

**SPREADING OF SNOW CRAB *CHIONOECETES OPILIO* (FABRICIUS)  
IN THE BARENTS SEA**

**by**

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**ABSTRACT**

Until recently snow crab *Chionoecetes opilio* (Fabricius, 1788) occurred in the north seas of the Pacific Ocean and in the north-western Atlantic Ocean. In 1996 this species was found in the Barents Sea for the first time (Kuzmin et al., 1999). *C. opilio* was assumed to get there with ballast waters of vessels from the Northwest Atlantic.

Revealing the snow crab in the following years confirms the fact of its invasion to the southern Barents Sea. The reproduction of *C. opilio* in the Barents Sea has been proved, as a female with external eggs was revealed.

Crabs were found in the trawl catches at the depths of 100-324 m. They, mainly, occurred in the north slope of the Goose Bank. At present the snow crab is distributed in the Barents Sea - from 30°27'E in the west to 47°20'E in the east; and from 69°36'N in the south to 74°08'N in the north.

The carapace width (CW) was 41-123 mm in males and 42-72 mm in females. Almost all the females were caught in the northern slope of the Goose Bank. The males found in the Barents Sea were mostly, mature (92%). There was the noted trend of increase in the male size from the Goose Bank westward and southward.

Obviously, this species is able to form a commercial population in the Barents Sea in future. Snow crab will hardly be a competitor of another one moved into the Barents Sea - the king crab.

**INTRODUCTION**

Snow crab *Chionoecetes opilio* is related to the real crabs of Brachyura suborder (Majidae family - spider crabs). This commercial crab is widely distributed and occurs not only in the seas of the northern Pacific Ocean, but in the Northwest Atlantic, at the coast of the West

Greenland and the North America. The northern border of species habitation is located to the north of the Vrangal Island, in the Chukchee Sea, almost reaches the mouth of the MacKenzy River in the Beaufort Sea and passes along 71°N near the West Greenland (Galkin, 1985).

In 1996 the first individuals of the snow crab *Chionoecetes opilio* (Fabricius, 1788) were found in the Barents Sea (Kuzmin et al., 1998, Kuzmin et al., 1999). The two of these crab specimens caught are kept in the museum of Moscow State University with N Ma4828, N Ma4829 numbers. The authors (Kuzniin et al., 1998) have analysed possible tracks of this crab migration from the Northwest Atlantic to the West Arctic waters and suggested about the invasion of the species with the ballast water of vessels. It is corroborated by the results of some experimental works indicating that plankton organisms are capable to remain viable during the transatlantic cruises (10-14 days) (Olenin, 2000).

In the following years the reports on this crab finds in the other areas of the Barents Sea continued to be received (Matishov et al., 1999). At present there is a sufficient number of collected data showing the continual invasion of *Chionoecetes opilio* to the southern and south-eastern Barents Sea. They allowed some peculiarities of crab distribution in the new area presented by the author in the paper to be preliminarily analysed.

## MATERIAL

In the paper the fixed crab specimens or data on their catch brought to the PINRO's Shellfish Laboratory by the scientists from this and other institutes (SevPINRO, Arkhangelsk) are used (Table). Besides, more detailed information on the catch of snow crab in the Finnmarken Bank briefly mentioned in the paper by Matishov et al. (1999) was kindly given to me by the scientist from Murmansk Marine Biological Institute (MMBI) E.G.Berestovsky. I express my sincere gratitude to everybody responding to my request and rendering the assistance in collecting the material on snow crab. Brief data of these specialists are given in the Table 1.

All the information on snow crab was collected in the period of monitoring when fishing bottom species (cod, haddock), as well as during the scientific surveys for the North shrimp (data of S.V.Bakanev), bottom fishes (data of E.V.Gusev) and Iceland scallop (data of T.E.Bliznitchenko).

The data on fishing efforts of bottom hauls when fishing in the Barents Sea in 1996-99 were taken from PINRO's information fishing base. Four year fishing efforts are given in haul hours. Fishing efforts were summarized in each fishing square (10 x 10 NM).

