover, trawl indices from surveys that cover deeper waters at the continental slope, are also used in the stock assessment.

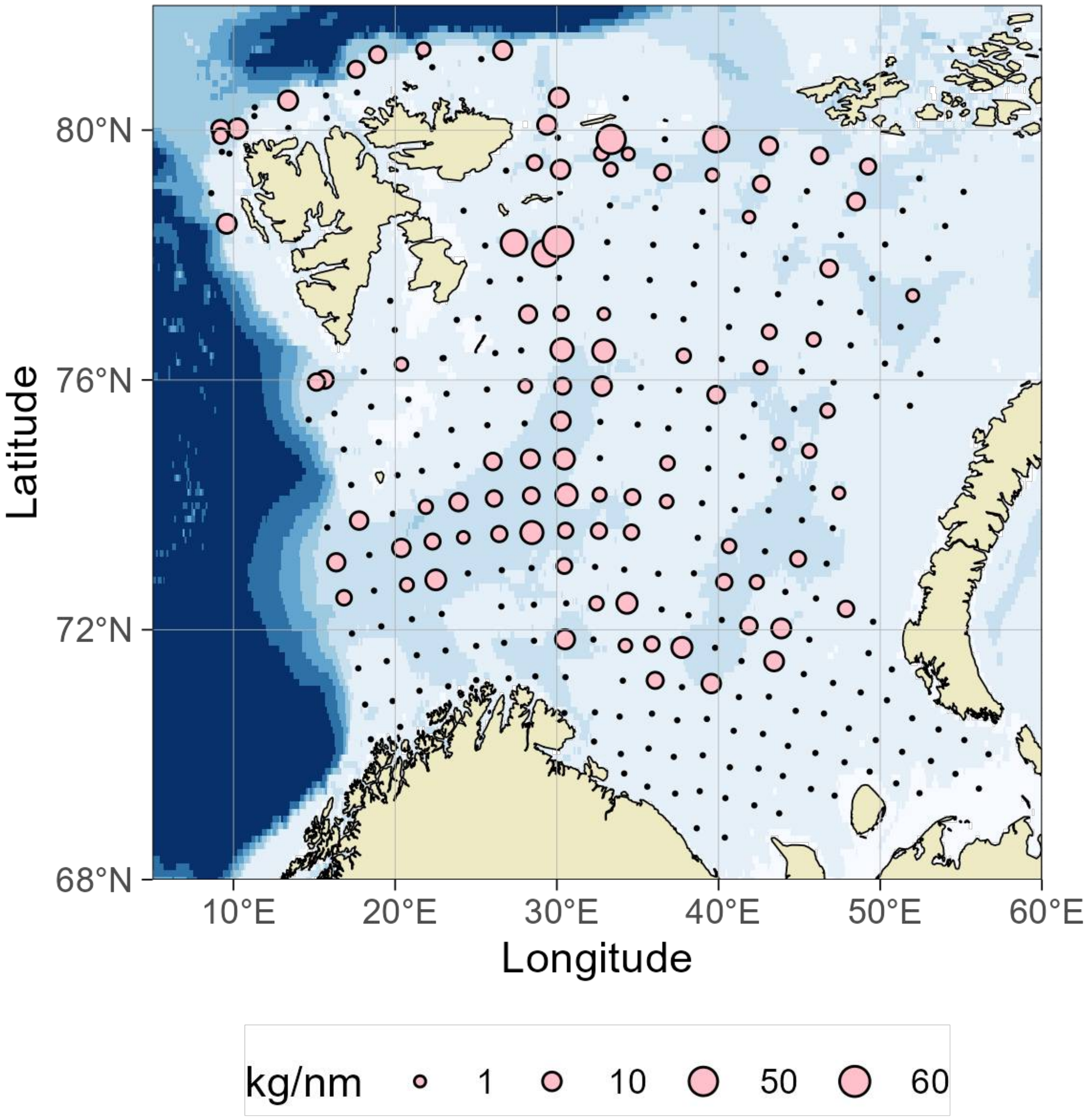

Figure 8.3 *Distribution of Greenland halibut, August-October 2024.*

8.4 Golden redfish (*Sebastes norvegicus*)

Data from the ecosystem survey is currently not used in the assessment of golden redfish. In 2024, centers of abundance for golden redfish were observed along the coast of the Troms region in Norway, along the Murman coast, and along the northern and western coast of Svalbard/Spitsbergen (fig. 8.4). As in earlier years observations in the eastern Barents Sea, were few and of low abundance.

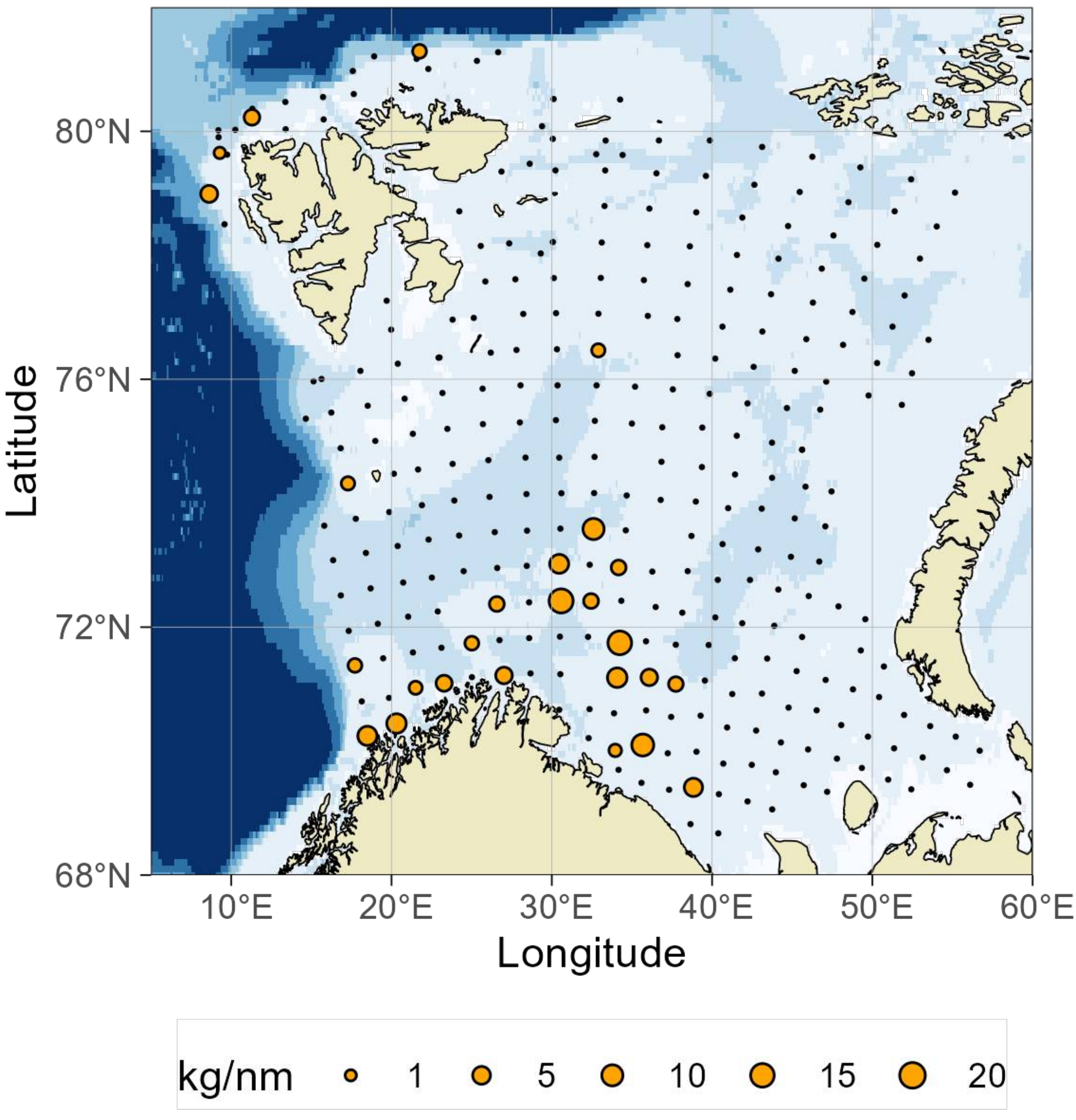

Figure 8.4 *Distribution of golden redfish, August-October 2024.*

8.5 Beaked redfish (*Sebastes mentella*)

Data from BESS is used in the assessment of beaked redfish. As in previous years, beaked redfish were absent from an area north of Bear Island and in the south-eastern part of the Barents Sea (Fig. 8.5). Moreover, in contrast to last year, the species was largely absent east of 40 °E and along the west shelf of Svalbard (but note lacking coverage there). The highest catches of beaked redfish were concentrated in the area south and east of Bear Island. and some catches were also recorded along the shelf break north of Bear Island and north and northwest of Svalbard/Spitsbergen. Catch weight decreased from the west towards the eastern Barents Sea.

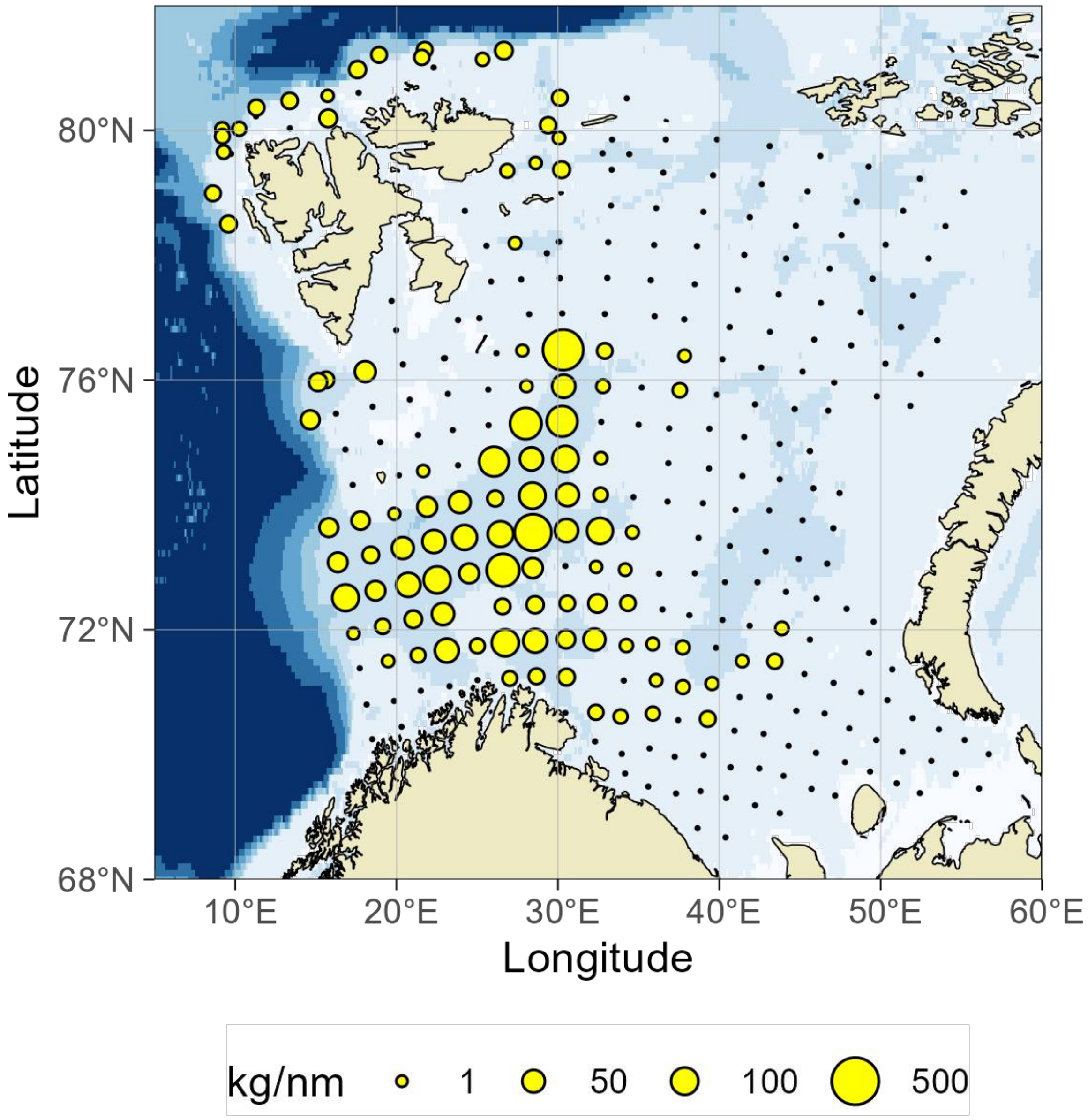

Figure 8. 5 *Distribution of beaked redfish, August-October 2024.*

8.6 Long rough dab (*Hippoglossoides platessoides*)

The long rough dab as usually the most numerous species in the demersal survey in the Barents Sea. Long rough dab was found in almost all trawl catches in the survey area, but the maximum densities and highest catches were in the Central Bank, along the slopes of the Svalbard/Spitsbergen bank and in a small area in the southeast. (fig. 8.6). The numbers and biomass of long rough dab in the Barents Sea have been stable over the past 20 years. Based on the ecosystem survey data, the total stock biomass index of this species is between 400 and 500 thousand tons.

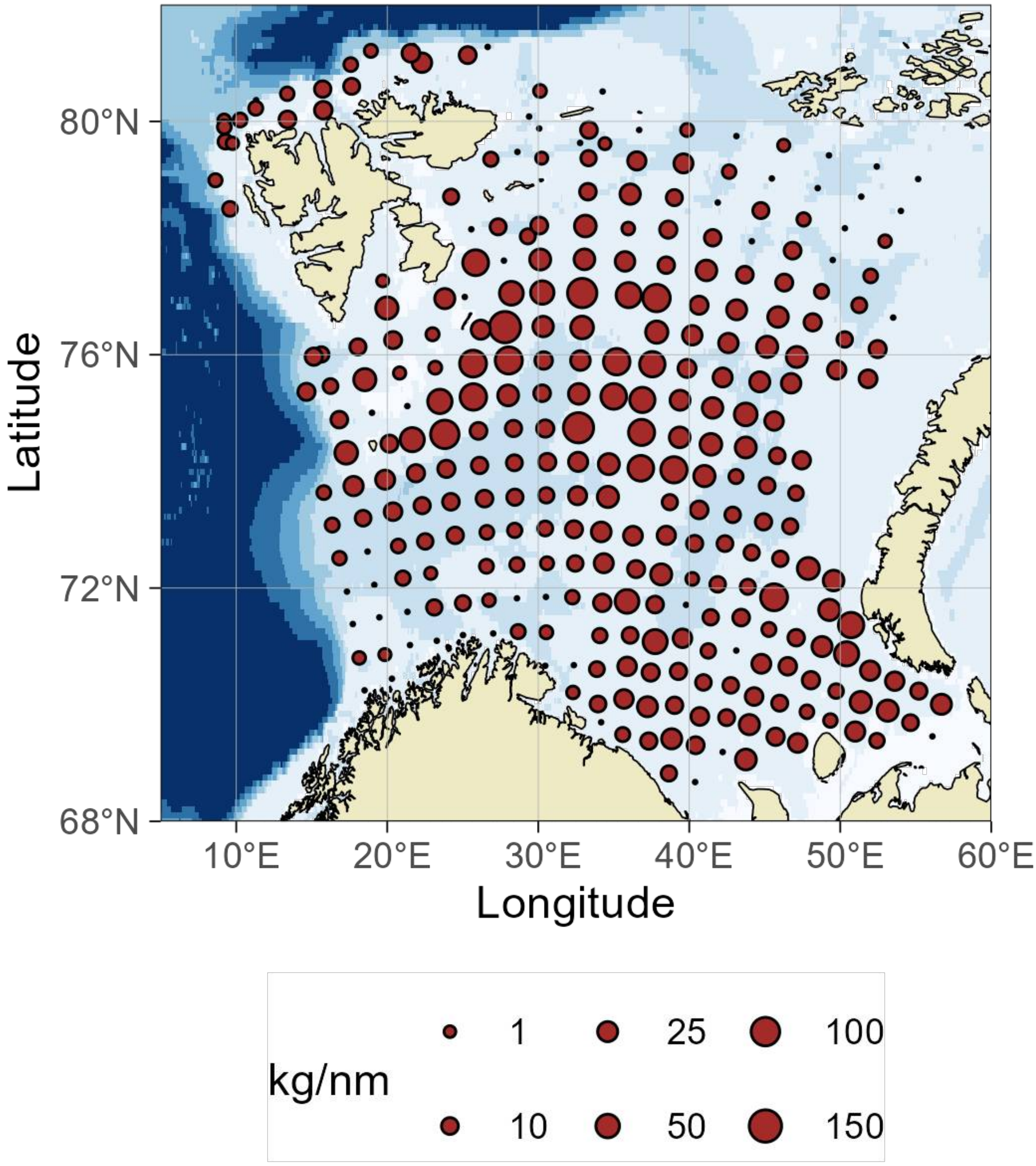

Figure 8.6 *Distribution of long rough dab, August-October 2024.*

8.7 Plaice (*Pleuronectes platessa*)

Plaice is mainly found in the southeastern Barents Sea from the coast of Murman to the Kolguev Island. The highest densities were on the border to the White Sea and in the area closed to trawl fishing, where the Kamchatka crab fishing takes place (Fig. 8.7).

The distance between the trawl stations at the ecosystem survey is too large to correctly assess plaice distribution and abundance. The plaice distribution is very patchy, and partly found in areas that cannot be trawled, this greatly affects the possibility to assess the stock. According to the ecosystem survey data, the total stock biomass index is about 50 thousand tons and its biomass has been stable in recent years.

