



SCIENTIFIC COUNCIL MEETING – SEPTEMBER 2014

**Results of Russian investigations of the northern shrimp in the Barents Sea in
2004-2014**

by

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Abstract

In 2004-2013 Russian researches of the northern shrimp in the Barents Sea were conducted within the joint Russian-Norwegian ecosystem survey. During the survey in 2013 486 trawls were made. Northern shrimp was found in catches of 388 trawls. Catches of shrimp varied from several grams to 102 kg per 15 minutes of trawling. The total index of the stock was 9% higher than the long-term annual average and 11% lower compared to 2012; the stock index comprised 386 thousand tons.

Introduction

Since 2004 the studies of the northern shrimp stock were carried out within the Russian-Norwegian ecosystem survey from August to September. The survey area covers the Barents Sea area and adjacent area of the Spitsbergen. During the survey 3-5 vessels conducted 300-700 trawls by the trawl Campelin-1800 used for the shrimp fishery.

The present document contains results of the survey 2013 compared to the results of preceding surveys.

Material and methods

The stock index of the northern shrimp was calculated applying the Kriging method (Cressie, N. A. C., 1990) wherefore catch data were recalculated into the reference area equal to 1 degree of latitude and 1 degree of longitude in view of the meridional narrowing.

Individuals with weight of 1 kg selected accidentally were subjected to a biological analysis, which included the following operations: length measuring and determination of a sex and stages of gonads' maturity (Aschan et al., 1993).

Carapace lengths (CL) for length frequency information were measured from the posterior margin of the eyestalk to the posterior mid dorsal edge of the carapace. Sex of the northern shrimp was determined by the shape of the endopodite of the first pair of pleopods, distribution of sternal spines on the first segment of abdomen and by the presence of roe (Rasmussen, 1953; McCrary, 1971).

Results

In 2013 the stock assessment was conducted by three Norwegian and one Russian research vessels. During the survey 2013 486 trawls were made (fig.1). The northern shrimp was found in catches of 388 trawls. Shrimp catches varied from several grams to 102 kg per 15 minutes of trawling (fig.1). The largest catches of the northern shrimp were found in the eastern and northern parts of the Barents Sea (Central Bank, Novaya Zemlya Bank, Franz-Victoria Trough) and to the north of the Spitsbergen Archipelago. In the south-eastern part of the Barents Sea and the Spitsbergen Bank no northern shrimp was observed.

The total index of the northern shrimp in 2013 decreased in comparison to the previous year and comprised 386 thousand tons that is 11 % less than in 2012 (table 1). Thus survey conducted in 2013 showed the increasing of the recruitment index of the northern shrimp (abundance of shrimp at size 13–16 mm CL) to the average level over 7 years of the observation period (fig.2).

Table 1. The number of station, total biomass and recruitment (abundance of shrimp at size 13-16 mm CL) index of northern shrimp in 2004-2013 according to the data of joint Russian-Norwegian ecosystem surveys in the Barents Sea.

Year	Number of stations	Total biomass index	Recruitment index
2004	669	215	
2005	756	363	
2006	676	400	29
2007	753	286	13
2008	471	262	14
2009	378	327	18
2010	318	455	23
2011	401	378	18
2012	443	424	14
2013	486	386	16
Average	535	349	18

Biological analysis of the northern shrimp stock was conducted in 2013 by Russian scientists in the eastern part of the survey area. Likewise in the previous year the bulk of population of the Barents Sea shrimp was made up of individuals of smaller age groups – males with carapace length of 14-22 mm and females with carapace length of 20-25 mm (fig.3). Sex ratio of the northern shrimp was various in different trawling sites, but on the whole in the surveyed area males were predominant in catches, around 71% from the total abundance of shrimps. The portion of spawning females was 10%, those post-spawning - around 19% from the total abundance of shrimps in the catch. Thus in the largest part of the surveyed area 170-220 individuals occurred in 1 kg of the catch. The higher portion of large individuals was found in the Franz-Victoria Trough where one kg of the catch accounted for less than 91 individuals. The highest portion of small individuals was found in the eastern area of the Novaya Zemlya Bank where one kg of the catch numbered over 266 individuals of the northern shrimp.

In January-August 2014 Russian, Norwegian and Faroese vessels fished shrimp in the Russian part of the Barents Sea. This year shrimp was fished mostly on the northern Central trough while in last year all fishery was on the slope of the Novaya Zemlya Bank and Novaya Zemlya trough. In the

Central Trough catches of shrimp varied from several kilos to 5.7 tons and average catch was 1.62 ± 0.07 t. Also Russian vessel made several trawling around Goose Bank and in the Isfjord. On the Goose bank shrimp catches varied from 0.03 to 5 tons per trawling and average catch was 2.1 ± 0.12 t. In Isfjord catches varied from 0.09 to 2.7 tons per trawling and average catch was 1.47 ± 0.20 t.

