

**New data on composition and structure of the Kara Sea ichthyofauna**

by

Dolgov A.V., Smirnov O.V., Drevetnyak K.V., and Chetyrkina O.Yu.

Knipovich Polar Research Institute of Marine Fisheries and Oceanography (PINRO)

6 Knipovich Street, Murmansk, 183038, RUSSIA

**ABSTRACT**

The Kara Sea is one of the northern Eurasian seas, which is completely covered by ice almost throughout the year. This peculiarity limits research activity in this area to a great extent and explains rather poor knowledge on composition and structure of the Kara Sea ichthyofauna. Only a few marine expeditions were conducted in the Kara Sea during the XX century. Comparatively comfortable ice conditions caused by recent warming period in the North Atlantic allowed taking observations in the Kara Sea and adjacent areas of the northeastern Barents Sea in summer period 2007-2008. New data on species composition and fish community structure of the Kara Sea were obtained from demersal and pelagic trawls. Totally 46 species were found in catches, including 5 new species for this area (*Arctozenus risso*, *Benthoosema glaciale*, *Myctophum punctatum*, as well as commercially important deepwater redfish and Greenland halibut). So, the recent Kara Sea ichthyofauna list includes 70 fish species. Coldwater arctic species dominated the fish community. The most abundant species are polar cod *Boreogadus saida* and Greenland halibut *Reinhardtius hippoglossoides*. In addition, a number of non-target species such as *Liparis fabricii*, *Lycodes pallidus*, *Triglops nybelini*, *Leptagonus decagonus*, *Gymnacanthus tricuspis* and *Liparis gibbus* are abundant. Our results were compared to previous investigations.

Keywords: bottom survey, fish community, ichthyofauna, Kara Sea.

Contact author: Andrey V. Dolgov: Knipovich Polar Research Institute of Marine Fisheries and Oceanography (PINRO), 6 Knipovich Street, Murmansk, 183038, Russia [tel. +7 (8152) 47 22 31, fax: +7 (8152) 47 33 31, e-mail: [dolgov@pinro.ru](mailto:dolgov@pinro.ru)

**INTRODUCTION**

Investigations in the Kara Sea including the exploration of ichthyofauna are of great scientific and commercial interest. Studies in this area are problematic in view of hard ice conditions in the Kara Sea which hamper trawl surveys. As a result, a few data on fish fauna in the area have been collected over one-and-half century of studies (Esipov, 1952; Andryashev, 1964; Norvillo et al., 1982; Borkin, 1983, Astafyeva et al., 1985).

During the last decade, the level of water temperature in the Barents Sea increased and, therefore, the areas earlier covered by ice including the Kara Sea became open. On this ground,

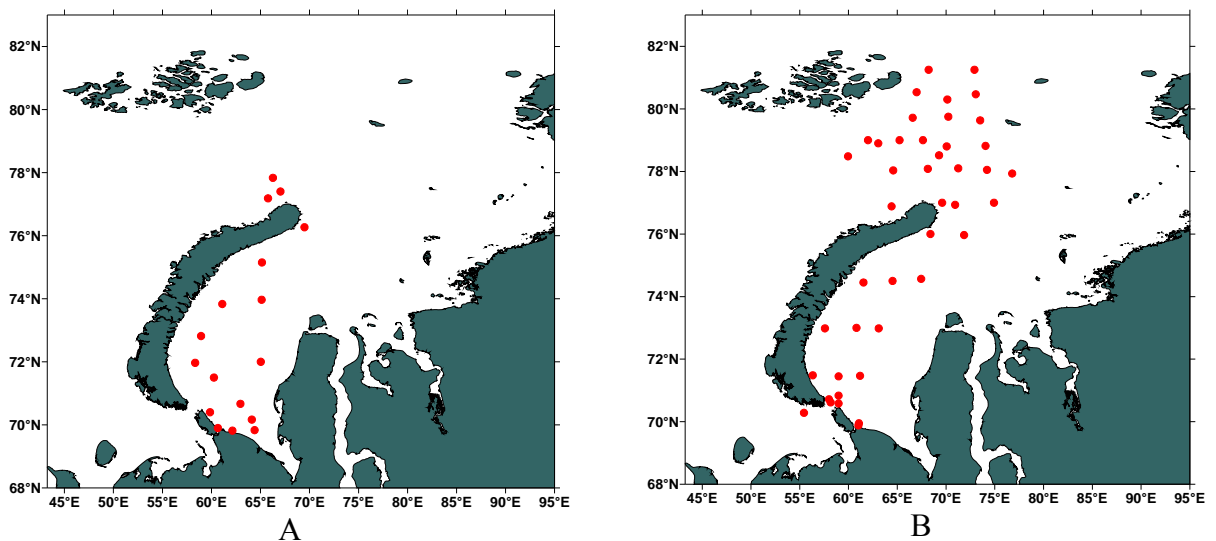
in the period 2007-2008 PINRO initiated 3 marine expeditions with trawl surveys in the most area of Kara Sea including its central and northern parts (The ecosystem of the Kara Sea, 2008).