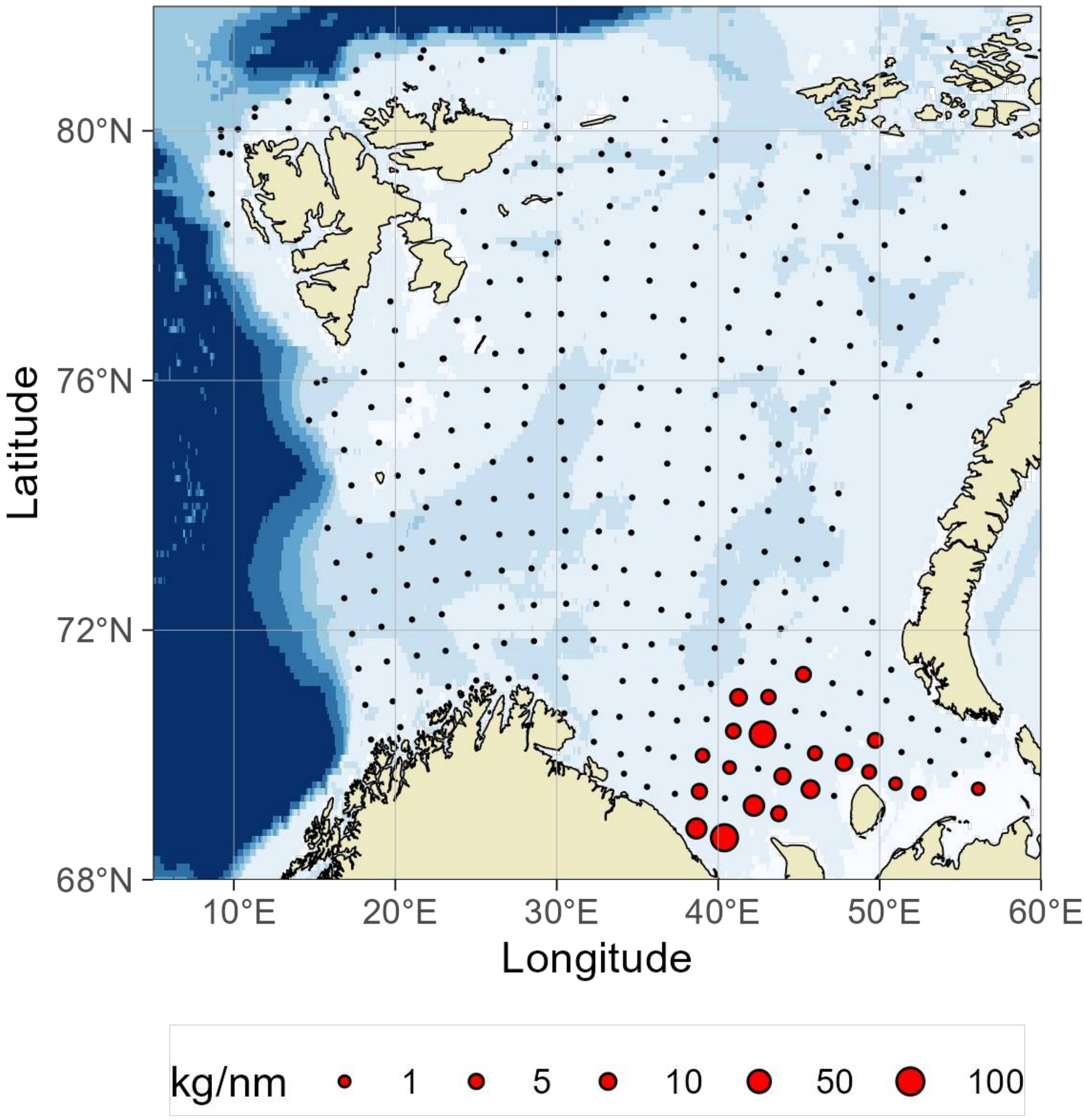

Figure 8.7 *Distribution of plaice, August-October 2024.*

8.8 Atlantic wolffish (*Anarhichas lupus*)

Atlantic wolffish is the most numerous of the three species of wolffishes inhabiting the Barents Sea, while due to its smaller size has the lowest biomass of the three species. At the survey in 2024 Atlantic wolffish was mainly found in Atlantic waters north-west of Svalbard/Spitsbergen and in shallower waters along the edge of the Hopen Trough and Bear Island Trench and scattered as well as scattered further south (fig. 8.8).

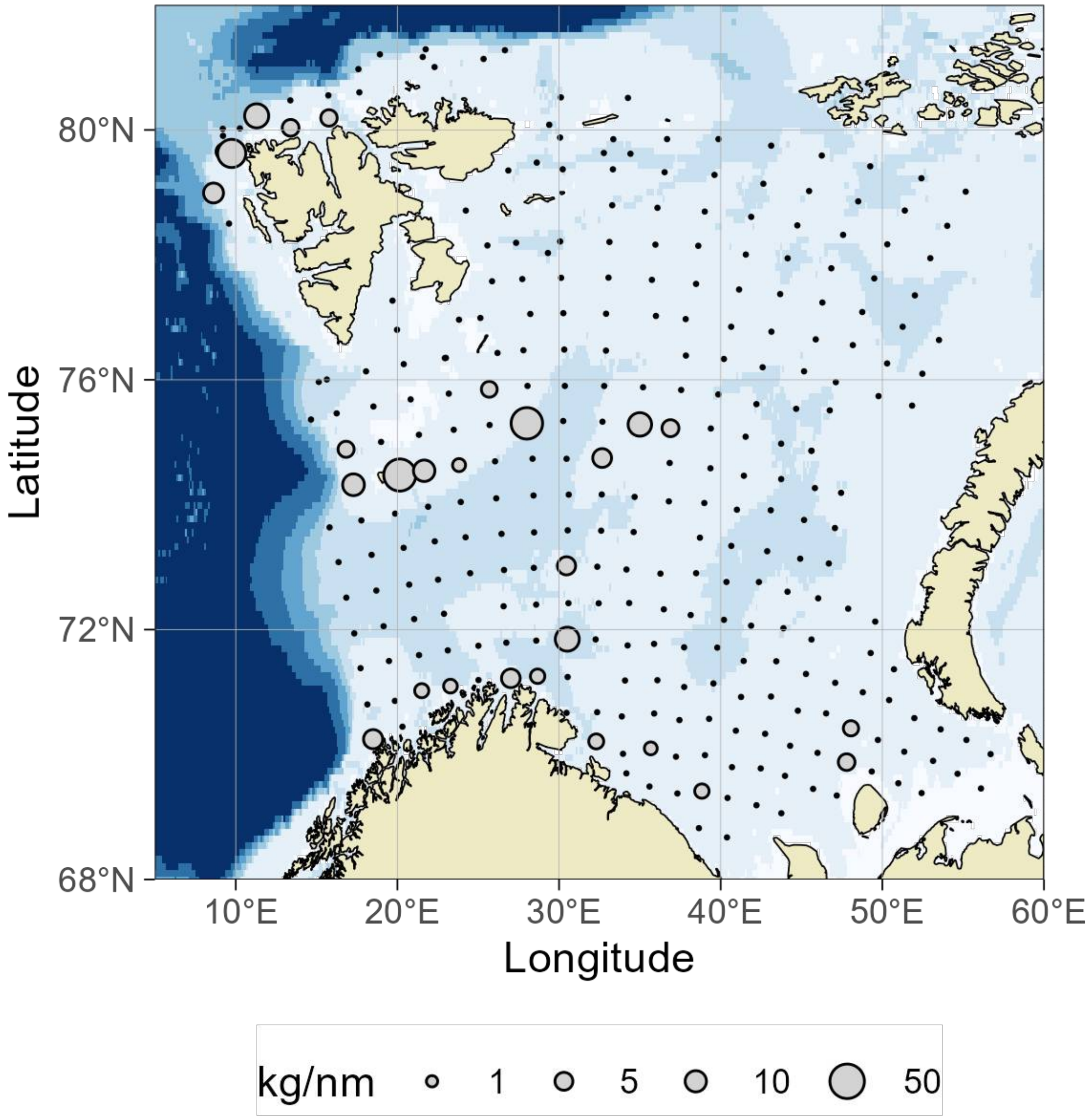

Figure 8.8 *Distribution of Atlantic wolffish, August-October 2024.*

8.9 Spotted wolffish (*Anarhichas minor*)

In 2024 the spotted wolffish was found in the central part of the sea with densities along the slopes of the Svalbard/Spitsbergen and Central Banks (fig. 8.9).

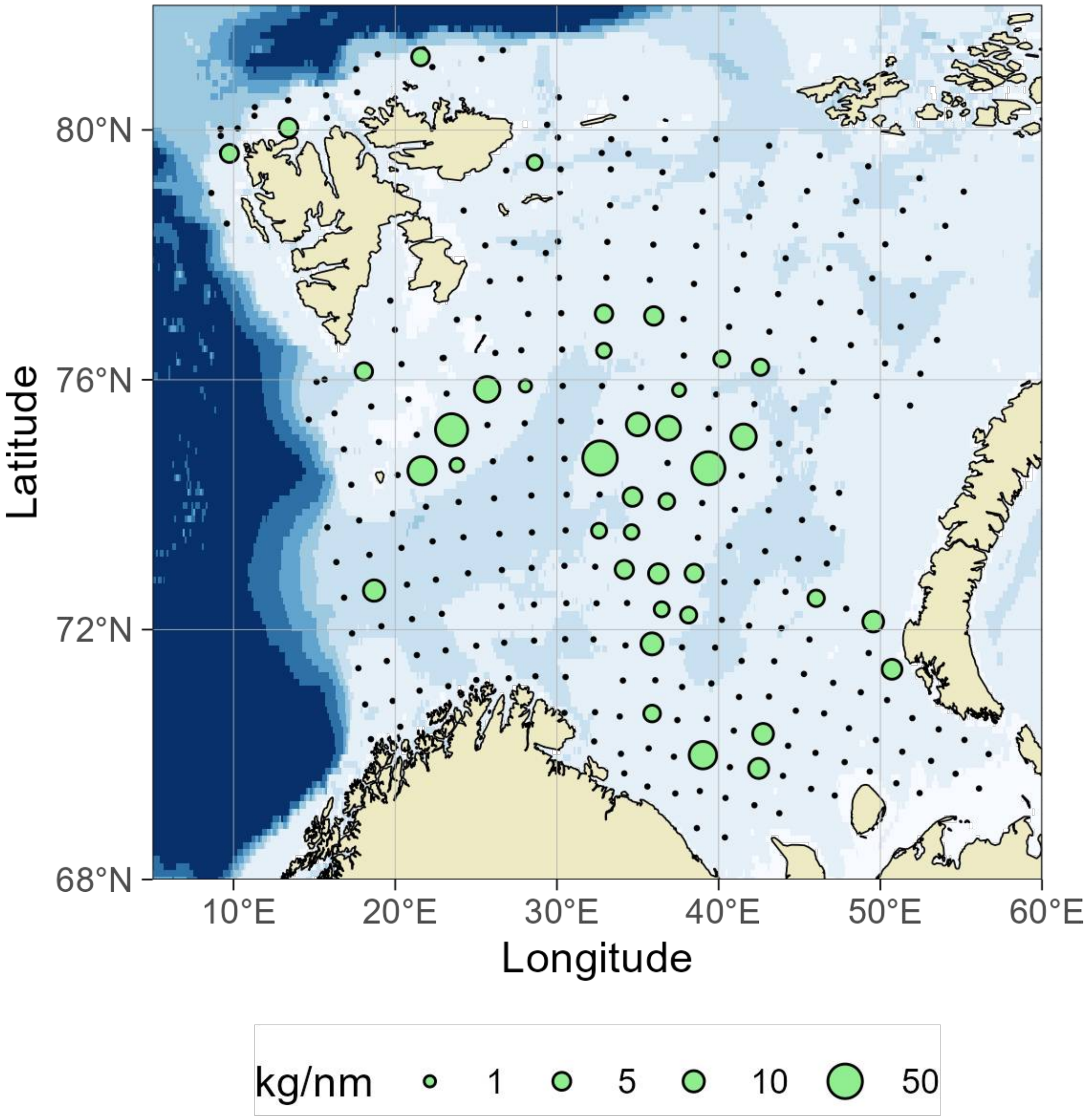

Figure 8.9 *Distribution of Northern wolffish, August-October 2024.*

8.10 Northern wolffish (*Anarhichas denticulatus*)

In 2024 Northern wolffish was distributed along the slopes of Hopen Trench extending into the slopes of the Central Basin in the eastern Barents Sea (Fig. 8.10).

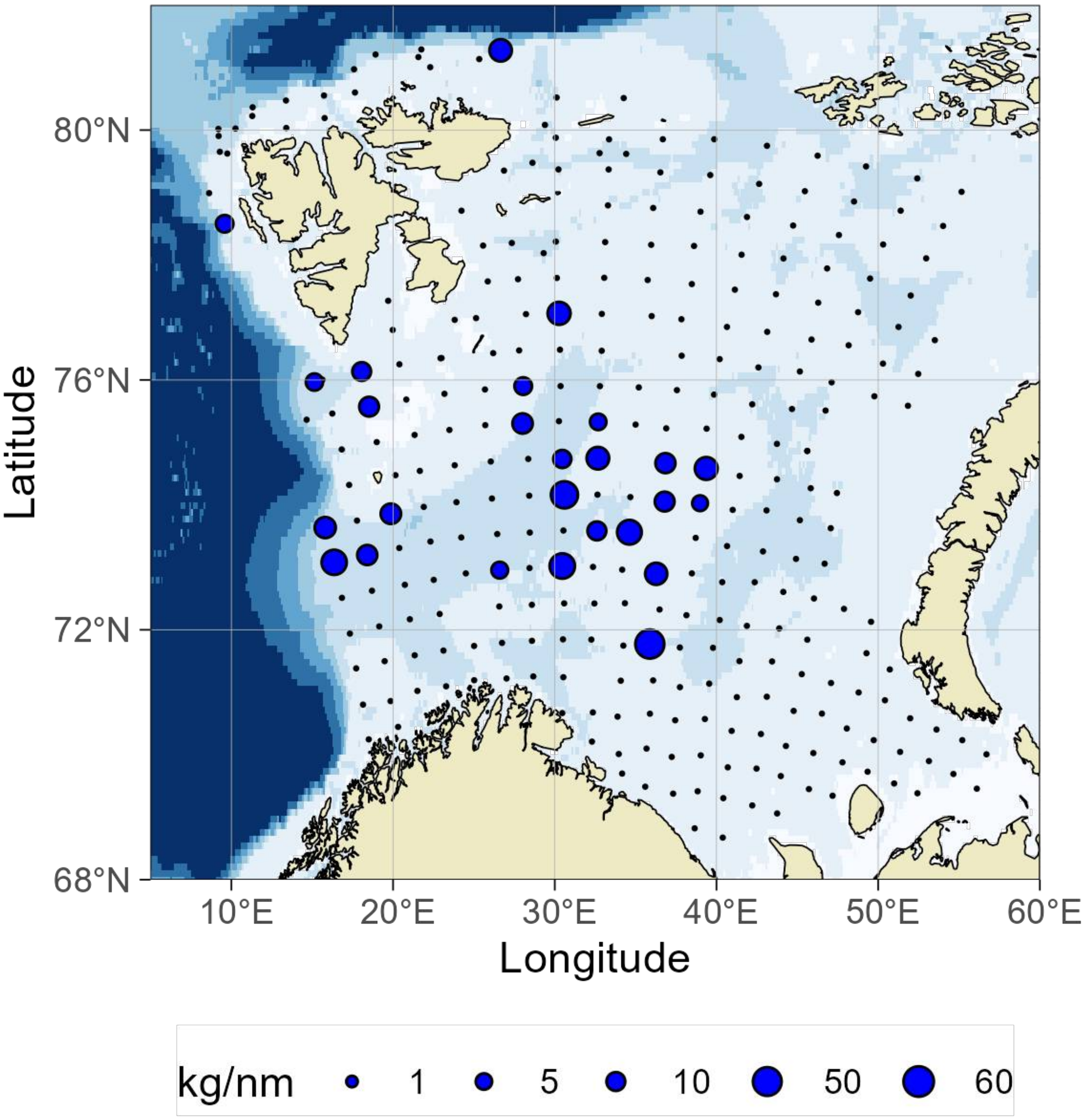

Figure 8.10 *Distribution of spotted wolffish, August-October 2024.*

9 - Fish Biodiverity

Author(s): Tanya Prokhorova (VNIRO-PINRO), Andrej Dolgov (VNIRO-PINRO), Edda Johannesen and Rupert Wienerroither (IMR)

9.1 Small non-target fish species

This group will no longer be updated due to reduced resources.

9.2 Fish biodiversity in the demersal compartment

Figures by: D. Prozorkevich

9.2.1 Norway pout (*Trisopterus esmarkii*).

Norway pout is usually found in the south-western part of the ecosystem survey area. The distribution of Norway pout in 2024 was approximately the same as in 2023 (fig. 9.2.1).

The maximum catch of Norway pout in 2024 (138.7 kg/nm) was a little lower than in 2023 (153.9 kg/nm), but the average catch in 2024 (1.6 kg/nm) was a little higher (1.4 kg/nm in 2023). Total abundance and biomass of Norway pout in 2024 (1520.2 million individuals and 44.1 thousand tons respectively) were higher than in 2023 (1067.8 million individuals and 36.1 thousand t respectively) (tab. 9.2.1).