Conclusions

1. The total index of the stock was 9% higher than the long-term annual average and 11% lower compared to 2012; the stock index comprised 386 thousand tons.
2. Thus survey conducted in 2013 showed the increasing of the recruitment index of the northern shrimp.
3. Frequency distribution of shrimp in the surveyed areas corresponded to the traditional one with high concentrations in the eastern areas of the Central Bank and Novaya Zemlya Bank. On the whole, the state of the northern shrimp stock in 2013 was evaluated as satisfactory.
4. In 2014 Russian, Norwegian and Faroese vessels fished shrimp in the Russian part of the Barents Sea. This year shrimp was fished mostly on the northern Central trough while in last year all fishery was on the slope of the Novaya Zemlya Bank and Novaya Zemlya Trough.

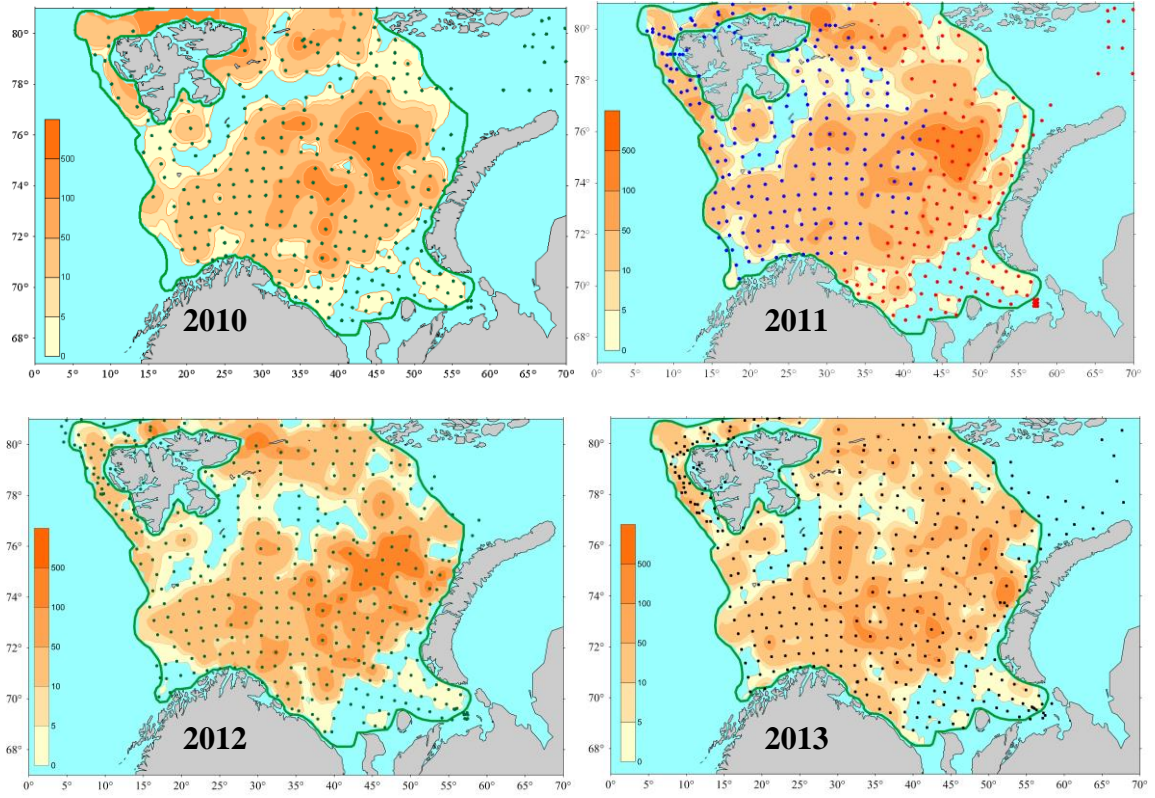


Fig.1. Distribution of *Pandalus borealis* in 2010-2013 according to the data of joint Russian-Norwegian ecosystem surveys in the Barents Sea (kg/ hour of trawl)