Since PINRO is the institute of marine fisheries, the primary goal of PINRO's marine expeditions in the Kara Sea was the exploration of potential fish resources and assessment of commercial fish stocks in the area. However, in the course of surveys additional tasks were set, i.e. to analyze species composition of fish fauna and structure of the Kara Sea ichthyocenosis.

## MATERIALS AND METHODS

In 2007-2009 3 surveys were conducted in the Kara Sea (Fig. 1). During the first cruise in August-September 2007, 17 bottom tows were made in the Kara Sea itself. In the course of the second cruise in 2007, the area of studies expanded through the area between the Franz Josef Land and Novaya Zemlya, where dense concentrations of Greenland halibut were found. 43 trawlings were made during this survey (39 bottom and 4 pelagic trawlings). In this connection in 2008 much attention was focused on distribution and assessment of the Greenland halibut stock in the northern Kara Sea and adjacent areas of the Arctic Basin and Barents Sea. It should be noted that in 2008 for the first time of this period, several trawlings were carried out in the St. Anna and Voronin Troughs. In the course of this survey, a total of 50 bottom tows were made.

Bottom tows were carried out by Campelen-1800 trawl with 22mm mesh in codend. As a rule, duration of hauls was 30 minute and towing speed was 3 knots.



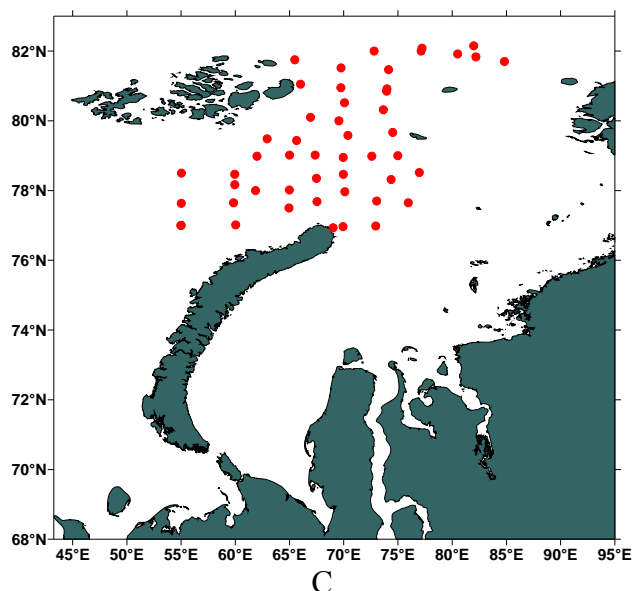


Fig. 1. Location of trawl stations made by R/V «Professor Boiko» in August 2007 (A), by R/V «Fritiof Nansen» in September 2007 (B) and by R/V «Obva» in August-September 2008 (C)

## RESULTS AND DISCUSSION

### *Species composition of catches*

In the period of investigation a total of 59 species from 20 families were found in catches. The most abundant species were registered in families of eelpouts *Zoarcidae* (12), sculpins *Cottidae* (9), snailfishes *Liparidae* (6), cods *Gadidae* (5) and pricklebacks *Stichaeidae* (4) (Fig. 2). Other families were represented by 1-2 species. Five other species were found in this area for the first time: there were Greenland halibut, deepwater redfish and such non-target species as spindlegfish *Arctozenus risso*, *Benthosema glaciale* and *Myctophum punctatum*. It should be noted that the number of species might increase. In particular, our catches contained specimens of several families, which may represent potential new species to science. So, according to our data, almost 70 species belonging to 20 families may occur in the Kara Sea.