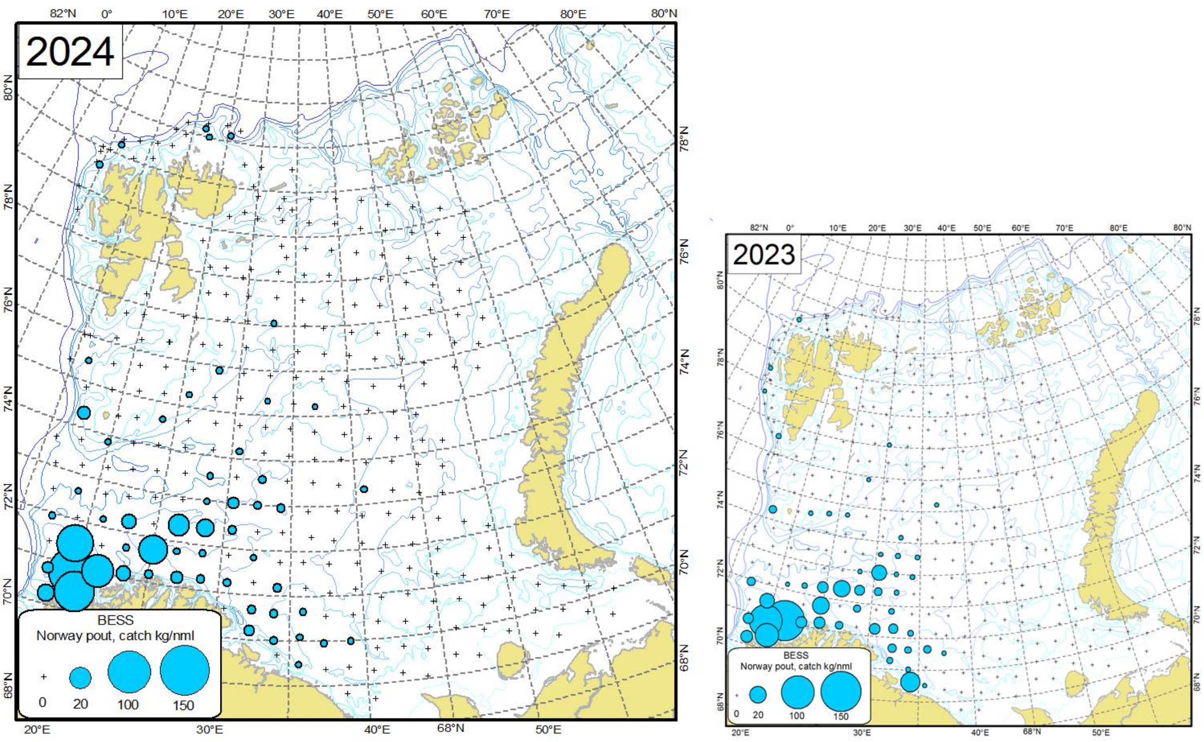

Figure 9.2.1 *Distribution of Norway pout, August-October 2024 and August-September 2023.*

9.2.2 Norway redfish (*Sebastes viviparus*).

Norway redfish occurred in the south-western area of the survey along the Norwegian coast in 2024 (fig. 9.2.2).

The maximum catch of Norway redfish in 2024 (63.0 kg/nm) as well as the average catch (0.7 kg/nm) were much lower than in 2023 (330.7 kg/nm and 1.6 kg/nm respectively). Total abundance and biomass of this species in 2024 (127.4 million individuals and 13.6 thousand t) were less than in 2023 (189.6 million individuals and 28.9 thousand t respectively) (tab. 9.2.1).

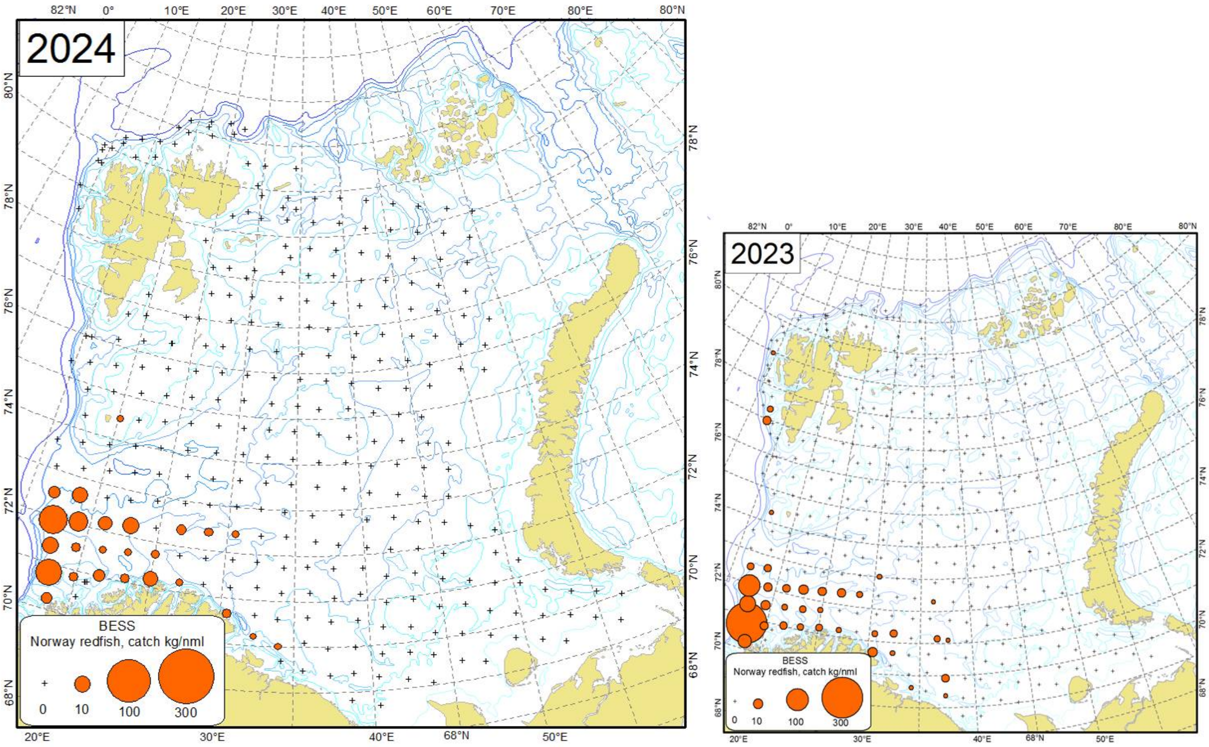

Figure 9.2.2 *Distribution of Norway redfish, August-October 2024 and August-September 2023.*

Table 9.2.1 *Total abundance (N, million individuals) and biomass (B, thousand t) of Norway pout and Norway redfish in the Barents Sea in August-September 2006-2024 based on demersal trawls (not including 0-group).*

	Species			
Year	**Norway pout**		**Norway redfish**	
	N	**B**	**N**	**B**
2006	1838	32	219	19
2007	2065	61	64	10
2008	3579	97	24	4
2009	3841	131	17	2
2010	3530	103	26	2
2011	5976	68	83	9
2012	3089	105	114	12
2013	2267	40	233	25
2014	1254	37	105	6
2015	943	33	168	20
2016	797	28	125	13
2017	1260.6	21.6	133.7	14.3
2018	1687.2	50.8	202.9	25.3
2019	1949.2	51.1	142.5	15.5
2020	515.2	14.6	155.7	22.6
2021	330.6	11.6	131.6	19.1
2023*	1067.8	36.1	189.6	28.9
2024	1520.2↑	44.1↑	127.4↓	13.6↓

* – 2022 is not included due to the lack of synoptic coverage

9.2.3 Thorny skate (*Amblyraja radiata*) and Arctic skate (*Amblyraja hyperborea*)

Thorny skate and Arctic skate were selected as indicator species to study how ecologically similar fishes from different zoogeographic groups respond to changes of their environment. Thorny skate belongs to the mainly boreal zoogeographic group and is widely distributed in the Barents Sea except the most north-eastern areas, while Arctic skate belongs to the Arctic zoogeographic group and is found in the cold waters of the northern area.

In 2024 thorny skate was distributed over a wide area from the north-western to the south-western and south-eastern Barents Sea where warm Atlantic and Coastal Waters dominated (fig. 9.2.3). Compared to 2023 this species occurred less abundant in the south-eastern area.

Thorny skate was observed in 31.1 % of the bottom stations in 2024, approximately the same level as in 2023 (32.7 %). Thorny skate was distributed within a depth of 61-493 m, and the highest biomass occurred at depth of 150-299 m (55.9 % of total biomass). The mean catches in 2024 (0.8 individuals per nm and 0.7 kg per nm) were lower than in 2023 (1.1 individuals per nm and 0.9 kg per nm respectively) (tab. 9.2.2). The estimated total abundance and biomass of thorny skate in 2024 (23.2 million individuals and 20.5 thousand t) were also lower than in 2023 (32.3 million individuals and 28.0 thousand t and have not been in 10 years (tab. 9.2.1).

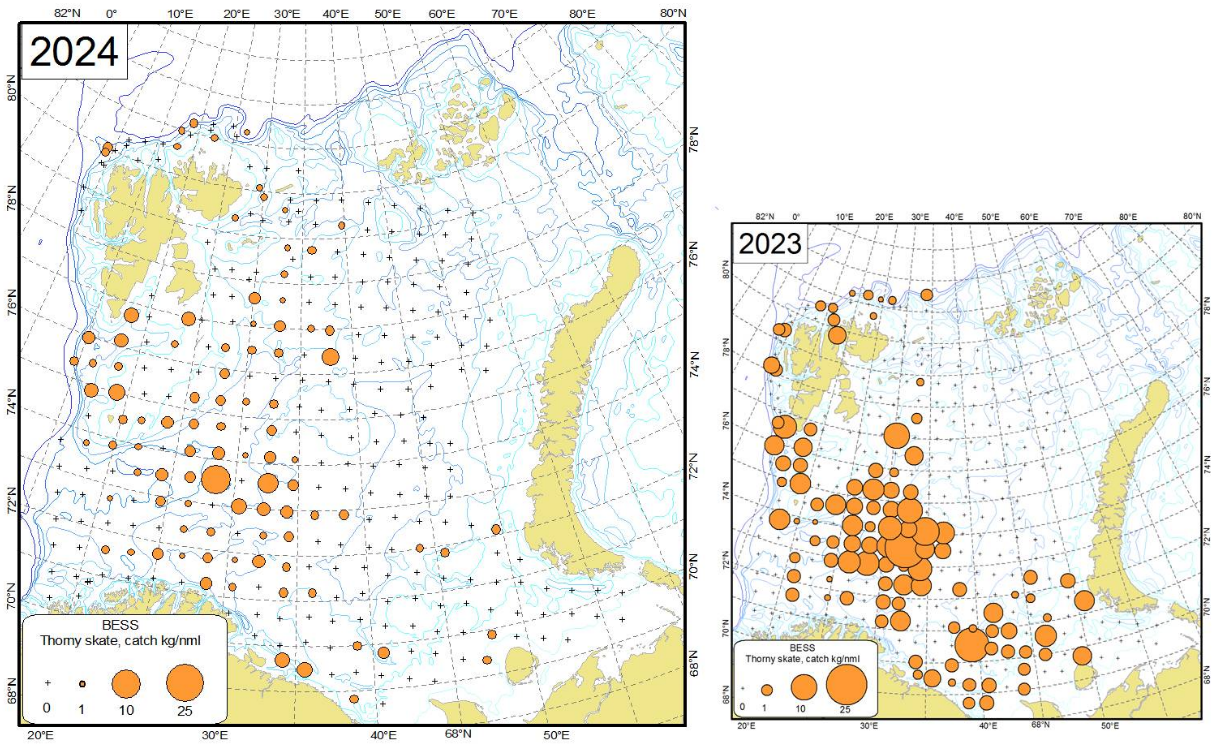

Figure 9.2.3 *Distribution of thorny skate, August-October 2024 and August-September 2023.*

***Table 9.2.2** Mean catches (abundance N, individuals per nm and biomass B, kg per nm) and total abundance (N, million individuals) and biomass (B, thousand t) of thorny skate during BESS 2014-2024.*

	Mean catch		**Total abundance**	
	N	**B**	**N**	**B**
2014	1.4	1.2	34.4	30.0
2015	1.1	1.0	31.8	30.5
2016	1.0	0.9	30.7	28.2
2017	1.8	1.3	52.0	39.7
2019*	2.0	1.4	57.0	41.3
2020	0.8	0.7	31.7	31.1
2021	0.6	0.4	30.7	27.6
2023**	1.1	0.9	32.3	28.0
2024	0.8	0.7	23.2	20.5

* – 2018 is not included due to the poor survey coverage

** – 2022 is not included due to the lack of synoptic coverage

Arctic skate was only observed in two bottom stations in 2024, at a depth of 336 m in the Central Trough (1 individual: 68 cm and 3.55 kg) and 322 m on the Great Bank (Perseus Bank) (1 individual: 55 cm and 1.85 kg) (Figure 9.2.4). The mean catch (in terms of abundance and biomass) of Arctic skate in 2024 (0.01 individuals per nm and 0.02 kg per nm) was less than in 2023 (0.02 individuals per nm and 0.03 kg per nm) (Table 9.2.3). The total abundance and biomass of Arctic skate in 2024 was not calculated due to lack of sufficient data for analysis.

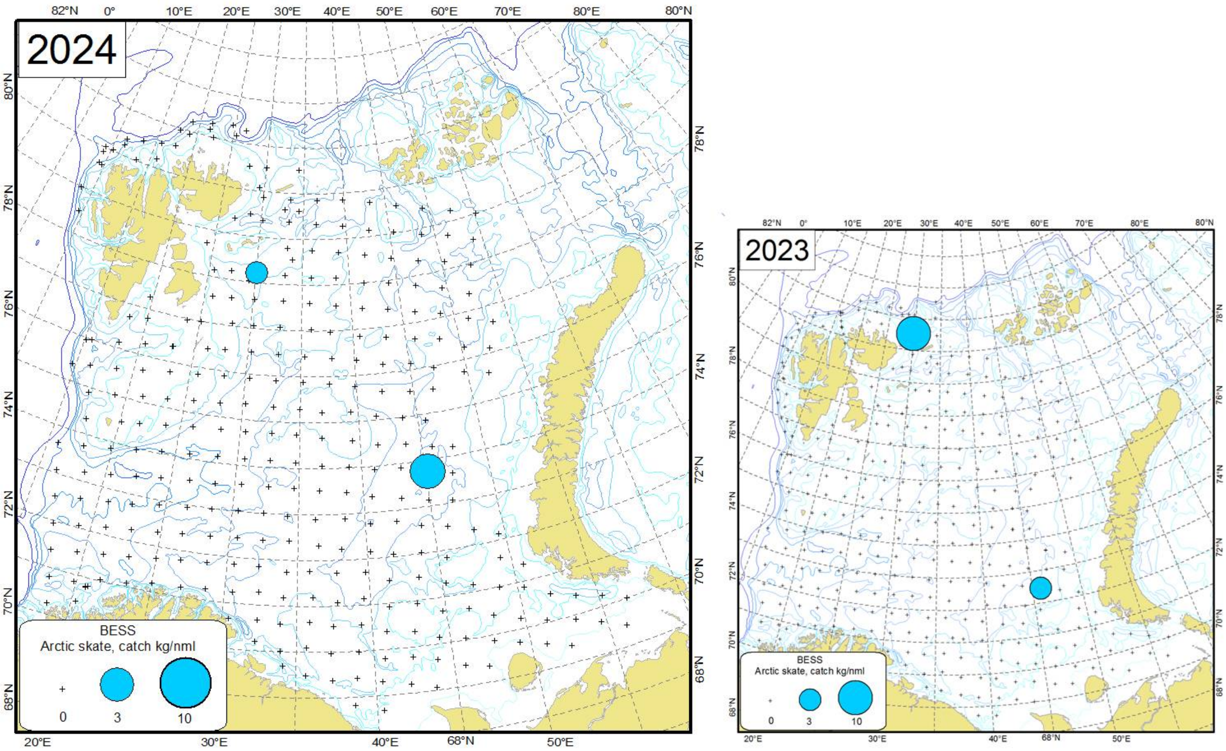

Figure 9.2.4 *Distribution of Arctic skate, August-October 2024 and August-September 2023.*

Table 9.2.3 *Mean catches (abundance N, individuals per nm and biomass B, kg per nm) and total abundance (N, million individuals) and biomass (B, thousand t) of Arctic skate during BESS 2014-2024.*

	Mean catch		**Total abundance**	
	N	**B**	**N**	**B**
2014	0.2	0.3	3.7	6.7
2015	0.07	0.1	1.6	1.9
2016	0.2	0.2	8.6	4.0
2017	0.3	0.3	4.9	4.4
2019*	0.07	0.09	2.0	2.3
2020	0.12	0.11	1.8	1.8
2021	0.02	0.01	0.7	0.6
2023**	0.02	0.03	0.3	0.4
2024	0.01	0.02	–***	–***

* – 2018 was not included due to the poor survey coverage

** – 2022 is not included due to the lack of synoptic coverage

*** – have not been estimated due to lack of sufficient data for analysis

9.3 Uncommon or rare species

Rare or uncommon species are either species that are not caught at the Barents Sea ecosystem survey every year (e.g. megrim *Lepidorhombus whiffiagonis* – known from the Atlantic coasts off northern Africa to Norway, including the Mediterranean, the British Isles and Iceland, but uncommon in the Arctic region), or caught most years but in low numbers and with limited occurrence (e.g. Arctic rockling *Gaidropsarus argentatus*, known off southeastern Greenland, off Iceland and the Faroe Islands to the Norwegian coast and northward to the Barents Sea in the survey area found along the continental slope between the Norwegian coast and Svalbard/Spitsbergen and eastward to Franz Josef Land). Most of these species usually occur in areas adjacent to the Barents Sea and were therefore found mainly along the border of the surveyed area.

Some uncommon species were also observed in the Barents Sea during the ecosystem survey in 2024 (Figure 9.3.1).