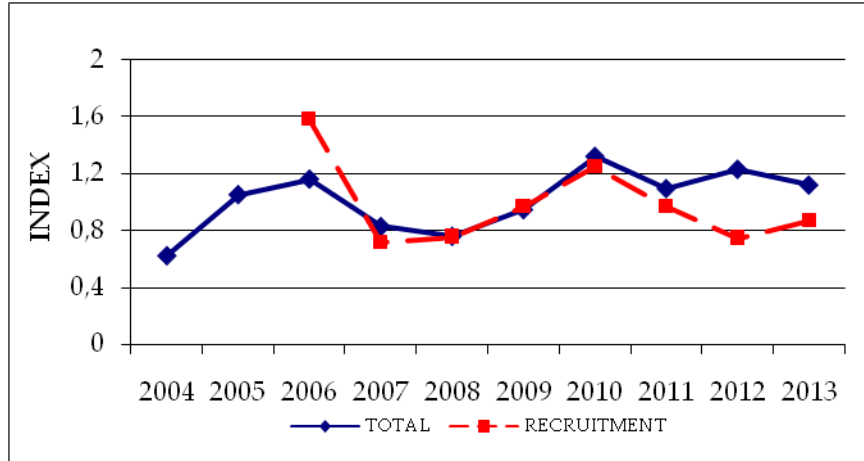


Fig.2. Total biomass and recruitment index of northern shrimp in 2004-2013 according to the data of joint Russian-Norwegian ecosystem surveys in the Barents Sea.

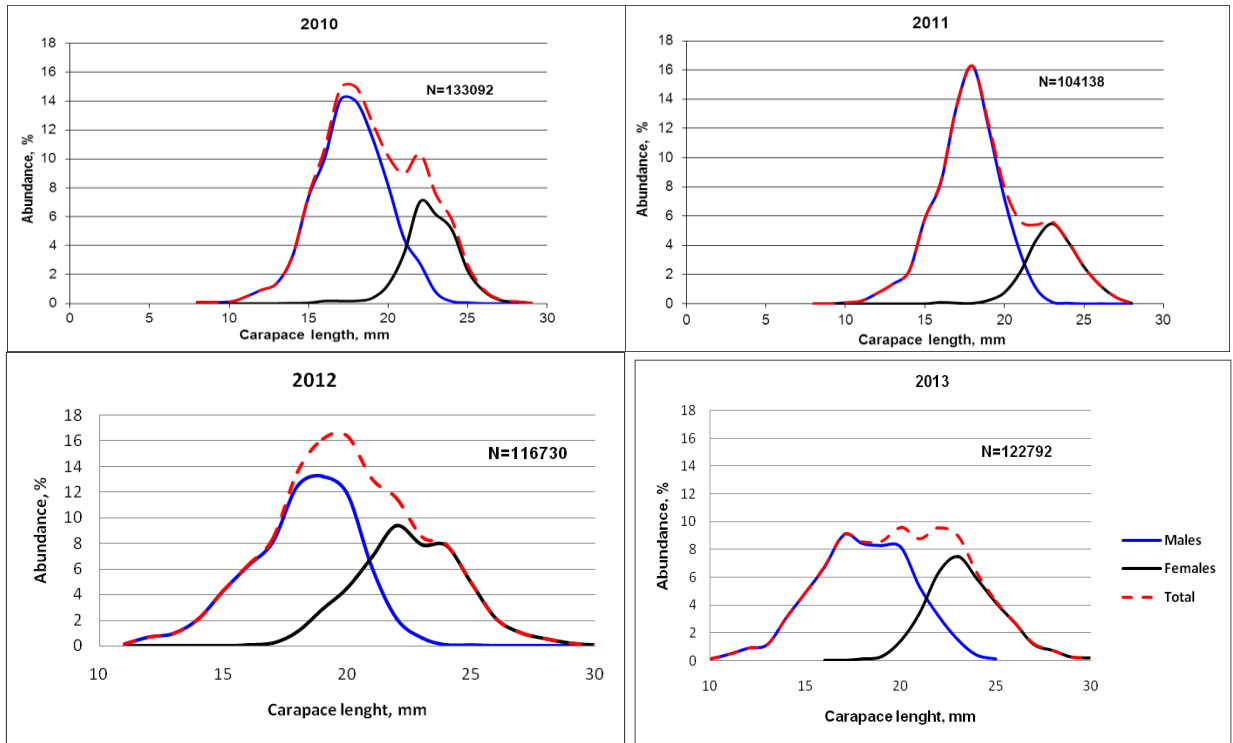


Fig.3. Length composition of catches of northern shrimp in the eastern part of the Barents Sea resulted from Russian-Norwegian surveys in 2010-2013