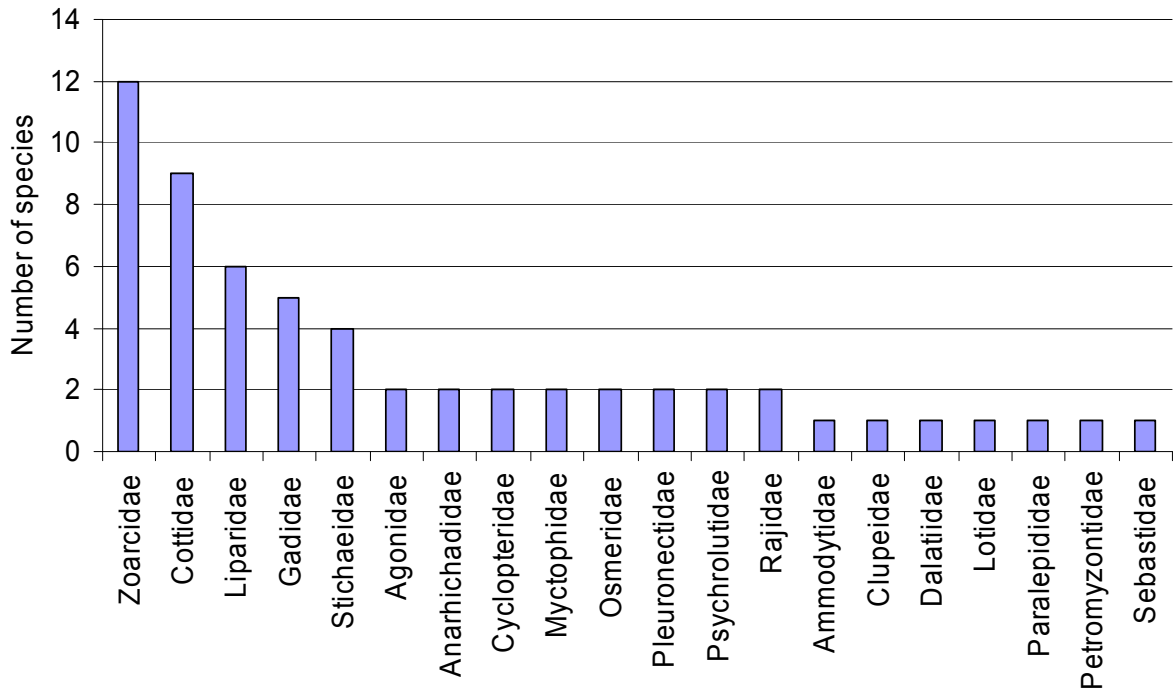
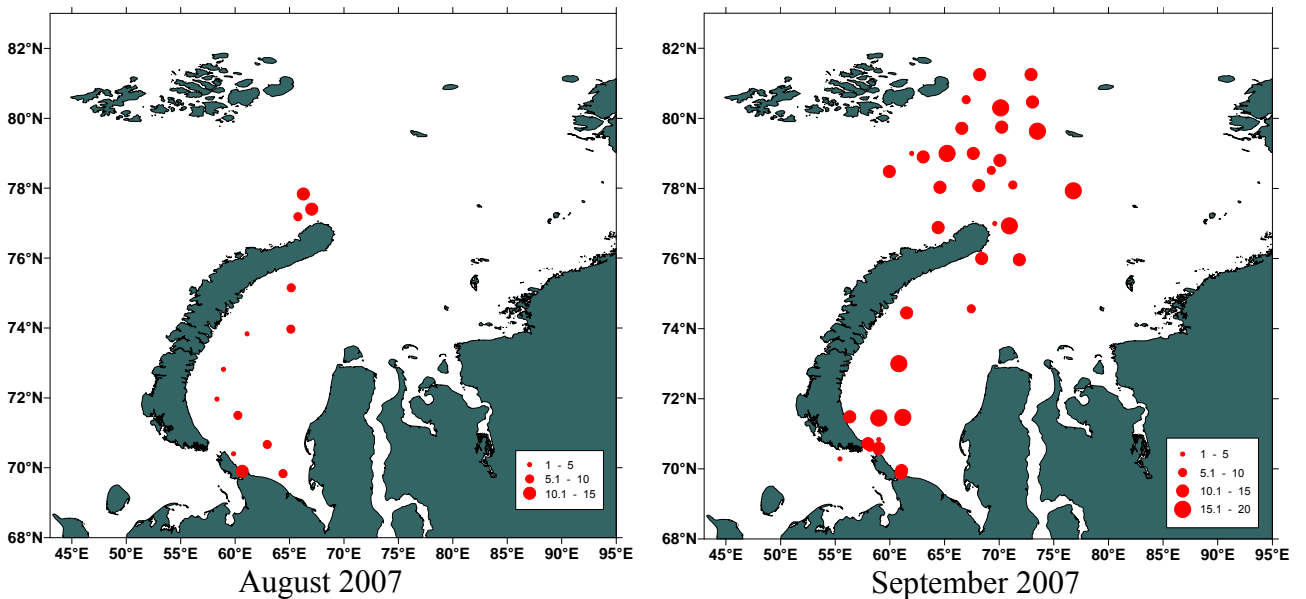


Fig. 2. Number of species of various fish families in the Kara Sea according to data 2007-2008.