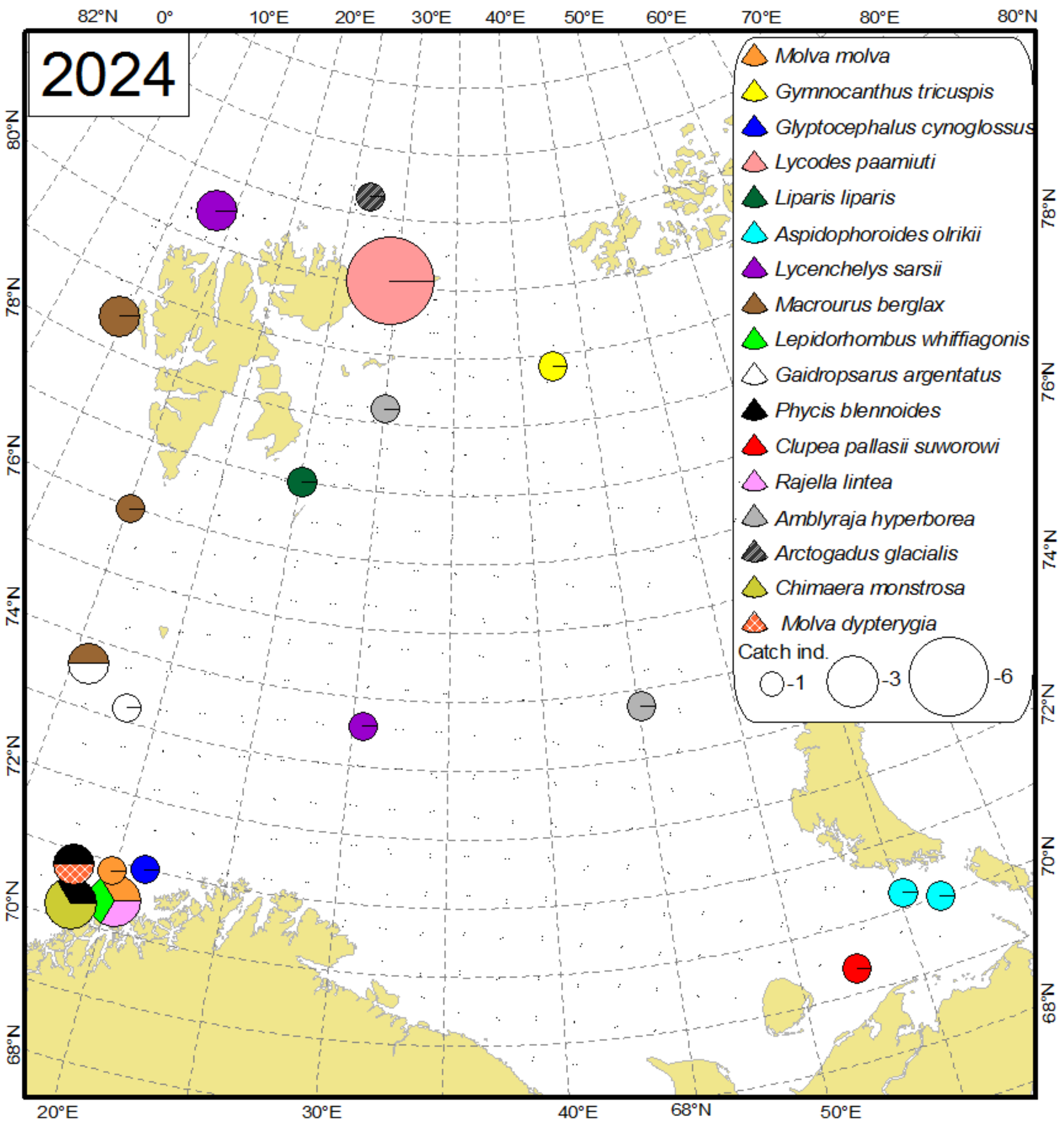

Figure 9.3.1 *Distribution of rare and uncommon fish species in the Barents Sea in August-October 2024. The size of circles corresponds to total abundance (individuals per trawl station, both pelagic and bottom trawl stations were used, both pelagic and demersal species are included).*

9.4 Zoogeographic and taxonomic groups

During the 2024 ecosystem survey, 83 fish species from 27 families were recorded in the catches. Some specimens were only identified to genus or family level, especially from the families Liparidae, where genus Careproctus includes different species which are difficult to identify onboard. The highest number of species belonged to the families Zoarcidae (13.3 % of the total number of species), Gadidae (12.0 %) and Cottidae (9.6 %). The recorded species belonged to 7 zoogeographic groups: widely distributed, south boreal, boreal, mainly boreal, Arctic-boreal, mainly Arctic and Arctic as defined by Andriashev and Chernova (1994). Only bottom trawl data were used, and only non-commercial species were included in the analysis, both demersal (including bentho-pelagic) and pelagic (neritopelagic, epipelagic, bathypelagic) species (Andriashev and Chernova, 1994, Parin, 1968, 1988). Among the analyzed species most belonged to the Arctic (31.0 % of the total number of species), mainly boreal (25.9 %) and boreal (24.1 %) zoogeographic groups.

The median and maximum catches of non-commercial fish from the different zoogeographic groups are shown in tabs. 9.4.1, 9.4.2. Please note that differences in spatial survey coverage within years are not taken into account).

Widely distributed (only ribbon barracudina *Arctozenus risso* represents this group), south boreal (e.g. silvery pout *Gadiculus argenteus*, greater forkbeard *Phycis blennoides*) and boreal (e.g. moustache sculpin Triglops murrayi, fourbeard rockling *Enchelyopus cimbrius*) species were mostly found in the central, southwestern and western part of the survey area where warm Atlantic and Coastal Waters dominate (fig. 9.4.1). The median catches of ribbon barracudina in 2024 were one third of that in 2023. The median catches of species from the south boreal zoogeographic group in 2024 half of the median catch in 2023, but the second highest since the start of this times series in 2013. The median catches of species from the boreal zoogeographic group in 2024 were double that in 2023, and at the level as 2020-2021 (tab. 9.4.1).

Mainly boreal species (e.g. three-spined stickleback *Gasterosteus aculeatus*, gracile eelpout *Lycodes gracilis*) were widely distributed throughout the survey area (fig. 4.2.1). The median and maximum catches of species from the mainly boreal group were little lower in 2024 than in 2023 (tabs. 9.4.1, 9.4.2).

Arctic-boreal species (e.g. Atlantic poacher *Leptagonus decagonus*, ribbed sculpin *Triglops pingelii*) were found in the central, northern and south-eastern part of the Barents Sea (fig 9.4.1). The median catches of species from the Arctic-boreal zoogeographic group in 2024 were approximately at the same level as in 2020-2023 (tab. 9.4.1). The maximum catches in 2024 were lower than in 2023 (tab. 9.4.2).

Mainly Arctic (e.g. Atlantic spiny lumpsucker *Eumicrotremus spinosus*, nebulous snailfish *Liparis bathyarcticus*) and Arctic (e.g. pale eelpout *Lycodes pallidus*, leatherfin lumpsucker *Eumicrotremus derjugini*) species were mainly found in the northern part of the Barents Sea (fig. 9.4.1). Species from these groups mostly occur in areas influenced by cold Arctic Water, Spitsbergen Bank Water and Novaya Zemlya Coastal Water. Median and maximum catches of mainly Arctic species in 2024 were higher than in 2023 (tabs. 9.4.1, 9.4.2). Median and maximum catches of species from the Arctic zoogeographic group in 2024 were the lowest since 2014 (tabs 9.4.1, 9.4.2).

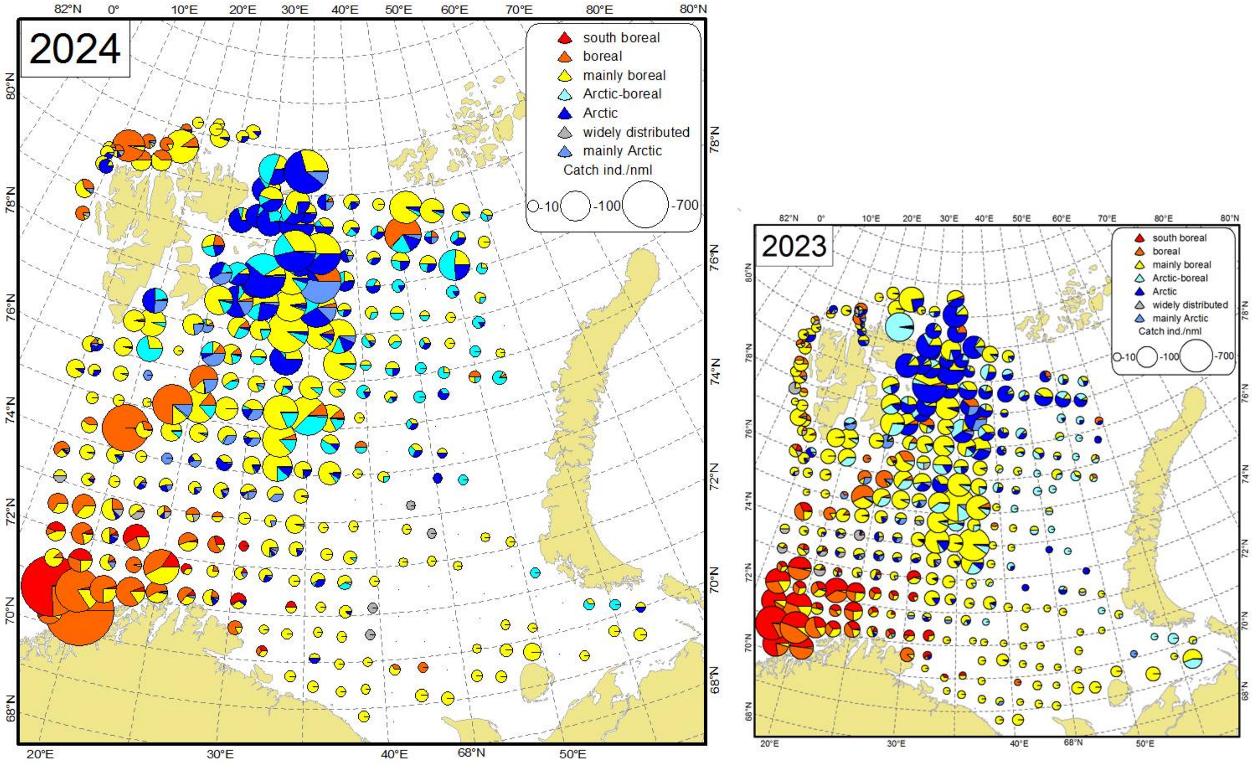

Figure 9.4.1 *Distribution of non-commercial fish species from different zoogeographic groups during the ecosystem survey 2024 and 2023. The size of circles corresponds to total abundance (individuals per nm, only bottom trawl stations were used, both pelagic and demersal species are included).*

Table 9.4.1 *Median catch (individuals per nm) of non-commercial fish from different zoogeographic groups (only bottom trawl data were used, both pelagic and demersal species are included).*

	Widely distributed	South boreal	Boreal	Mainly boreal	Arctic-boreal	Mainly Arctic	Arctic
2013	0.2	0.8	7.1	48.9	25.4	10.2	70.8
2014[1]	0.1	0.9	8.7	36.4	8.6	1.7	7.4
2015	0.09	1.2	8.7	71.4	14	1.9	31.5
2016[2]	0.5	1.4	18.3	55.3	8.8	3.3	29.1
2017	0.2	3.2	15	53.7	19.3	4.9	78.5
2019[3]	0.02	2.6	14.2	54.3	15	7.2	108.5
2020	0.1	2.7	17.9	23.7	8.9	1.9	93.7
2021	0.06	1.3	23.0	47.7	7.5	1.7	70.1

	Widely distributed	South boreal	Boreal	Mainly boreal	Arctic-boreal	Mainly Arctic	Arctic
2023[4]	0.6	8.8	8.2	31.3	8.1	1.8	13.3
2024	0.2	4.5	19.1	28.6	8.0	3.3	11.7

1 – Coverage in the northern Barents Sea was highly restricted

2 – The survey started in the north

3 – 2018 is not included due to the poor coverage of the Russian Zone

4 – 2022 is not included due to the lack of synoptic coverage

Table 9.4.2 *Maximum catch (individuals per nm) of non-commercial fish from different zoogeographic groups (only bottom trawl data were used, both pelagic and demersal species are included).*

	Widely distributed	South boreal	Boreal	Mainly boreal	Arctic-boreal	Mainly Arctic	Arctic
2013	17.1	171.4	230.0	982.5	3326.9	656.3	3013.8
20141	14.3	105.7	478.6	3841.4	371.6	60.9	386.4
2015	10.0	216.3	660.0	1587.1	1502.4	53.8	832.2
20162	36.7	135.0	743.8	2962.5	283.8	123.2	808.6
2017	7.5	372.9	792.9	2945.0	571.3	282.5	2731.1
20193	1.3	312.0	735.6	1406.1	297.5	828.8	2968.8
2020	11.0	357.0	1646.1	464.8	573.1	156.2	6770.6
2021	9.9	71.3	1788.2	751.3	268.0	80.8	2178.3
20234	29.9	595.1	282.0	614.8	476.0	74.5	402.5
2024	10.4	991.2	1713.5	471.7	191.9	309.1	349.2

1 – Coverage in the northern Barents Sea was highly restricted

2 – The survey started in the north

3 – 2018 are not included due to the poor coverage of the Russian Zone

4 – 2022 is not included due to the lack of synoptic coverage

10 - Commercial Shellfish

Author(s): Fabian Zimmermann, Ann Merete Hjelset, Hanna Ellerine Helle Danielsen (IMR), Daria Y. Blinova (VNIRO-PINRO) and Sergey Bakanev (VNIRO-PINRO)

10.1 Northern shrimp (*Pandalus borealis*)

Text by: S. Bakanev, F. Zimmermann

Figures by: S. Bakanev

During the survey in 2024, 317 trawl hauls were completed and 214 of them contained Northern shrimp. The biomass of shrimp varied from several grams to 90.7 kg/nm with an average catch of 8.2 kg/nm (tab. 10.1.1).

Table 10.1.1 *The catch characteristics of the Northern shrimp (include SEM) during BESS in 2004-2024.*

Year	Total number of stations	Number of stations with shrimp	Total catch, thousand ind.	Total catch, kg	Mean catch, ind./nm	Mean catch, kg/nm
2004	586	385	896	5665	1272	8
2005	602	420	786	6814	1493	12.9
2006	635	469	990	5800	1947	11.4
2007	528	407	796	4528	1849	10.5
2008	387	293	391	2091	1272	6.8
2009	357	262	361	1772	1253	6.1
2010	320	241	390	2280	1600	9.4
2011	379	301	503	2553	1710	8.7
2012	429	328	594	3082	1727	9
2013	416	336	479	2635	1484	8.1
2014	294	211	289	1536	1211	6.4
2015	325	244	288	1533	1050	5.6

Year	Total number of stations	Number of stations with shrimp	Total catch, thousand ind.	Total catch, kg	Mean catch, ind./nm	Mean catch, kg/nm
2016	292	197	204	1078	896	4.7
2017	321	222	377	2114	1408	8
2018	216	171	244	1410	1413	8.2
2019	314	251	386	2201	1503	8.6
2020	417	314	271	1581	806	4.8
2021	333	252	308	1669	1155	6.3
2022	287	238	236	1294	1210	6.8
2023	320	253	482	2857	1880	10.7
2024	317	214	362	2144	1409	8.2

As in previous years, the densest concentrations of shrimp were registered in the central part of the Barents Sea and around Svalbard/Spitsbergen (fig. 10.1.1).

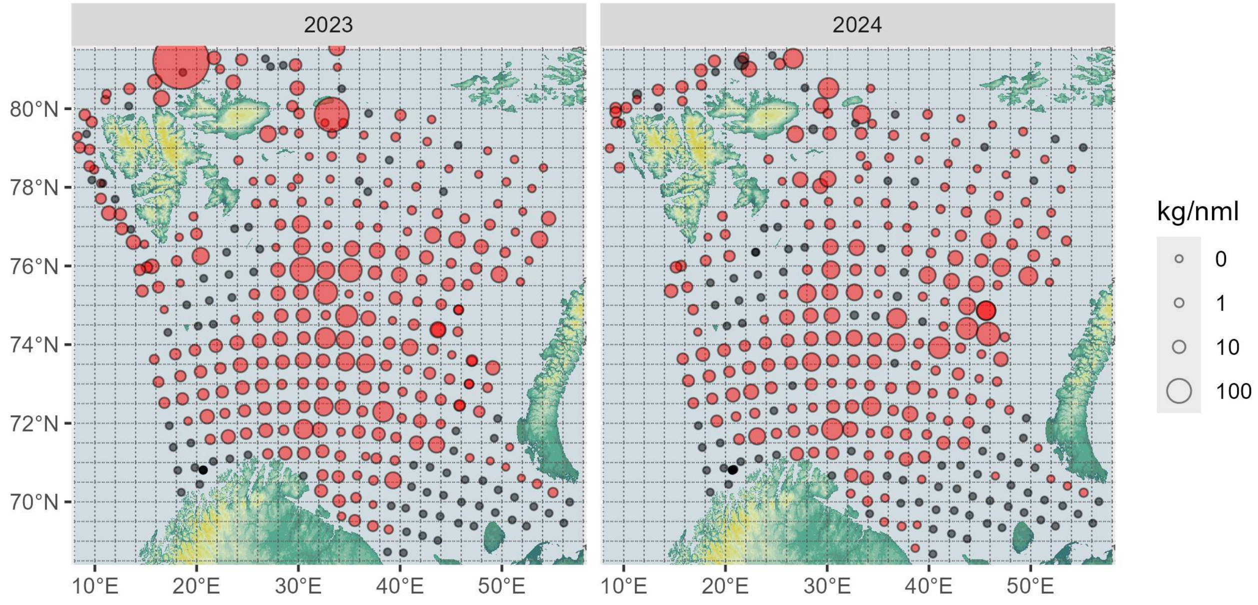

Figure 10.1.1. *Distribution of the Northern shrimp in the Barents Sea in August-September in the two years 2023 and 2024.*

Biological analysis of the Northern shrimp was conducted in 2024 by registering carapace length and developmental stage. As in 2023, the bulk of the population of the Barents Sea shrimp was made up of smaller individuals with a carapace length of 12-22 mm (fig.10.1.2). Information on stages and, thus, the proportion of males and females in 2024 was too limited and is therefore not presented.