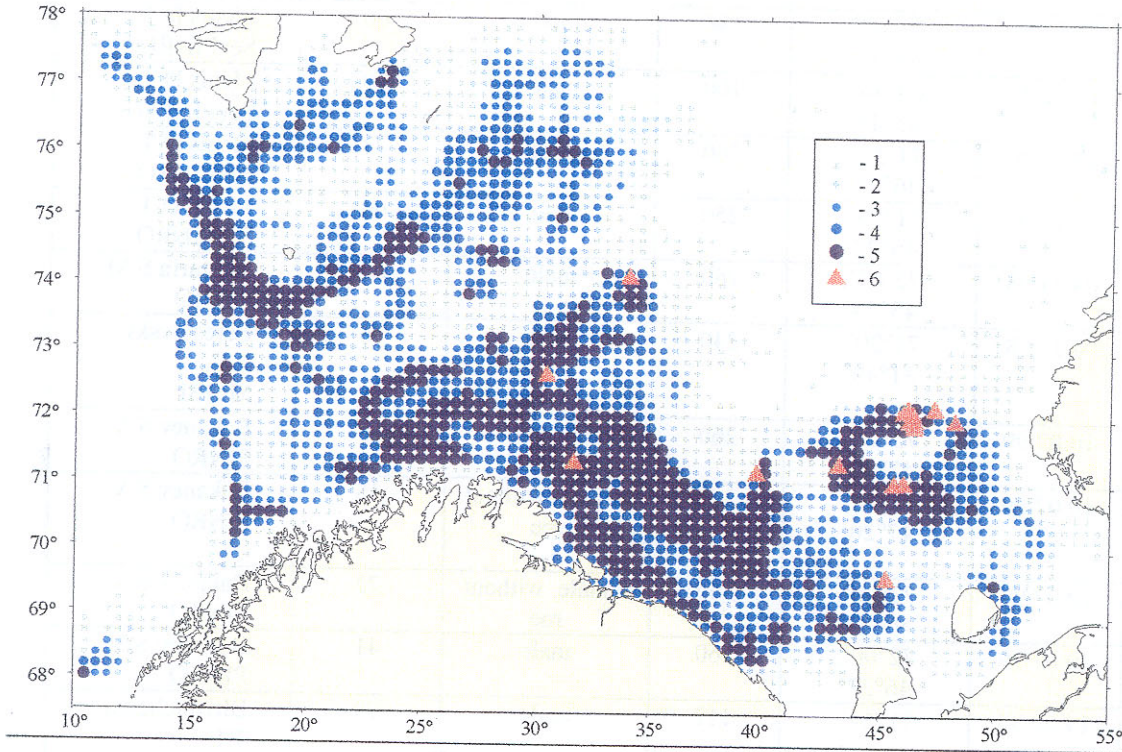
**Table 1.** Catches of individuals from *Chionoecetes* genus in the Barents Sea

№	Date	Trawling position (N: E)	Trawling depth (m)	Sex, female availability of roe	c w (mm)	Crab or data delivered by (name, institute)
1	02.05.96	72°10', 46°13'	280	female, without roe	42	Akhtarin S.M., PINRO
2	14.11.96	71°02', 45°36'	180	male	60	Menis D.T., SevPINRO
3	13.12.96	69°36', 45°18'	100	male	90	Menis D.T., SevPINRO
1	22.12.96	71°57', 46°28'	200	male	71	Menis D.T., SevPINRO
5	23.12.96	71°59', 46°27'	250	male	66	Menis D.T., SevPINRO
6	04.11.98	72°07', 45°59'	260	male	62	Akhtarin S.M., PINRO
7	08.12.98	71°20', 31°40'	240	male	96	Berestovsky E.G., MMBI
8	10.07.99	72°10', 47°20'	260	female, without roe	47	Bakanev S.V., PINRO
9	10.07.99	72°10', 47°20'	260	female, without roe	45	Bakanev S.V., PINRO
10	10.07.99	72°00', 46°27'	260	female, without roe	72	Bakanev S.V., PINRO
11	10.07.99	72°00', 46°27'	260	male	41	Bakanev S.V., PINRO
12	19.09.99	71°59', 48°14'	112	male	79	Bliznitchenko T.E., PINRO
13	20.09.99	71°03', 46°01'	193	male	60	Akhtarin S.M., PINRO
14	14.11.99	71°19', 43°10'	210	male	92	Koloskov A. A., PINRO
15	17.12.99	71°11', 39°39'	321	male	80	Gusev E.V., PINRO
16	25.12.99	72°39', 30°27'	292	male	123	Rotschin E. A., PINRO
17	10.05.00	74°08', 34°00'	270	female, without roe	61	Bakanev S.V., PINRO
18	18.05.00	71°59', 46°15'	250	female, berried	62	Bakanev S.V., PINRO
19	18.05.00	71°59', 46°15'	250	male	77	Bakanev S.V., PINRO