The number of fish species in tows varied to a great extent and comprised 2-19 species (Fig. 3). The lowest number (2-12) of species (on the average 7.1 species per one trawling) was observed in the Kara Sea area. With widening of study area in north- and northward direction the number of species increased due to occurrence in catches of warm-water species which could move far northward. So, in September 2007 and September 2008 from 2 to 19 species were found in catches, the mean number being 12.0 and 10.8, respectively.



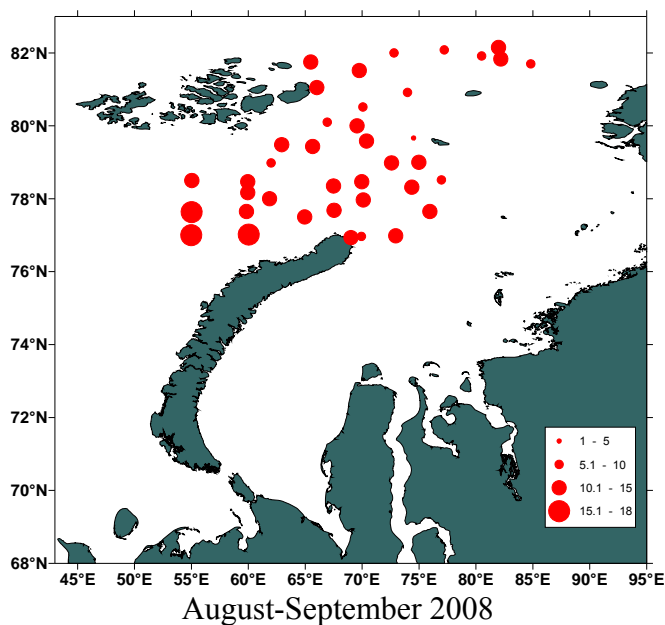


Fig. 3. Number of fish species per one trawling in the Kara Sea in 2007-2008

Analysis of relationship between water temperature and the number of species in catches showed a significant relation between these characteristics despite a low correlation factor. On the whole, the number of species slightly grew with increased near-bottom water temperature (Fig. 4).

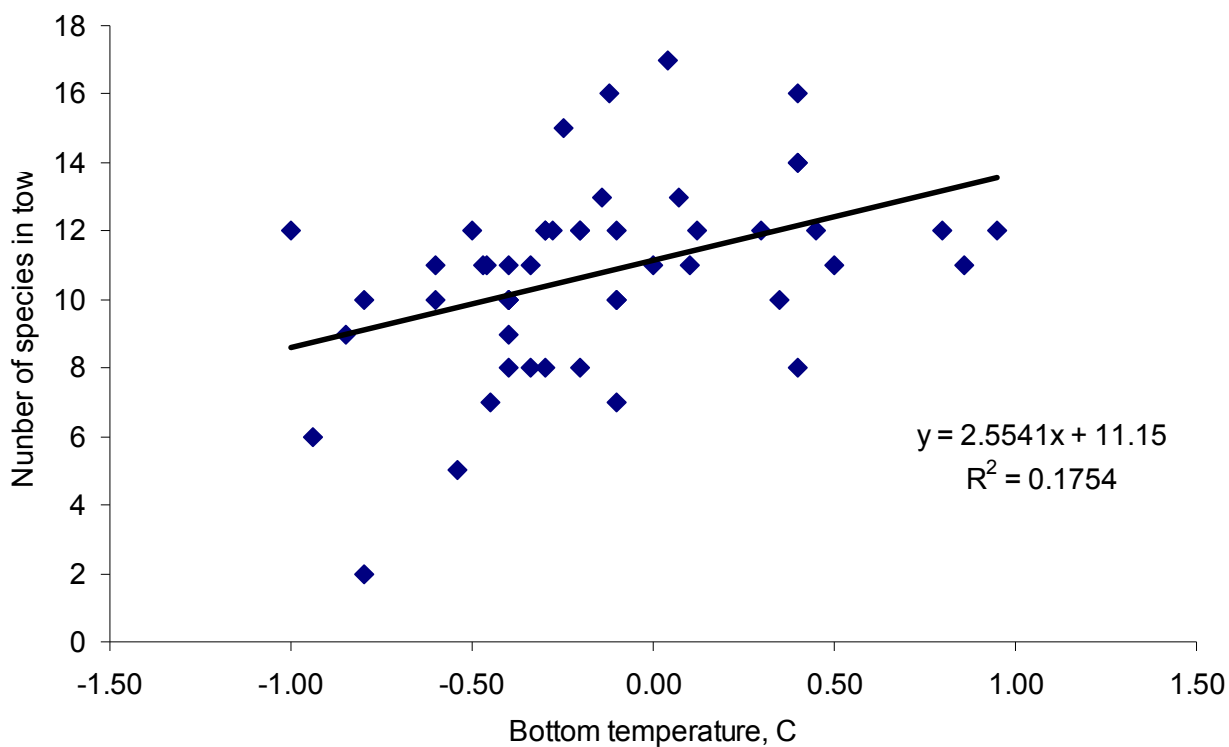


Fig. 4. Relationship between near-bottom water temperature and number of species in catches.