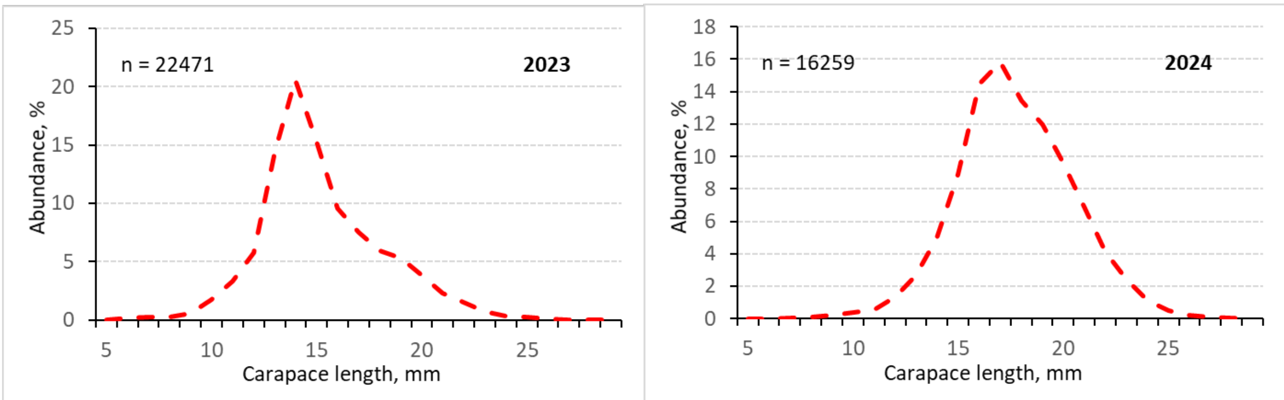

Figure 10.1.2. *Size structure of catches of the Northern shrimp in the eastern Barents Sea 2023-2024.*

10.2 Red king crab (*Paralithodes camtschaticus*)

Text by: S. Bakanev, A.M Hjelset, H.E.H. Danielsen

Figures by: S. Bakanev

During BESS-2024 the red king crab were recorded in 20 of 317 trawl catches. All stations with king crab were in the Russian part of the survey area. Compared to previous years, in 2024 no expansion of red king crab range northward or eastward was observed, compared to previous years (fig. 10.2.1).

Despite the identical coverage of the red king crab area by stations in 2024, compared to 2023, both the number of recordings and the total catch were significantly lower (tab. 10.2.1).

Table 10.2.1. *The total catches of the Red king crab during BESS 2004-2024.*

Year	Total number of stations	Number of stations with Red king crab	Total catch, ind.	Total catch, kg	Mean catch, ind./nm	Mean catch, kg/nm
2004	586	9	385	1293	0.4	1.3
2005	602	11	100	296	0.2	0.5
2006	635	67	1180	3340	2.3	6.1
2007	528	13	310	1100	3.1	8.1
2008	390	10	127	93	0.4	0.3
2009	357	6	14	23	0.0	0.1
2010	320	6	12	25	0.0	0.1
2011	379	4	40	22	0.1	0.1
2012	429	9	126	308	0.3	0.8
2013	416	10	272	437	0.6	1.0
2014	295	11	168	403	0.7	1.6
2015	325	11	252	508	0.9	1.9
2016	293	10	201	496	0.7	1.8
2017	322	13	299	687	0.9	2.2
2018*	217	5	73	175	0.4	0.9
2019	314	33	970	1687	3.6	6.3

Year	Total number of stations	Number of stations with Red king crab	Total catch, ind.	Total catch, kg	Mean catch, ind./nm	Mean catch, kg/nm
2020	417	21	229	531	0.4	1.0
2021	333	26	373	1186	1.3	4.2
2022	287	23	306	1035	1.2	4.2
2023	320	22	238	751	0.9	2.7
2024	317	20	83	320	0.4	1.4

* reduced coverage of the Red king crab area

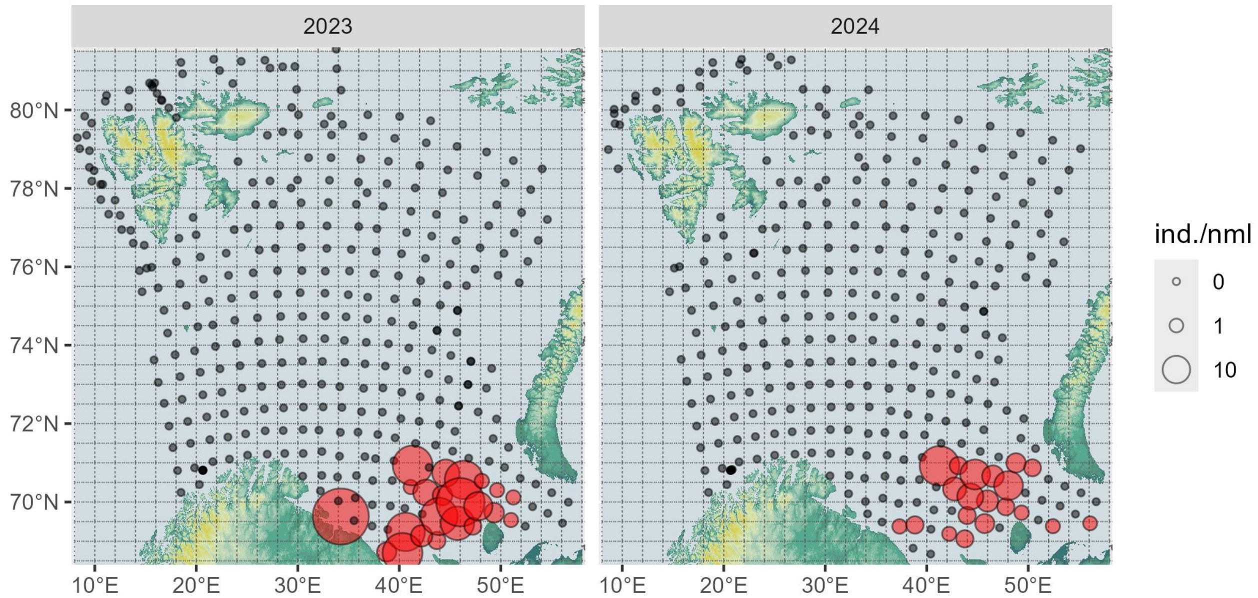

Figure 10.2.1 *Distribution of the Red king crab in the Barents Sea in August-September in the two years 2023 and 2024.*

The biomass of red king crab catches in 2024 varied from 1.8 to 90.9 kg/nm compared with 2.9 to 157.2 kg/nm in 2023. The mean biomass and standard deviation were 19.76±7.11 kg/nm compared with 42.04±9.23 kg/nm in 2023.

The abundance of crab in 2024 ranged from 1.1 to 25.6 ind./nm given an average crab abundance of 5.1±2.5 ind./nm compared with 1.2 to 58.0 ind./nm given a mean crab abundance of 13.3±3.2 ind./nm in 2023.

The size structure of the observed red king crab in 2024 was represented by a monomodal distribution of males with sizes of crabs with carapace width 150-220 mm. (fig. 10.2.2). No females were found in the catches in 2024.

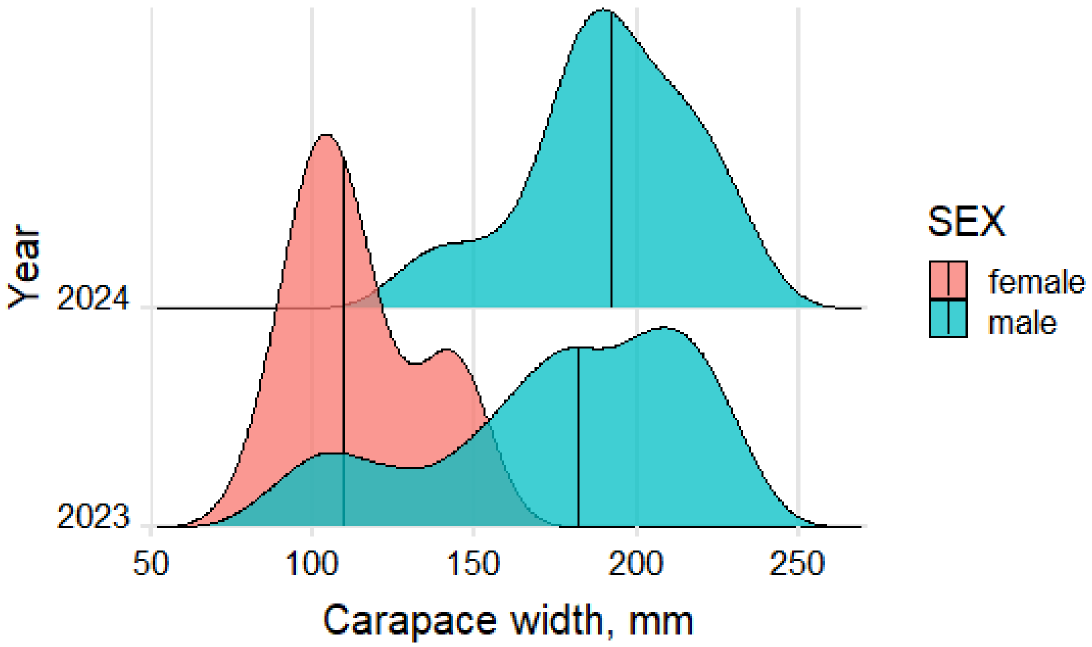

***Figure 10.2.2** Carapace width distribution of the red king crab in the Barents Sea in August-September 2023- 2024.*

10.3 Snow crab (*Chionoecetes opilio*)

Text by: S. Bakanev, A.M. Hjelset, H.E.H Danielsen

Figures by: S. Bakanev

Catch rates of snow crab per station varied from 0.008 to 9.8 kg/nm, with an average 1.3±0.4 kg/nm compared with 0.002 to 13.2 kg/nm with an average 0.9±0.3 kg/nm in 2023 (fig. 10.3.1).

The catch rates in number in 2024 ranged from 1 to 95 ind./nm with an average of 9.0±3.3 ind./nm compared with 1-40 ind./nm and 6.1±1.1 ind./nm in 2023 (fig. 10.3.1).

Table 10.3.1. *The total and mean (per nautical mile) catches of snow crab during BESS in 2004-2024.*

Year	Total number of stations	Number of stations with Snow crab	Total catch, ind.	Total catch, kg	Mean catch, ind./nm	Mean catch, kg/nm
2004	586	7	7	2	1	0.2
2005	602	12	16	4	2	0.3
2006	635	21	39	10	3	0.6
2007	528	45	115	14	3	0.4
2008	387	65	600	56	12	1.1
2009	357	49	212	37	5	0.9
2010	320	57	396	25	9	0.6
2011	379	84	6658	162	98	2.4
2012	429	114	34798	1 179	377	12.8
2013	416	112	13253	1 086	153	12.4
2014	294	83	10580	677	157	10.0
2015	325	87	1787	258	24	3.5
2016	292	57	1070	103	24	2.3
2017	321	116	20132	1 351	208	14.0
2018*	216	61	9816	764	201	15.7
2019*	314	104	6591	386	77	4.5
2020	417	130	4050	382	33	3.1
2021	333	105	1705	110	20	1.3
2022	287	94	891	50	12	0.7
2023	320	83	1430	151	19	2.0
2024	317	40	280	62	8	0.8

* Some stations in the Snow crab area were not surveyed in 2018 and 2019

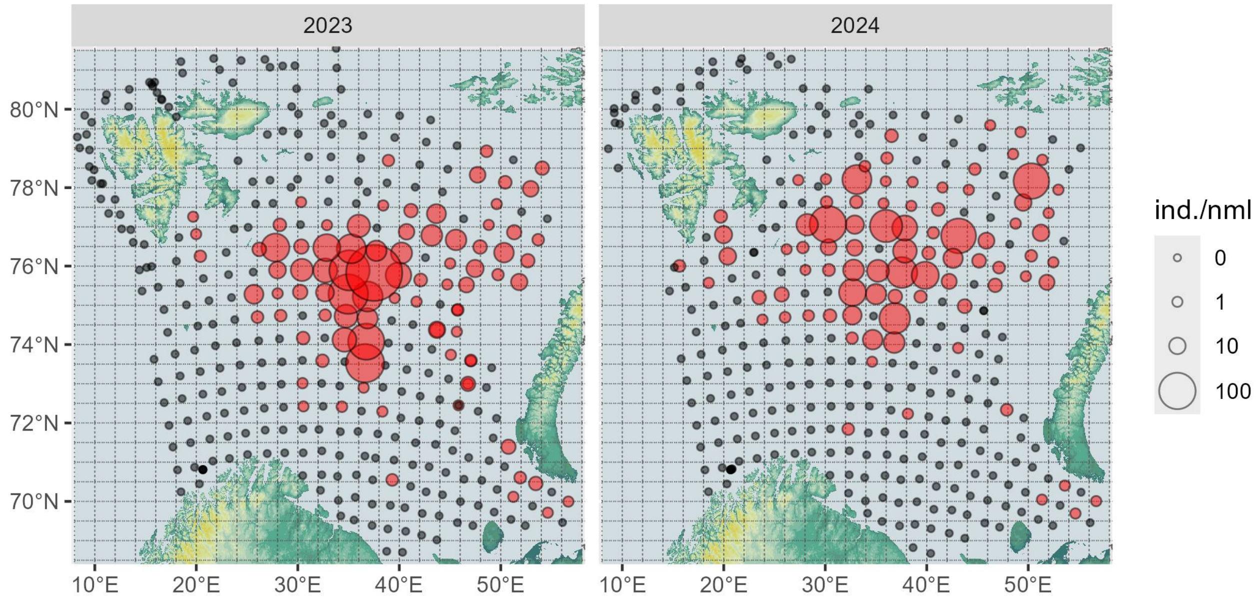

Figure 10.3.1 *Distribution of the snow crab in the Barents Sea in August-September 2023-2024.*

The size distributions of snow crabs caught in 2023 and 2024 were dominated by females within the size range 30-60 mm carapace width. The male size distribution was broader, ranging between carapace width from less than 25 to more than 110 mm (fig. 10.3.2).

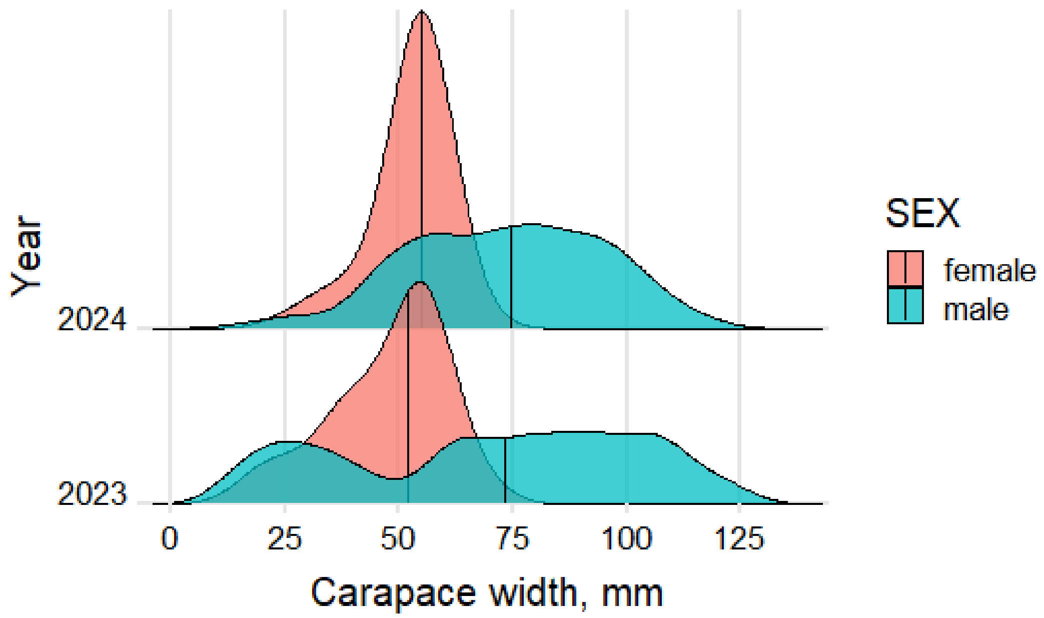

Figure 10.3.2 *Size distribution of the snow crab in the Barents Sea in August-September 2023-2024.*

10.4. Icelandic scallop (*Chlamys islandica*)

Text by: D.Y. Blinova, F. Zimmermann, A.M. Hjelset

Figures by: D.Y. Blinova

Within the survey area, the Icelandic scallop is the dominant species. It is not difficult to identify this species, but in some cases other species of related bivalves (*Pseudamussium peslutrae*, *Karnekampia sulcata*, *Delectopecten vitreus* and *Palliolum tigerinum*) can be mistake identified as the Icelandic scallop. Therefore, caution should be exercised in assessing the distribution and biomass of the Icelandic scallop, which is shown in this chapter. This issue will be investigated later using genetic analysis and the results will be published in the next reports.

Icelandic scallop was recorded at 70 of 294 trawl stations where benthos was examined in 2024. The survey showed a wide distribution of scallops in the Barents Sea. The deepest record in 2024 was at 493 m, but the most abundant catches were recorded in the shallow banks and elevations of the bottom is Spitsbergen Bank (fig. 10.4.1).

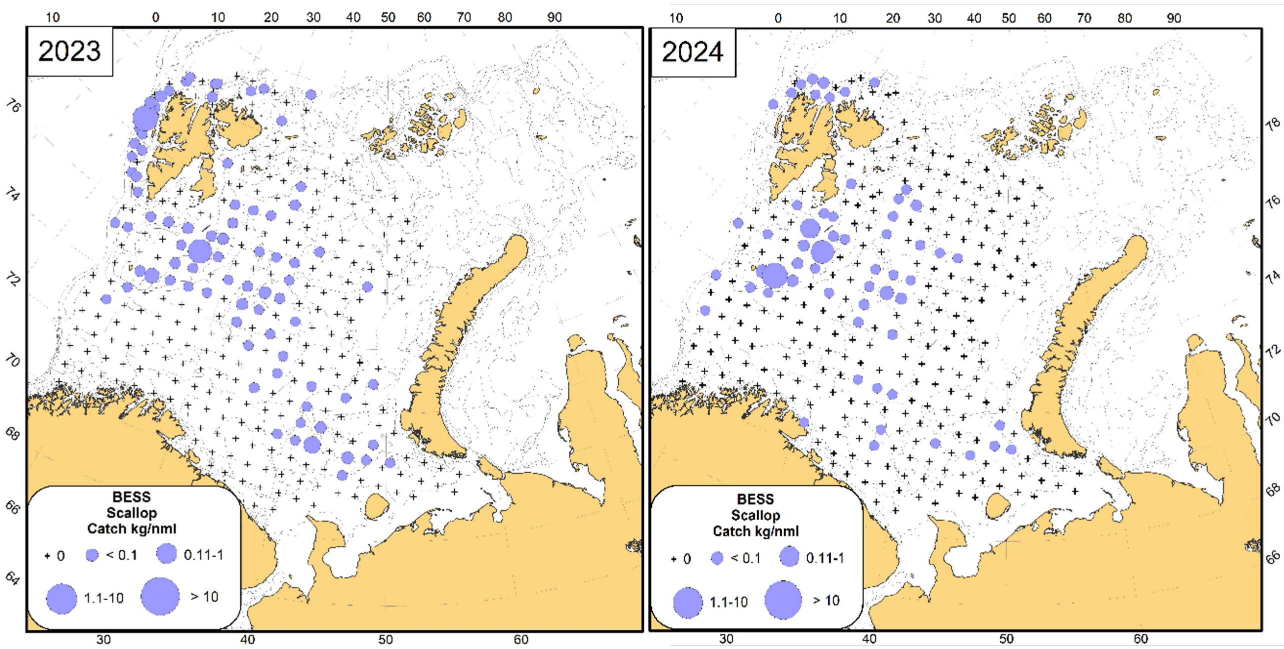

Figure 10.4.*1 Distribution of scallops and Chlamys islandica, in the Barents Sea, August-November 2023-2024.*

Table 10.4.1 Annual parameters of Icelandic scallop in the Barents Sea.