## RESULTS AND DISCUSSION

Spatial distribution. Crabs were revealed in the catches of trawls at 100-324m depths. The average depth of male catches was  $221 \pm 18$  m, the female ones -  $263 \pm 4$  m. The standard error of average is given as an interval.

Most of crabs were caught on the Goose Bank (74%), and the eleven of them, i.e. 58% of the total number of catches, - on the north slope of the bank. On the whole, at present snow crab are distributed in the Barents Sea from 47°20'E (the northern slope of the Goose Bank in the east to 30°27'E (the Murmansk Tongue) in the west; and from 74°08'N (the Central Elevation) in the north to 69°36'N (the Kanin-Kolguev Shallow) in the south (Fig. 1).



**Fig. 1** Summary fishing efforts of bottom trawlings by fishing squares and the sites of *Cantonoecetes opilio* catches in 1996- 1999 in the Barents Sea. Legend: 1 - 0.1-50 trawling hours; 2 - 51-150 trawling hours; 3 - 151-500 trawling hours; 4 - 501-1500 trawling hours; 5 - 1501-21000 trawling hours; 6 - the catch of snow crab.

As the figure shows, all the sites of crab catches were located in the areas of intensive fishing - on the Goose and Finnmarken Banks, in the Murmansk Tongue, in the southern Central Deep and the Central Elevation. One catch was in the area of less significant fishery - in the Kanin-Kolguev Shallow. Trawl efforts were comparatively evenly distributed over the area of the Barents Sea, except for its north-eastern part. There were no finds of snow crab to the west of 30°E and north of 74°N.

Thus, it could be assumed that now the snow crab are not distributed in the Barents Sea to the west of the North Cape.

Probably, the densest crab concentrations occur on the north slope of the Goose Bank, since in 1999 and 2000 the maximum catches - 2 individuals per a trawling - were obtained during three the least lasting trawlings (one hour each).

Length and sex composition. Caught males and females had the carapace width (CW) of 41-123 mm and 42-72 mm, respectively (see Table). CWs of 60-69 mm and 90-99 mm may be preliminarily considered as the modal male size-groups.

The number of females as well as males caught is insufficient to analyse the length composition. But, it may be noticed, that three of the six females found had the CW of 42-47 mm, the other three - of 61-72 cm. Almost all the females were caught on the north slope of the Goose Bank. Only one of them brings the external eggs.

It should be notable, that all the finds of crabs in the west were represented by large males (see Table, notes No.7, 14, 15, 16). The largest males were caught in the most westward areas of crabs having been revealed (see Fig. 1).

According to the results from the native regions, all the males of snow crab with the CW of over 60 mm have spermatophores in spermathecae (Conan and Comeau, 1986). The minimum size of mature crabs at the East Canada coast is 51 mm CW (males) and 47 mm CW (females) (Watson, 1970). In such a way, it may be assumed that 92% of males found in the Barents Sea were physiologically mature. Three of the females revealed were definitely mature, as has the CW of more than 47 mm (see Table, Note N 10,17,18), one of them, besides, had the external eggs (see Table, Note 18).

Other biological features. There were no separate pereopods in some found crabs. Usually they were the walking legs of the fourth and fifth pairs. This leg autonomy by snow crab is often observed in their native areas of habitation (Ivanov, 1994).