*Catch values*

In the period of investigation, catch values varied over a large range: from 0.1 kg to 2.7 t per hour of trawling (Fig. 5). The lowest values were observed immediately in the Kara Sea. For instance, in August 2007 the mean catch per hour of trawling was only 19.5 kg, whereas the mean range of catches varied from 0.5 to 121 kg. In the Kara Sea areas adjacent to the Barents Sea catch values increased sharply, and, as a result, mean catches in September 2007 and August 2008 were equal to 296 and 151 kg per hour of trawling and the highest catches amounted to 2.7 and 1.5 t per hour of trawling.

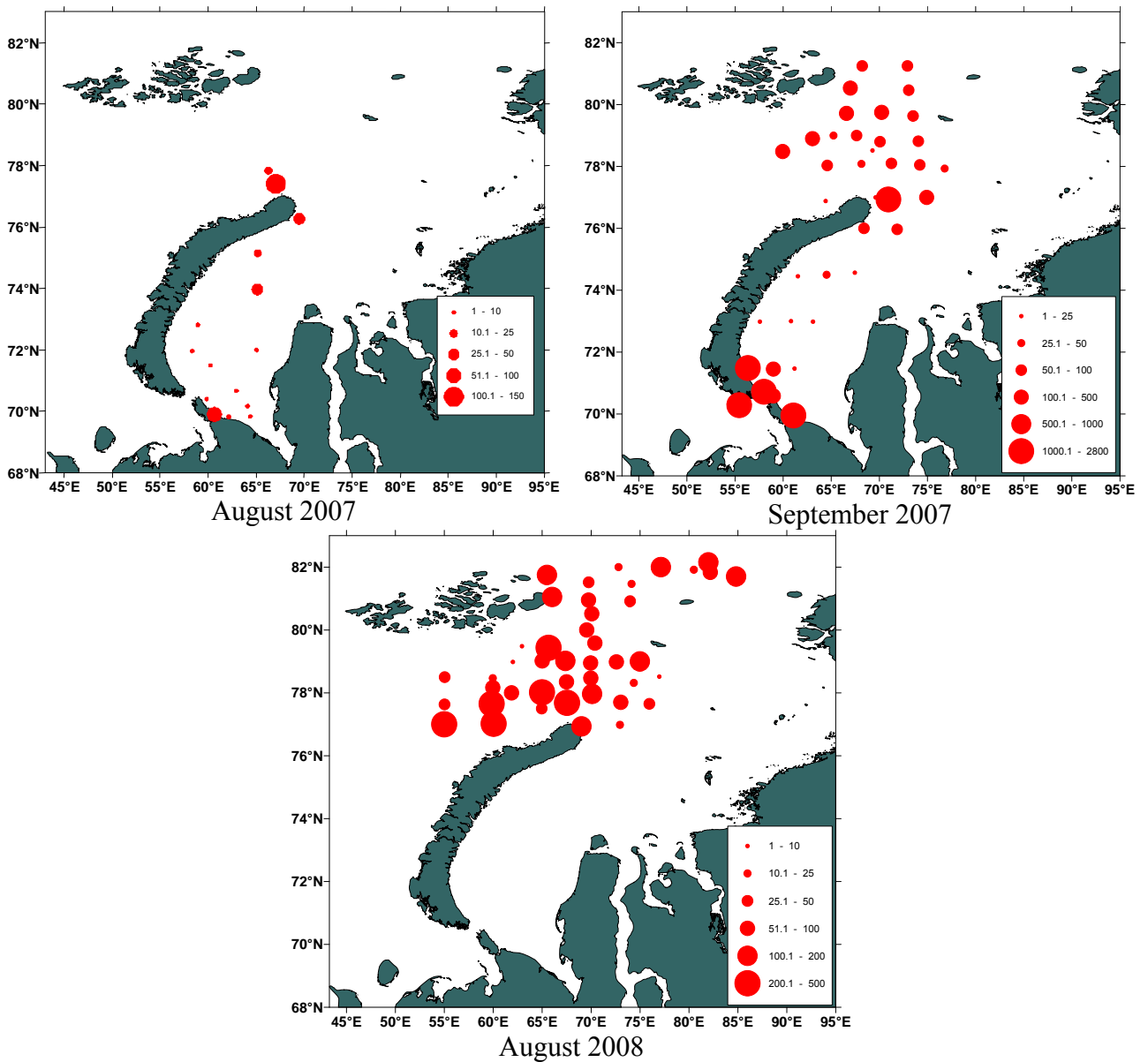


Fig. 5. Total catches of fishes in the Kara Sea in 2007-2008, kg per 1 hour of trawling