Year	Stations (% of total)	Catch rate, ind./nm	Catch rate, g/nm
2012	146 (33)	62±7	1580±195
2013	131 (27)	115±17	8378±1359
2014*	50 (36)	29±4	812±121
2015	103 (31)	13±1	264±32
2016*	76 (24)	18±2	268±38
2017	125 (33)	82±11	1486±198
2018*	65 (30)	31±4	537±91
2019*	112 (35)	42±11	1039±334
2020	97 (23)	15±5	146±40
2021*	88 (35)	20±6	225±51
2022*	77 (27)	34±6	224.8±39.9
2023*	82 (26)	14±4	108.1±31.9
2024*	58 (20)	25±14	354.0±128.0

* - survey area was not complete

11 - Benthic Invertebrate Community

Author(s): Natalia Strelkova (VNIRO-PINRO) and Lis lindal Jørgensen (IMR)

Figures by: Kudryashova A.

The list of benthic experts onboard Russian and Norwegian RVs is shown in the Background, tab. 1.

In 2024, bycatch records of megabenthos were made from 294 bottom trawl hauls across four R/Vs during the BESS. Megabenthos was processed to nearest possible taxon with abundance and biomass recorded on all four ships. This was done by three benthic experts from “VNIRO”, and by eight experts from IMR.

11.1 Species diversity

A total of 623 invertebrate taxa (432 identified to species level) was recorded in 2024, which is 5 % (9 %) less than in 2023 (tab. 11.1.1).

In 2024, 69.3 % of benthic invertebrate taxa were recorded at species level versus 66.4 % in previous year. G.O. Sars and Johan Hjort part 1 covered areas with highest biodiversity (403 taxa) and more than 65.1 % of the catch was identified to species level. Vilnyus covered the areas with lowest biodiversity (165 taxa) but had more than 84.8 % of the catch identified to species level. (tab. 11.1.2).

Table 11.1.1 *The megabenthos bycatch measures obtained in BESS since 2005-2024. Pelagobenthic Pandalus borealis (Northern shrimp) are excluded from abundance and biomass values.*

Year	Number of stations	Total abundance, ind.	Total biomass, t	Average abundance, ind./n.ml	Average biomass, kg/n.ml	Number species	Number taxa
2005	224	83077	2.1	522.5	12.7	142	218
2006	637	779454	20.7	1576.0	42.1	261	388
2007	551	526263	18.2	1240.2	44.6	222	351
2008	431	757334	12.2	2183.7	35.7	157	244
2009	378	653918	12.3	2056.4	42.2	283	391
2010	319	239282	6.8	900.0	27.3	273	360
2011	391	1089586	10.8	3411.4	34.3	282	442
2012	443	3521820	42.6	9832.1	125.5	354	513
2013	487	1573121	27.6	3885.0	71.7	362	538
2014	165	390444	5.3	2806.7	36.7	220	333
2015	334	481602	5.3	1815.1	19.9	398	599
2016	317	1116405	6.8	4230.1	36.3	266	423
2017	339	1073697	16.2	3769.4	58.6	319	500
2018	217	852613	15.4	4887.8	89.2	404	574
2019	305	1292902	19.0	4239.0	62.5	427	621
2020	429	898168	10.7	1719.1	30.4	401	611
2021	254	212931	10.2	1076.6	50.6	384	572
2022	287	426850	5.8	2101.2	31.3	382	562
2023	317	342660	7.0	1328.8	33.0	453	682
2024	294	505464	6.1	2193,0	31.5	419	603
Total						865	1377
Long-time average*	**362±29**	**747484±94716**	**12.4±1.5**	**2543±310**	**43.9±4.3**	**323±21**	**482±30**

* The average long-term value for the period 2006-2023 except invalid (inflated) abundance and biomass data of 2012.

Table 11.1.2. *Statistics of megabenthos bycatch processing and assessment of the quality of taxonomic processing of invertebrates in the BESS 2024.*

Research vessels	G.O. Sars	Johan Hjort Part 1	Johan Hjort Part 2	Kronprins Haakon	Vilnyus	Total
Number of processed hauls	60	41	23	26	144	**294**
Phylum	12	13	14	13	10	**14**
Class	29	27	25	26	20	**31**
Order	83	80	66	66	49	**92**
Family	178	167	121	138	90	**220**
Species	280	252	162	190	137	**413**
Total number of taxa	381	382	237	265	162	**594**
Percentage of species identification*	**73.5**	**66.0**	**68.4**	**71.7**	**84.6**	**69.5**

* calculated as quotient from division of total number of identifications till species to total number of identifications, %

The taxonomical structure of the Barents Sea megafauna is almost identical from 2023 to 2024 (fig. 11.1.1), and the area coverage very similar (fig. 11.1.2). Mollusca had the highest number of taxa (153 taxa) followed by Arthropoda (107 taxa), Echinodermata (85 taxa), Porifera (89 taxa) and Cnidaria (71 taxa). Among the mollusks, 54.6 % of taxa belonged to Gastropoda (83 taxa), 32.9 % – to Bivalvia (50 taxa), 7.9 % to Cephalopoda (12 taxa) and the remaining 4.6 % were distributed between Solenogastres, Polyplacophora, and Scaphopoda. The Arthropoda phylum were primarily presented by Malacostraca (81 taxa) and Pycnogonida (18 taxa); only 4 taxa belong to Hexanauplia. Among the Cnidaria 52 % of taxa belonged to Hydrozoa (35 taxa), and 48 % to Anthozoa (33 taxa). Among the Echinoderms the most diverse groups were Asteroidea (48.8 % of taxa), Ophiuroidea (21.9 % of taxa) and Holothuroidea (14.6 % of taxa).

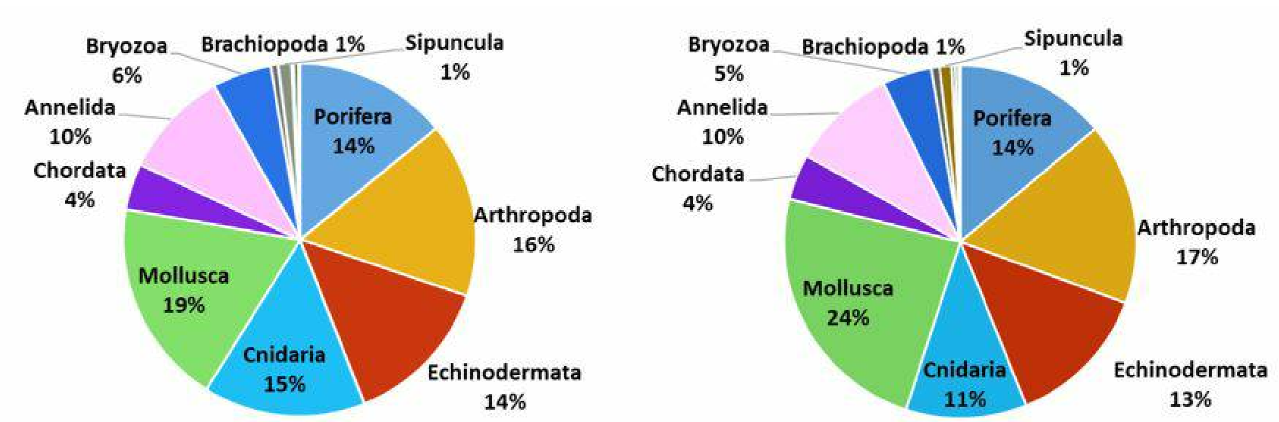

Figure 11.1.1 *The number of taxa given as the % distribution among megabenthic phyla in the Barents Sea, August- October 2023 and 2024. Groups having less than 1 % of the total taxa are not shown in the diagrams.*

The species density in terms of the number of taxa in standard trawl catches ranged from 0 to 88 with average of 30.5±1.4 taxa per trawl-catch (versus 31.1±1.3 taxa per trawl-catch in 2023). The differences between 2024 and 2023 data are statistically insignificant at the α-level of 0.05 ($p = 0.38$).

Traditionally, in 2024 the western part of the survey shows higher level of species diversity than the eastern part of the sea (fig. 11.1.2). The highest number of taxa in haul (88 taxa) was recorded on the shallow of Persey Bank (to east of Svalbard/Spitsbergen) at the depth 186 m. The lowest level of diversity (0-5 taxa per haul) was recorded in the south-eastern part of the survey area. There are a very visible division between the Russian ship in east and the Norwegian ships in west (fig. 11.1.2) and it is questioned if this may be a human artifact with different trawl standards rather than a natural phenomenon.

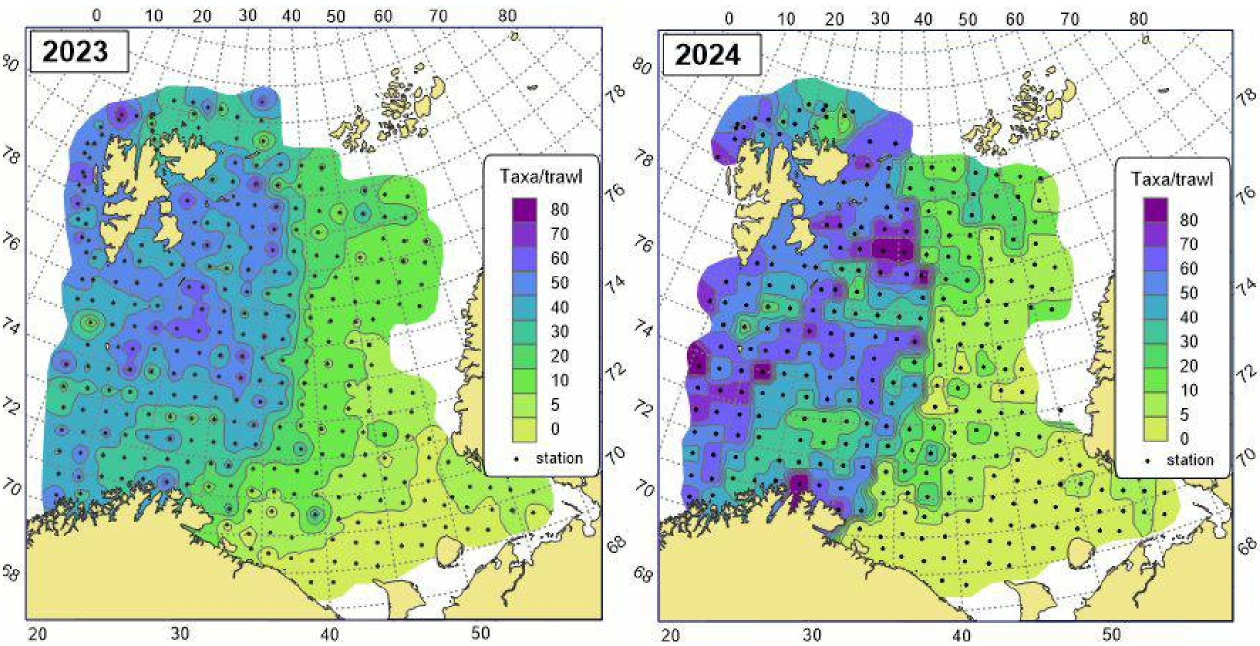

Figure 11.1.2 *The number of megabenthic taxa per trawl-catch in the Barents Sea in the periods August-October 2023 and 2024.*

The ten most frequently species taken by trawl in the investigated part of the Barents Sea in 2024 were the decapod crustaceans *Sabinea septemcarinata* (taken by 66 % of the trawl-hauls), sea stars *Ctenodiscus crispatus* (63 %), *Pontaster tenuispinus* (49 %), *Henricia* species (37 %), and *Urasterias lincki* (34 %) the brittle stars *Ophiacantha bidentata* (50 %), *Ophiopholis aculeata* (47 %), and *Ophiura sarsii* (43 %), soft coral *Gersemia rubiformis* (39 %), and sea spider *Nymphon hirtipes* (34 %). The lists of the ten most frequently caught species in 2023 and 2024 are almost identical except for the absence in 2024 of polychaetes *Spiochaetopterus typicus*.

11.1.3 New species records

During the BESS 2024 in the Norwegian part of the Barents Sea, 27 new taxa was recorded for the first time since 2005 when the ecosystem surveys started, there are three new species in the Russian part of the sea (fig. 11.1.3.1).

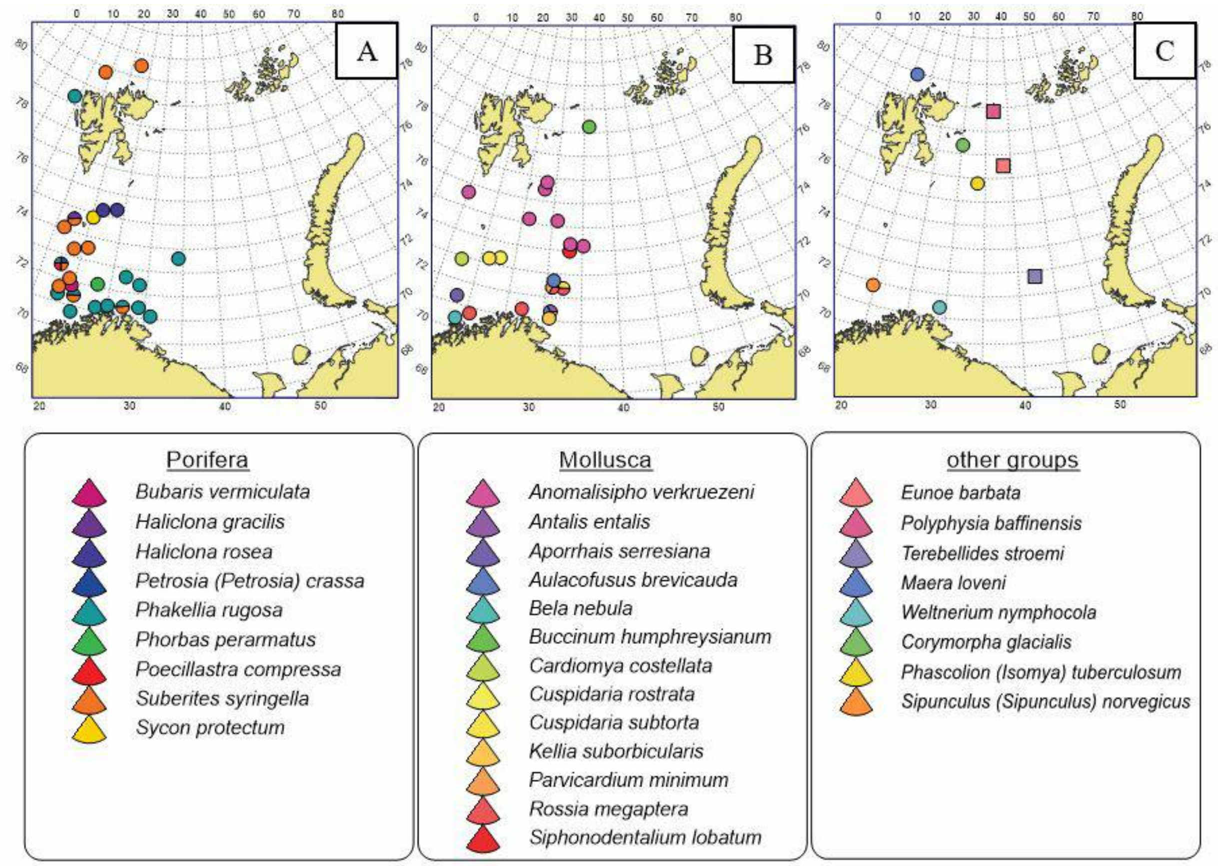

Figure 11.1.3.1 *Locations of megabenthic species of Porifera (A), Mollusca (B) and "other groups (C) registered in 2024 and for the first time since the start (year 2005) of the long-term monitoring of the Barents Sea and adjacent water of the BESS. Circles illustrate Norwegian ships while squares the Russian ship.*

New species of sponges and mollusks was identified by the expert specialists A. Plotkin and A. Voronkov onboard the Norwegian ships. The Polychaete worms observed on the Russian vessel in 2024 are common in the Barents Sea, and identified to species level by K. Rolskaya, who are a specialist of the polychates group on board the Russian vessel.

Of the new 30 species identified in the Barents Sea in 2024, 19 species are boreal and 13 species are new to the BESS (*Bubaris vermiculata*, *Phorbas perarmatus*, *Aulacofusus brevicauda*, *Parvicardium minimum*, *Kellia suborbicularis*, *Maera loveni*, *Phascolion (Isomya) tuberculosum*, *Haliclona rosea*, *Bela nebula*, *Buccinum humphreysianum*, *Petrosia (Petrosia) crassa*, *Phakelia rugosa*, *Poecillastra. compressa*), and a possible result of their spreading to the east and north due to the long warming period.

The other 17 new species have previously been recorded from the Barents Sea and adjacent shelf areas outside the BESS, and the identification of these species can be a result of a more detailed and/or qualified species identification made by the benthos expert onboard.

11.2 Abundance (number og individuals)

The number of megabenthos individuals in the trawl-catches in 2024 (excluding the pelago-benthic species *Pandalus borealis*) ranged from 0 to 129936 (0-138229 ind./nm) with an average of 1811±464 ind. per trawl-catch (2193±503 ind./nm). This is 65 % more than in 2023 tab. 11.1). A possible explanation may be the increased number of trawl hauls in 2024 with high number of megabenthos individuals compared to 2023 where the number of such trawl hauls was fewer and within a smaller area. (fig. 11.2.1). But despite the increase in 2024 with 65%, the differences between 2023 and 2024 are statistically insignificant at the α-level of 0.05 (p = 0.56).