It should be noticed that the male of maximal size (123 mm CW) had a significant number of fish leech *Johanssonia arctica* cocoons on the lower part of pereopods. Another large male with 90 mm CW caught on 13.12.96 also carried cocoons on the lower part of walking legs. Laying cocoons on the crab external skeleton surface by the leech *J. arctica* is in general for the areas of the Northwestern Atlantic (Khan, 1982; Khan, Paul, 1995). In the Barents Sea, for this purpose, besides the local species of decapods and sea spiders they started using the surface of king crab acclimatized from the Pacific Ocean areas (Bakai et al., 1998). As it is obvious, in the West Arctic waters not only a king crab, but a snow crab were included into the life cycle of *J. arctica*.

## CONCLUSIONS

Despite the reasons favouring snow crab moving to a new region, the fact of its invasion to the Barents Sea remains undoubted.

The crab are distributed in the Barents Sea from 47°20'E (the north slope of the Goose Bank) in the east to 30°27'E (the Murmansk Tongue) in the west; and from 74°08'N (the Central Elevation) in the north to 69°36'N (the Kanin-Kolguev Shallow) in the south.

Obviously, at present the Goose Bank is the main area of crab habitation.

The north slope of the Goose Bank should be considered as a hypothetical crab reproduction area, since almost all the females including the roe-bearing one found were from this area. Due to the roe-bearing female found the *C. opilio* reproduction in the Barents Sea has been proved.

The trend to increase in male size from the Goose Bank area to the west and south was noticed.

This species is able to form a significant commercial stock of a valuable crab in the Barents Sea in future. Besides, it is important, that the snow crab will not be a competitor for another commercial species from the Barents Sea crustaceans - the king crab, as well as in the native regions.



## REFERENCES

- BAKAY, Yu.I., KUZMIN S.A. and S.Yu.UTEVSKY. 1998. Ecological and parasitological investigations of the Barents Sea red king crab *Paralithodes camtschatica* (the first results). ICES CM 1998/AA:4, 14 pp.
- CONAN, G.Y., and M.COMEAU. 1986. Functional maturity and terminal molt of male snow crab, *Chionoecetes opilio*. Can. J. Fish. Aquat.Sci. 43: P.1710-1719.
- GALKIN, Yu.I. 1985. On the increase in fishing productivity of the White and Barents Seas by the way of acclimatizing. Ecological investigations of the promising mariculture objects in the White Sea. L.: the Academy of Science of the USSR, Zoological Institute. p.122-133 (in Russian).
- IVANOV, B.G. 1994. Limb injuries in crabs in the western Bering Sea (Crustacea Decapoda: Brachyura Majidae, Anomura Lithodidae). Anthropoda Selecta 3(3-4). - 1994, pp.33-56.
- KHAN, R.A. 1982. Biology of the marine piscicolid leech *Johanssonia arctica* (Johansson) from Newfoundland. In: Proc. Helminthol. Soc. Was. 1982. 48(2): 266-278.
- KHAN, R.A. and A.J.PAUL. 1995. Life cycle studies on arcto-boreal leeches (Hirudinea). J.Helminthol. Soc. Wash. 1995. 62,2: 105-110.
- KUZMIN, C.A., AKHTARIN S.M. and D.T.MENIS. 1998. First findings of snow crab *Chionoecetes opilio* (Fabricius) (Decapoda: Majidae) in the Barents Sea. Zoological journal, 1998, Vol.77, N4, p.489-491 (in Russian).
- KUZMIN, S.A., AKHTARIN S.M. and D.T.MENIS. 1999. The first finding of the snow crab *Chionoecetes opilio* (Fabricius) (Decapoda: Majidae) in the Barents Sea. Can. Transl. Fish. Aquat. Sci. 1999. No.5667. 5pp.
- MATISHOV G.G., BERESTOVSKY E.G., MATISHOV D.G., NAMYATOV A.A., MOISEEV D.V. and I.V.BRONNIKOV. 1999. Biological and hydrological indications of cooling in the West Arctic. Papers of the Academy of Science, 1999, Vol. 368, N 2, p.254-258 (in Russian).
- OLENIN, S.N. 2000. Transporting species moving in by vessel ballast waters. Theses of paper from Scientific Seminar (Murmansk, 27-28 January 2000) - Murmansk: MMBI KNC RAN, 2000. p.66-67 (in Russian).
- WATSON, J. 1970. Mating and egg laying in the spider crab, *Chionoecetes opilio*. J.Fish. Res. Bd. Canada 27: p. 1607-1616.