### *Predominant species*

In August 2007 in the Kara Sea area the polar cod dominated the catches (85% in abundance and 95% in biomass) (Fig. 6). Among other species with high abundance and biomass were gelatinous snailfish, *Liparis fabricii*, Arctic staghorn sculpin, *Gymnacanthus tricuspis*, bigeye sculpin, *Triglops nybelini*, and long rough dab *Hippoglossoides platessoides*.

In September 2007 in the light of expanded area of investigation northwards and dominance of polar cod in catches, abundance and biomass of Greenland halibut increased to 0.6 and 5.9%, respectively.

In 2008 when the study area shifted northwards, the proportion of Greenland halibut sharply increased and their abundance and biomass amounted to 2.1 and 24.8 %, respectively.

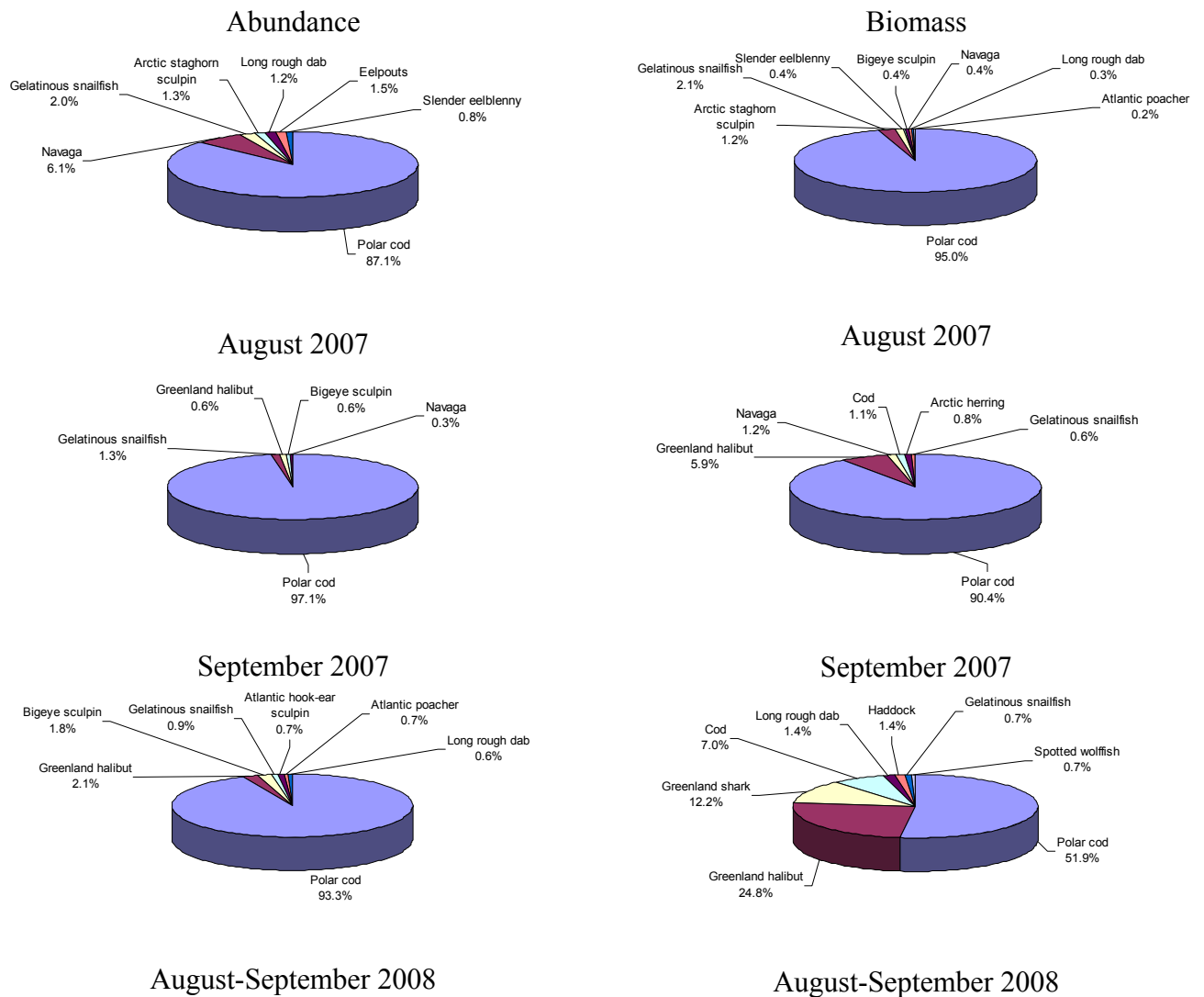


Fig. 6. Structure of fish catches in the Kara Sea in 2007-2008.