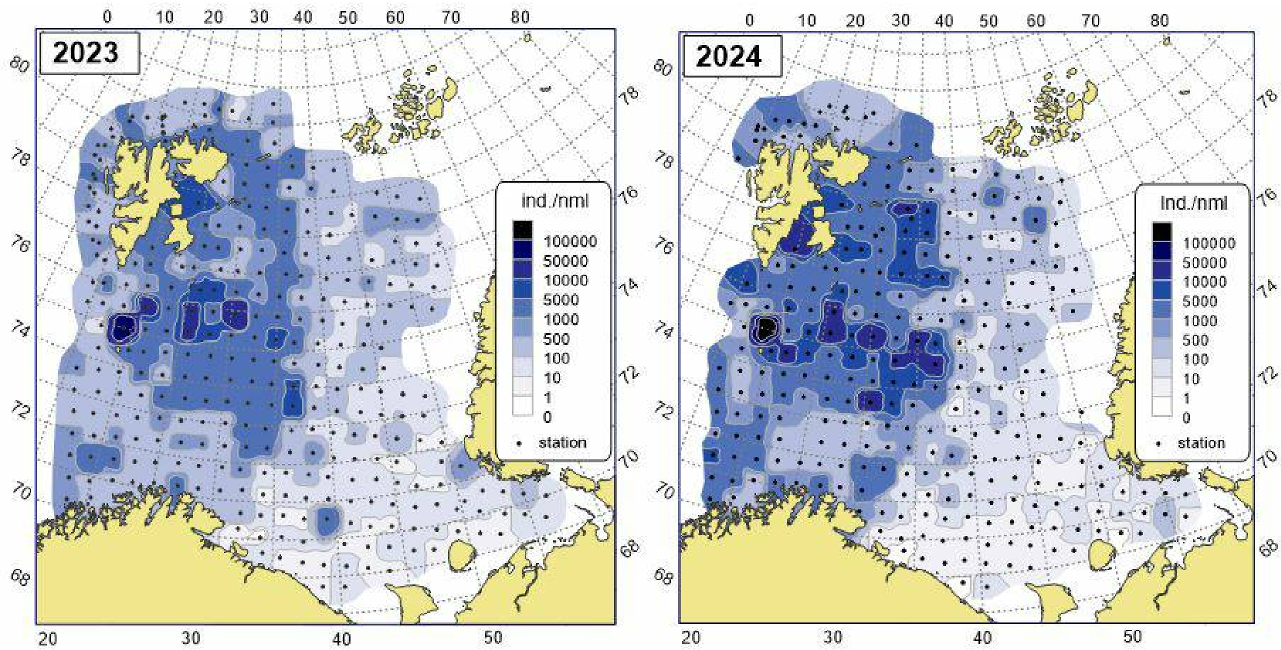

Figure 11.2.1 *Abundance (ind./nm) of megabenthos (excluding Pandalus borealis) in the Barents Sea in August- October 2023 and 2024.*

The abundance distribution in 2024 was very close to the pattern of the previous year (fig. 11.2.1). The largest catch in number of individuals (129936 ind./trawl-catch), mainly consisted of the sea-squirt (Ascidiacea) *Rhizomolgula globularis* (127929 ind./trawl catches, 98 % of total abundance). These catches were obtained in the western part of the Barents Sea to north of the Bear Island (75.00° N, 19.60° E) at the depth 61 m (fig. 11.2.1). The similar trawl haul with very high numbers of individuals of the sea-squirt *R. globularis* was recorded in 2021, 2022 and 2023 within the exactly same position and depth. As in previous year, the lowest abundances (less than 50-100 ind. per haul) was recorded in the south-eastern part of the sea within the Russian part of the survey.

In 2024, the abundance distribution across the main megabenthic groups (%, excluding *Pandalus borealis*) in the Barents Sea was dominated by Echinodermata, Chordata (due to high local concentration of sea-squirt *R. globularis*), and Arthropoda (Crustacea makes up the main part). This is in accordance with the long-term pattern (fig. 11.2.2).

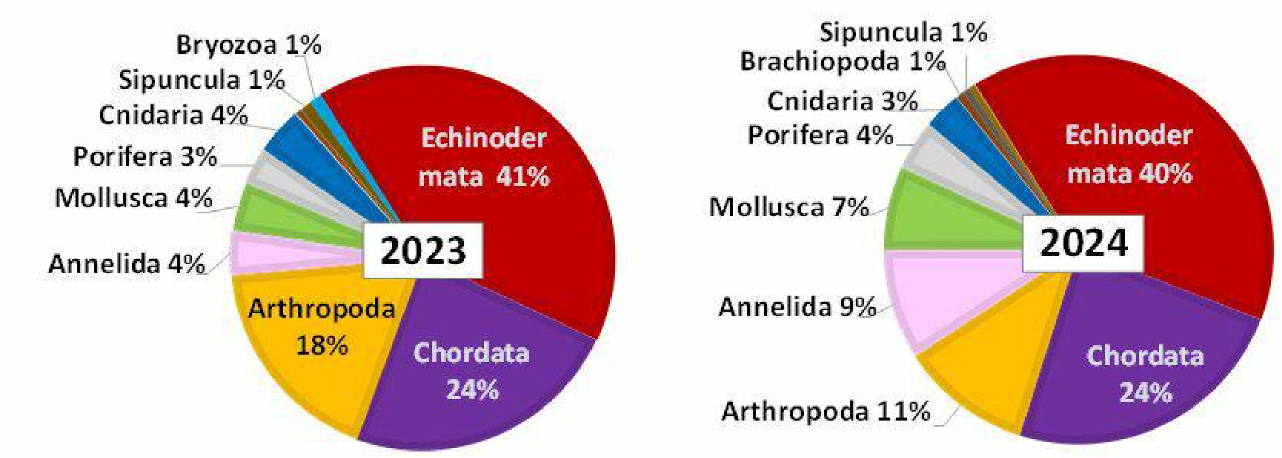

Figure 11.2.2 *The distribution of abundance (excluding Pandalus borealis) across the main megabenthic groups (%) in the Barents Sea, August- October 2023 and 2024. The groups with the number of individuals less than 1 % of total are not shown in the diagrams.*

The ten most abundant species (in the term of total number of individuals caught during the BESS 2024 were the sea-squirts *R. globularis* (24.0 %) and *Kukenthalia borealis* (2.4 %), sea star *Ctenodiscus crispatus* (11.5 % of total abundance), the brittle stars *Ophiacantha bidentata* (9.0 %), *Ophiopholis aculeata* (2,7 %), and *Ophiura sarsii* (1.7 %), sea urchins of genera *Strongylocentrotus* (mainly *S. pallidus*) (6,4 %), sedentaria polychaets *Spiochaetopterus typicus* (5.1 %), shrimp *Sabinea septemcarinata* (4.2 %), and bivalve *Bathyarca glacialis* (2.7 %).

11.3 Biomass

As in previous years in 2024, Sponges, Echinoderms, and Crustaceans made up the main part of the total megabenthic biomass (94 %) (Fig. 11.3.1).

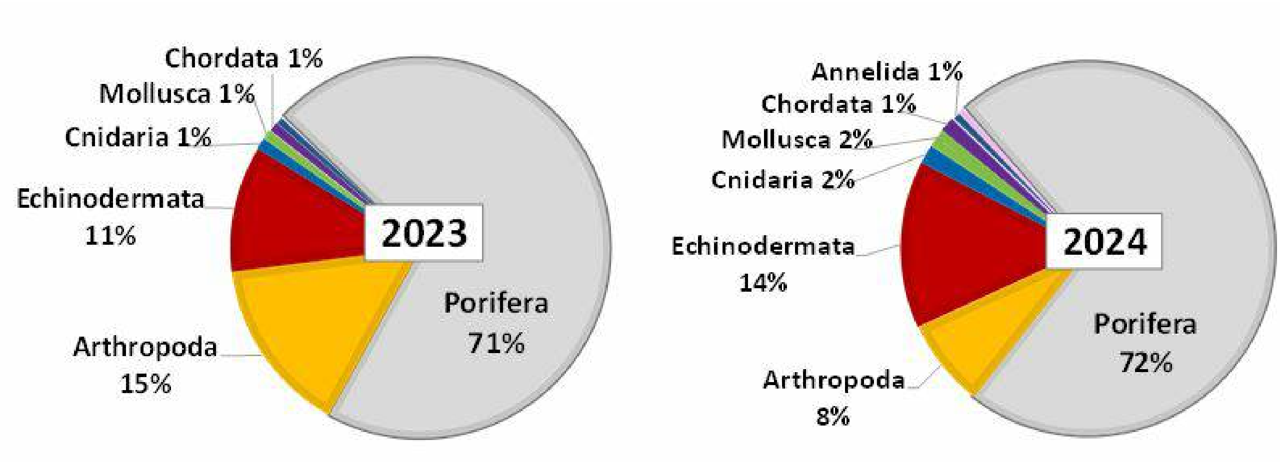

Figure 11.3.1 *The distribution of biomass (excluding Pandalus borealis) across the main megabenthic groups (%) in the Barents Sea, August-October 2023 and 2024. The groups with the biomass less than 1 % of total are not shown in the diagrams.*

The megabenthos biomass taken by the trawl (excluding the semi-pelagic species *Pandalus borealis*) in 2024 varied from 0 to 1168 kg (0-2089 kg/nm) with an average of 20.9±5.9 kg per trawl-catches (31.5±10.4 kg/nm). This average is 4.5 % less than in the previous year and 28.2 % less than the average long-term value for the period 2006-2023 except the invalid 2012 (tab. 11.1). The differences between 2023 and 2024 data are statistically insignificant at the α-level of 0.05 (p = 0.92).

The biomass distribution in 2023 were very close to the pattern of previous years (fig. 11.3.2) and did not show the division into the "Russian" and the "Norwegian" side as for the species number (fig 11.1.2) and the abundance (11.2.1) which indicates that "biomass" is a measure less sensitive for artificial artifacts such as trawl-rigging. Areas with low biomass was in the central south eastern area, while the highest trawl catches in biomass was in the south-west.

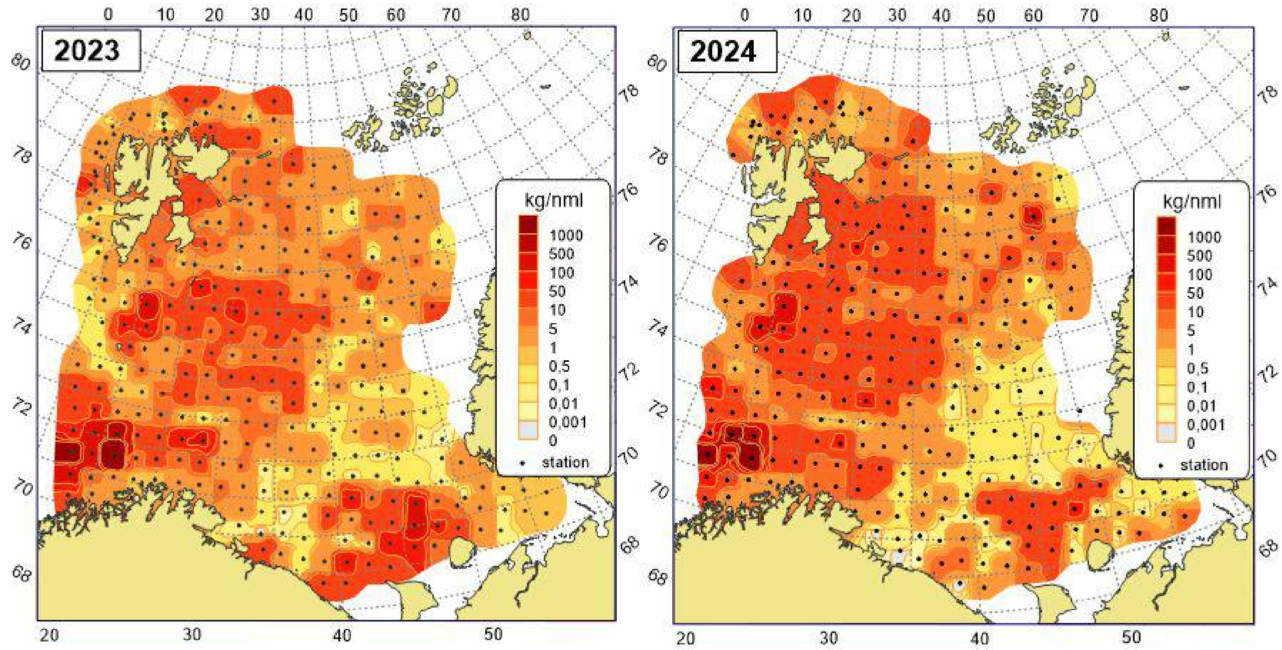

***Figure 11.3.2** The biomass distribution of megabenthos (excluding Pandalus borealis) in the Barents Sea in August- October 2023 and 2024.*

A trawl catch with biomass larger than 1 t was taken in 2024 at one station in the south-western part of the Barents Sea from 334 m depth. This haul was dominated by sponges: *Geodia barretti* (517 kg; 44.3 % of the total station biomass), *G. macandrewii* (513 kg; 44.0 %), *G. phlegrae* (42.5 kg; 3.6 %), *Stelletta rhaphidiophora* (72 kg; 6.2 %) and *Stryphnus fortis* (12.0 kg; 1.0 %). Other six stations with biomass more than 100 kg per trawling was recorded in nearby areas in the south-western part of the sea at depth of 271-335 m (dominated by *G. barretti* and *G. macandrewii*), in Spitsbergen Bank (46-61 m) and dominated by sea cucumber *Cucumaria frondosa*, making up to 91 % of the total biomass at this station, and the sea-squirts *Rhizomolgula globularis*, making up to 57 %), and in the north-eastern part of the sea (248 m and 98.9 kg of sponges *Thenea valdiviae* making up to 86 % of the total biomass on the station).

More than half of the total megabenthic biomass in the Barents Sea taken by trawls (59.5 % of the total biomass of by-catches) belonged to the sponges of *Geodia* genera (*G. barretti*, *G. macandrewii*, *G. atlandica* and *G. phlegrae*) and the associated sponges *S. rhaphidiophora* and *S. fortis*. Other top-dominant species in biomass was sea cucumbers *C. frondosa* (4.7 % of the total biomass), *Parastichopus tremulus* (1.0 %), and holoturians of genera *Molpadia* (1.5 %), crabs *Paralithodes camtschaticus* (4.6 % of the total biomass) and *Chionoecetes opilio* (1.8 %), sponges *T. valdiviae* (2.6 %), sea star *Ctenodiscus crispatus* (2.0 %), basket stars of *Gorgonocephalus* genera (1.6 %), shrimps *Sabinea septemcarinata* (1.4 %), and sea urchin of the genera *Strongylocentrotus* (1.3 %). The contribution of each of the other species did not exceed 1 % of the total biomass of megabenthos bycatches and in sum add up 18 % of it.

12 - Marine Mammals and seabirds

Author(s): R. Klepikovsky (VNIRO-PINRO), Martin Biuw, Frederike Boehm (IMR) and Per Fauchald (NINA)

12.1 Marine Mammals

Text by R. Klepikovsky, M. Biuw, F. Boehm
Figures by F. Boehm

Marine mammal observers participated onboard all Norwegian and Russian RVs of BESS 2024. Total search effort added up to 5342 km for Norwegian and 5120 km for Russian vessels. In total, 636 observations including 1786 individuals of 11 marine mammal species were obtained, with 209 individuals not identified to species level. The observed number of marine mammals by species is given in tab. 12.1.1. Locations of toothed and baleen whale species are shown in figs. 12.1.1, 12.1.2.

Table 12.1.1. *Number of marine mammal observations and individuals recorded during BESS 2024.*

Species	Number of Observations	Number of Individuals	Average Group Size
Minke whale	115	116	1.0
Fin whale	46	52	1.1
Humpback whale	139	258	1.9
Blue whale	2	2	1.0
White-beaked dolphin	226	1067	4.7
Harbour porpoise	13	38	2.9
Killer whale	3	26	8.7
Sperm whale	3	3	1.0
Beluga whale	1	12	12.0
Hooded Seal	1	1	1.0
Walrus	2	2	1.0
Unidentified whale	64	153	2.4
Unconfirmed whale	3	3	1.0
Unidentified dolphin	17	51	3.0
Unidentified seal	1	2	2.0
Total	**636**	**1786**	

As in previous years, the most frequently observed and widely distributed species was the white-beaked dolphin (*Lagenorhynchus albirostris*) with higher sighting frequency north of 74°N.

Compared to 2023, the number of white-beaked dolphins recorded was 40% lower, and the size of the groups recorded was also smaller (maximum 20 individuals). Consistent with previous years, other dominant species observed during the survey included the baleen whales minke (*Balaenoptera acutorostrata*), humpback (*Megaptera novaeangliae*), and fin (*Balaenoptera physalus*) whale. This year, the number of minke whale sightings was 36% lower than in 2023. Minke whales were mainly observed east of Svalbard, in areas commonly associated with high capelin and krill biomass. In contrast to 2023, minke whales were not recorded in the Pechora Sea this year.

Humpback whales were observed mostly in areas east of Svalbard, where they overlap with the traditional capelin aggregations, often together with fin and minke whales. The number of humpback whales observed this year was 55% higher than in 2023.

As in 2023, fin whales were widely distributed in the western survey areas. As for minke and humpback whales, fin whales were most frequently observed in the waters east of Svalbard. Similar to minke whales, the number of fin whales recorded this year was 55% lower than in 2023.

Two blue whales (*Balaenoptera musculus*) were observed in the waters adjacent to Svalbard/Spitsbergen.

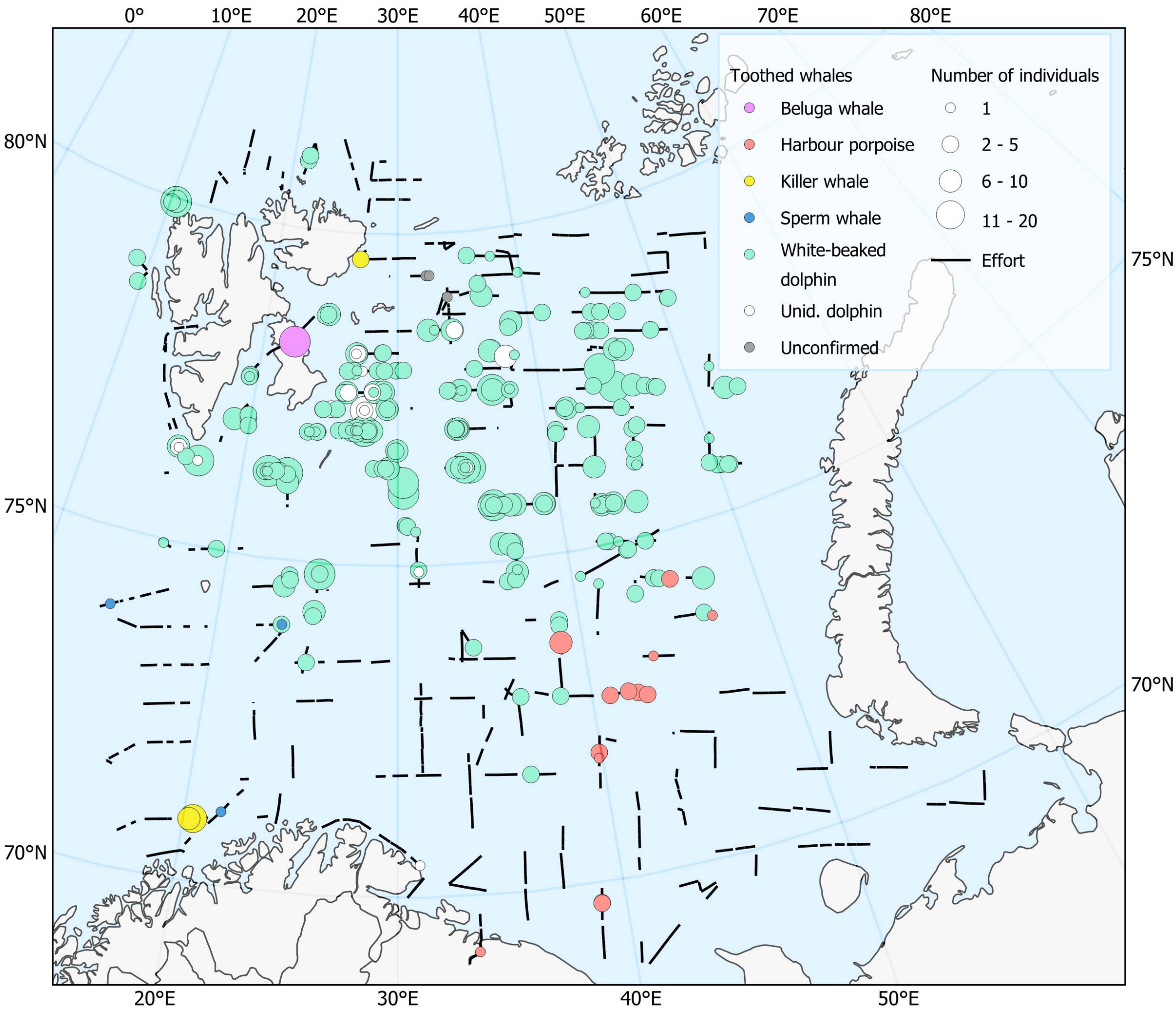

Figure 12.1.1. *Distribution of toothed whales in BESS 2024.*

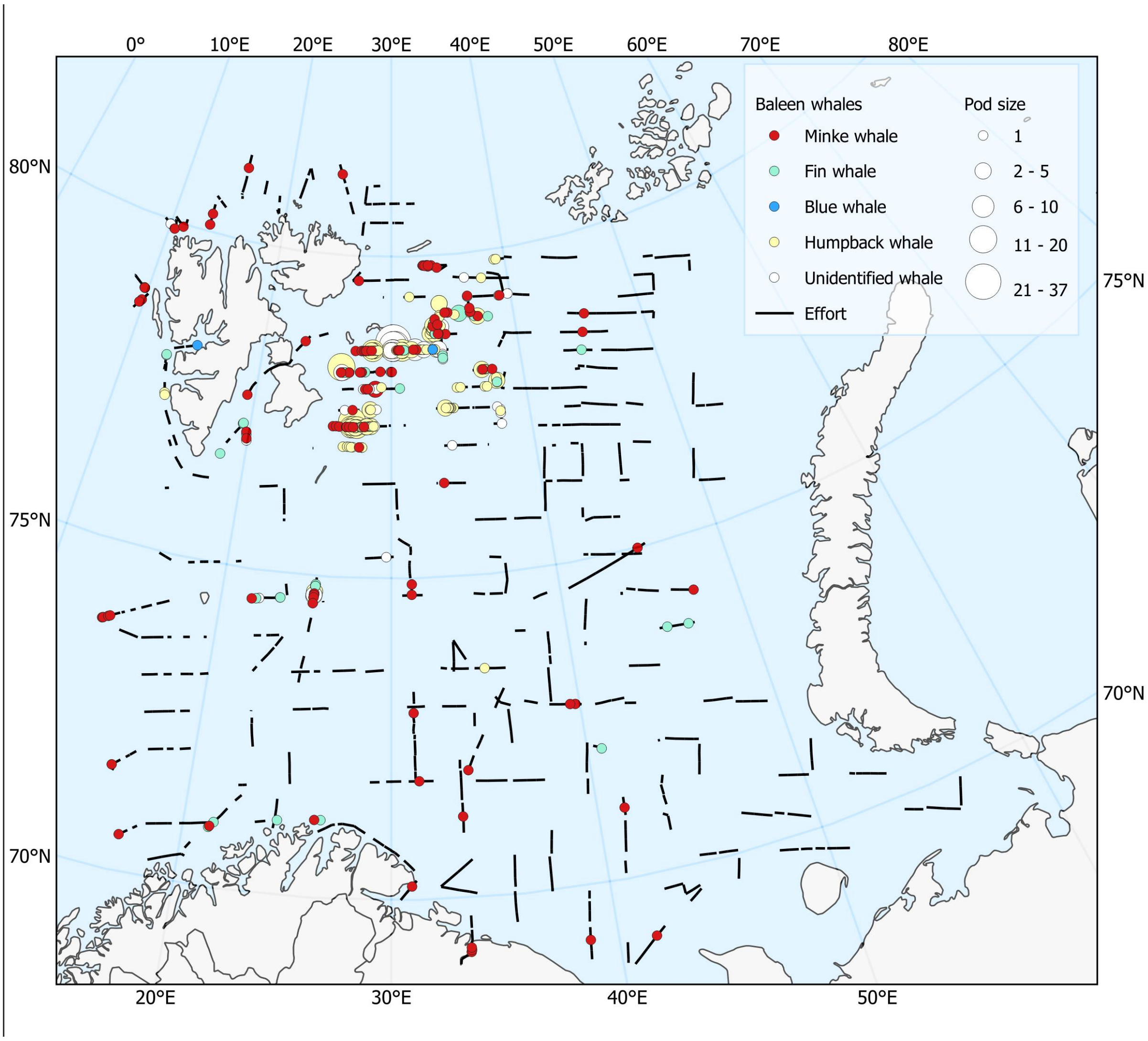

Figure 12.1.2. *Distribution of baleen whales in BESS 2024.*

The lower number of observations of some common species (white-beaked dolphin, minke, and fin whales) during the BESS 2024 period may be linked to a decrease in the biomass of capelin in the research area. However, challenging sighting conditions and overall less effort compared to 2023 may also have played a role in some areas.

Besides white-beaked dolphins, other toothed whales recorded included sperm whale (*Physeter macrocephalus*), harbour porpoise (*Phocoena phocoena*), killer whale (*Orcinus orca*), and beluga whale (*Delphinapterus leucas*). Sperm whales were mainly observed in the western areas (west of 24°E and south of 75°N). Harbour porpoises were only found in areas south of 75°N and east of 33°E, in association with herring aggregations. Killer whales were recorded in waters near the coast of Norway and northeast of Spitsbergen.

In addition, one group of beluga whales (12 individuals) was recorded near Barents Island.

Observations of pinniped species included hooded seal (*Cystophora cristata*) and walrus (*Odobenus rosmarus*). These species were encountered near White Island (only walrus) and Barents Island.

12.2 Seabirds

Text by P. Fauchald, R. Klepikovskiy

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 made only during daylight and when visibility allowed a complete overview of the transect. On "G.O. Sars" and "Kronprins Haakon", 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. On "Vilnius", ship-followers were counted continuously along the transects, and by a point observation at the start of each transect. 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.

The Norwegian sector was covered by "G.O. Sars" and "Kronprins Haakon" in the period 19. August to 12. October. The Russian sector was covered by "Vilnyus" in the period from 14 August to 4 October. No seabird observers were present on Johan Hjort and on the second leg of "GO Sars" and data is therefore lacking for a portion of the Norwegian sector. Total transect length covered by "GO Sars" and "Kronprins Haakon" was 2164 km. Total transect length covered by "Vilnyus" was 5237 km. A total of 34.328 birds belonging to 39 different species were counted. The distribution of the dominant auk species is shown in fig 1 and the distribution of the most common gull species and Northern fulmar is shown in fig. 12.2.2).

Broadly, the distribution of the different species (figs. 12.2.1, 12.2.2) was similar to the distribution in previous years. For the auks (fig 12.2.1), little auks (*Alle alle*) were found northeast of Svalbard/Spitsbergen. High densities of thick-billed murres (*Uria lomvia*) were found in the northern part of the Barents Sea with the highest densities east of Svalbard/Spitsbergen. Atlantic puffins (*Fratercula arctica*) and common guillemots (*Uria aalge*) were found in the southern Barents Sea. Northern fulmar (*Fulmarus glacialis*) and black-legged kittiwake (*Rissa tridactyla*) were encountered throughout the Barents Sea but with highest density of kittiwakes in the central and northern parts (fig. 12.2.2). For the large gull species, herring gull (*Larus argentatus*), glaucous gull (*Larus hyperboreus*) and great black-backed gull (*Larus marinus*) were found in the southern part of the study area.

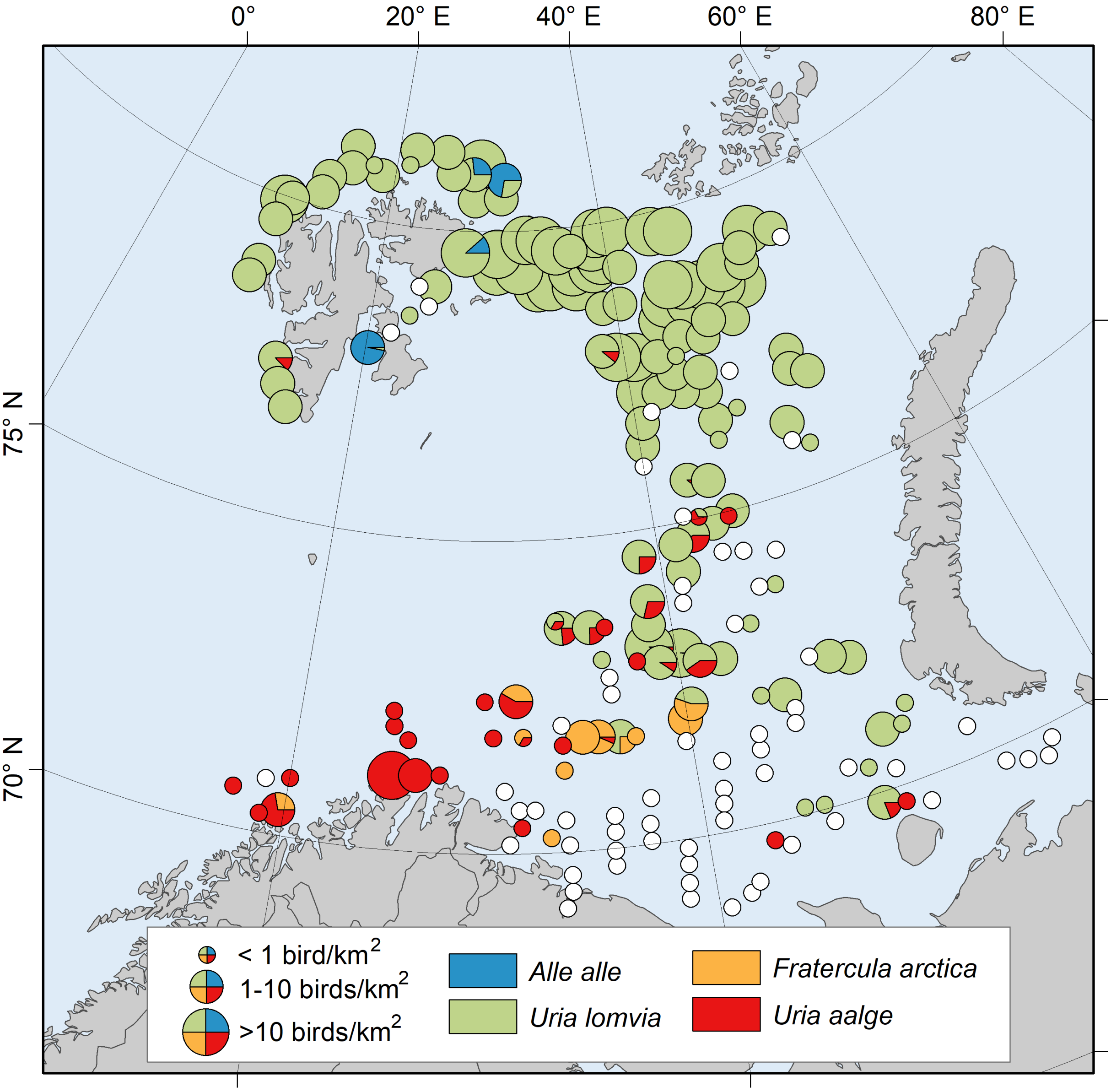

Figure 12.2.1 *Density of auk species along seabird transects in 2024. White-filled circles are zero density.*

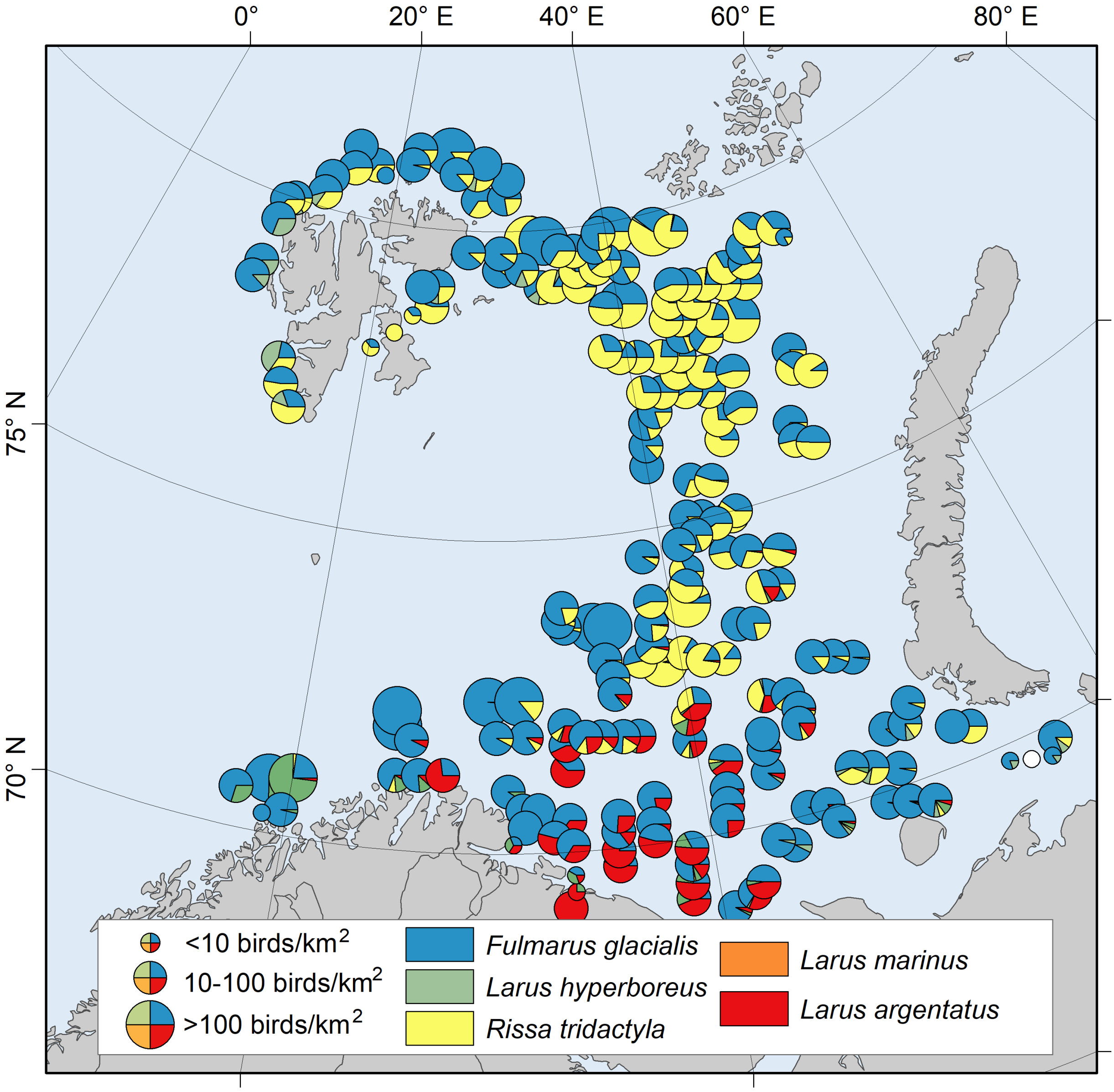

Figure 12.2.2 *Density of the most common gull species and Northern fulmar along seabird transects in 2024. White-filled circles are zero density. Note that because these species are attracted to and tend to follow the ship, the density is systematically over-estimated.*

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