### *Size structure of communities*

Data on size composition of fish community in the Kara Sea showed that small fish 6-20cm in length were predominant in the fish communities of this area (Fig. 7). In August 2007 when the Kara Sea area was covered by the survey, the largest size of fish was less than 33 cm, and the bulk of catches was made of fish 6-10cm long. While expanding the area of studies northwards and northwestwards, including adjacent areas of the Barents Sea with warm-water fish species, the highest size of fish had increased to 80-90 cm. These were single specimens of large species (cod), their number in the total size composition being minor. As a result, the number of large fishes 11-15 and 16-20 cm long increased.

Such size structure of ichthyocenosis is an evidence of almost complete absence of predators in the Kara Sea ecosystem. This appears to be related with a relatively low biological productivity of this area. Moreover, this is favourable for increased importance of the Kara Sea margin areas as a profitable growing area for juvenile Greenland halibut thanks to absence of predation, on the one hand, and available food supply including *Hyperiidea* and small food fish (polar cod and capelin), on the other hand.

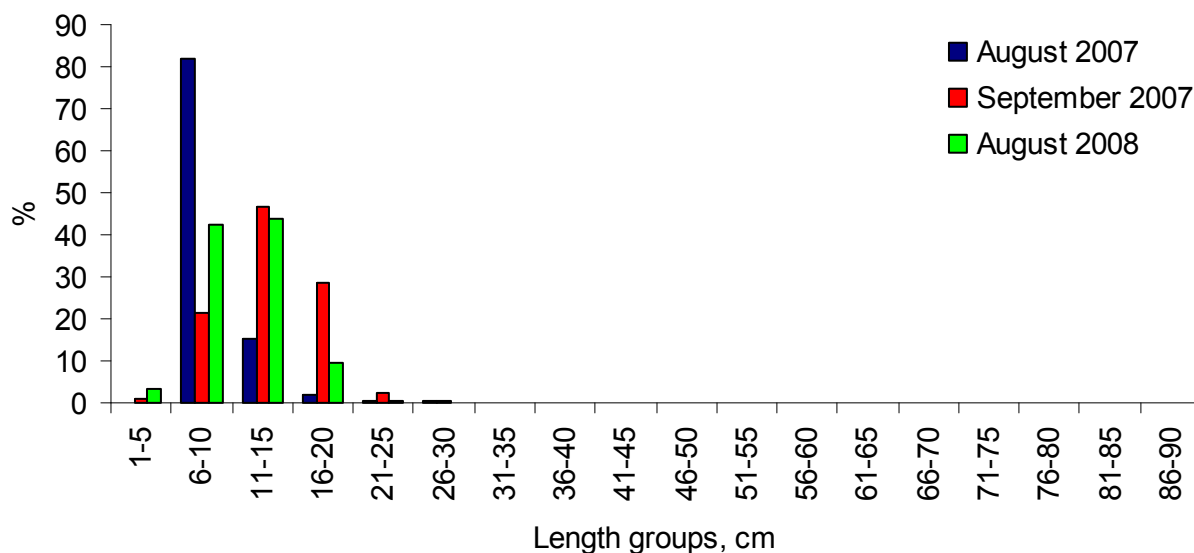


Fig. 7. Size composition of fish community in the Kara Sea.

### ***Greenland halibut***

One of the most important results of expeditions in the Kara Sea was acquisition of crucially new data on distribution of the Greenland halibut. This species occurred in all northern part of the Kara Sea, mainly deeper than 300 m (Fig. 8). Densest concentrations of Greenland halibut were observed along the western slope of the St. Anna Through at 450-500 m depths. Tows in the Voronin Trough, made for the first time, pointed to distribution of a great deal of juvenile Greenland halibut in this area.

Greenland halibut specimens 11-68cm in length occurred in catches. Fish 32cm long were predominant among males and females. All analyzed specimens including the largest fish were immature. In the studied area specimens aged 5-6 (abundant year-classes 2002-2003) were prevalent. The number of younger fish was slight. Larger halibut occurred at greater depths. It was recorded that the mean length of fish increased with depth.

The main food item for halibut was polar cod (frequency of occurrence of 75%). Intensity of feeding (mean index of stomach fullness was 1.6) was much higher compared to that in western and northwestern areas of the Barents Sea, where the mean index of stomach fullness rarely exceeded 0.5-1.0.

### **Conclusions**

1. In 2007-2008 PINRO carried out unique investigations of ichthyofauna and ichthyocenosis in the Kara Sea and adjacent areas of the Barents Sea and Arctic Basin.



2. During the studies 59 fish species belonging to 20 families occurred in catches. The list of the Kara Sea ichthyofauna (including literature data) covers about 70 species of 24 families.

3. The dominant species in the Kara Sea ecosystem in the terms of abundance and biomass is the polar cod. In the northeastern Kara Sea and adjacent areas of the Barents Sea and Arctic Basin the Greenland halibut is second in importance.

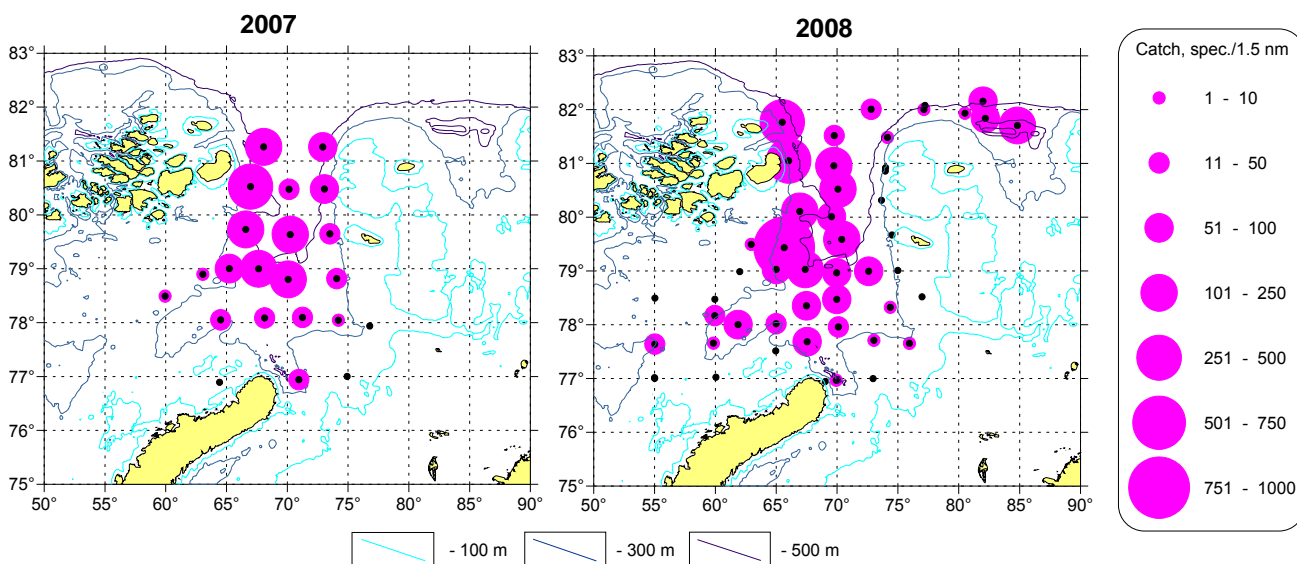


Fig. 8. Distribution of the Greenland halibut

4. In the northern Kara Sea significant concentrations of juvenile Greenland halibut were found. This finding thoroughly revised our understanding of distribution and stock structure of the Barents Sea population of this species.

## References

Andryashev, A.P. 1964. List of fish species collected during expedition onboard icebreaker “F. Litke” in 1955 northwards of Franz Josef Land and Spitsbergen. *Trudy AANII*, 259: 373-377. (in Russian)

Astafyeva A.V., Antonov S.G., Petrov A.A. 1985. Trawl investigations in the Kara Sea. P.3-12. In : *Biology peculiarities of the northern sea fishes. MMBI proceedings*. Leningrad, Nauka Publishing (in Russian).

Borkin I.V. 1983. Results of ichthyofauna investigations in the Franz Josef Land and northwards of Spitsbergen. P.34-42. In : *Investigations of hydrobionts biology, morphology and physiology*. Apatity. AN SSSR Press. (in Russian)

Esipov V.K. 1952. *Fishes of the Kara Sea*. Leningrad, AN SSSR Press. 145 pp. (in Russian)

Norvillo G.F., Denisov S.G., Petrov A.A. 1982. Some results of ichthyoplankton investigations in the Kara Sea. P. 47-52. In : *Complex investigations of nature of northern seas*. Apatity. KFAN SSSR Press. (in Russian).

*The ecosystem of the Kara Sea. 2008. Collected papers*. Ed. by B.F. Prishchepa. Murmansk. PINRO Press. 261 pp. (in Russian).