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Going eastward – climate changes evident from gastropod distribution in the Barents Sea

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ABSTRACT. *Aporrhais pespelecani* (Linnaeus, 1758) (fam. Aporrhaidae) was recorded for the first time in the Barents Sea on the Murman coast. The finding of established population of the mollusc probably reflects the raise of water temperature and significantly (nearly 1000 km) extends the area eastward. New findings of the gastropods in Russian part of the Barents Sea are discussed.

Molluscs are very useful indicator of long-term changes of the environmental conditions. In general they are capable to rapid expansion, especially the groups with planktonic larvae, thus occupying all suitable biotopes and environments. Shells are excellently preserved and remain postmortem, indicating the presence of the species at the given locality in the past. It is not surprising that molluscs atract significant attention of the researches interested in the long-term changes of the composition of the biota.

The Murman coast of the Barents Sea is greatly influenced by the Gulf Stream, which provides permanent transport of the planktonic organisms eastward along the coast. The Gulf Stream is also a major "heater" of the Barents Sea. The remarkable example is the Murmansk sea port which remains free of ice over the year despite the fact that it is situated at 69°N.

The average temperatures of the coastal waters of the Barents Sea are the subject to significant fluctuations. The tendencies of the temperatures were recently analyzed by Martynov *et al.* [2006] on the basis of the records of Dalne-Zelenetskaya weather station. In brief, the periods of decrease of the water temperature (second part of 1980-s and 1990-s) were replaced by warmings, especially strong in the 1999-2000. Therefore these changes in climate and water temperature should find the reflection in the distribution of the aquatic organisms and fauna and flora composition.

The fauna of the Mollusca of the Barents Sea and particularly of the Murman coast was well studied over the last century, with intensive sampling in 1960s [Propp, 1962, 1971], 1987-1988 [Golikov et al., 1993]. More recent the survey of the benthic communities of some regions of the Murman coast was held by the Laboratory of ecology and morphology of marine invertebrates of A.N.Severtzov Institute of Ecology and Evolution (2002-2008) and by PINRO.

Among the most remarkable recent finding of the last years is the record of the gastropod *Aporrhais pespelecani* (Linnaeus, 1758) (Aporrhaidae) on the Murman Coast.

Results and discussion

Specimens of *Aporrhais pespelecani* were found in two localities of the Murman coast – several hundred specimens at Kislaya Guba (Inlet) of the Motovsk Bay (69°31.6'N; 33°15.4'E) (Fig. 1 – square) in July 2007. The specimens (Fig. 2 A) were collected alive at muddy sand at 8 m in the biocenose of the bivalves *Mytilus edulis* and *Arctica islandica*. The specimens were fully grown adults with the shell length 37-42 mm and average shell length 39±3 mm.

The single subadult specimen (Fig. 2B) was collected alive in August 2007 in Dalnezelenezkaya Bay (69°07'03''N; 36°04'12''E) (Fig. 1 – circle) at muddy sand at 6 m by junior author (TIA).

The finding is a significant extension of the distribution of the species eastward. The previous most north-eastern record was in northern Norway [Hayward, Ryland, 1990] (67.5°N, 13.5°E) (Fig. 1 – star). Thus extension is *ca* 950 km.

The population of *Aporrhais pespelecani* in the Barents Sea is undoubtedly well established, that is obvious from large number of adults. Nevertheless due to the absence of the juveniles in our material we can not be positive about reproduction of the species in the Barents Sea.

This new records makes the species one of the most broadly distributed species with continuous area among Russian marine gastropods. It is known from the subtropical waters of the Black Sea [Anis-

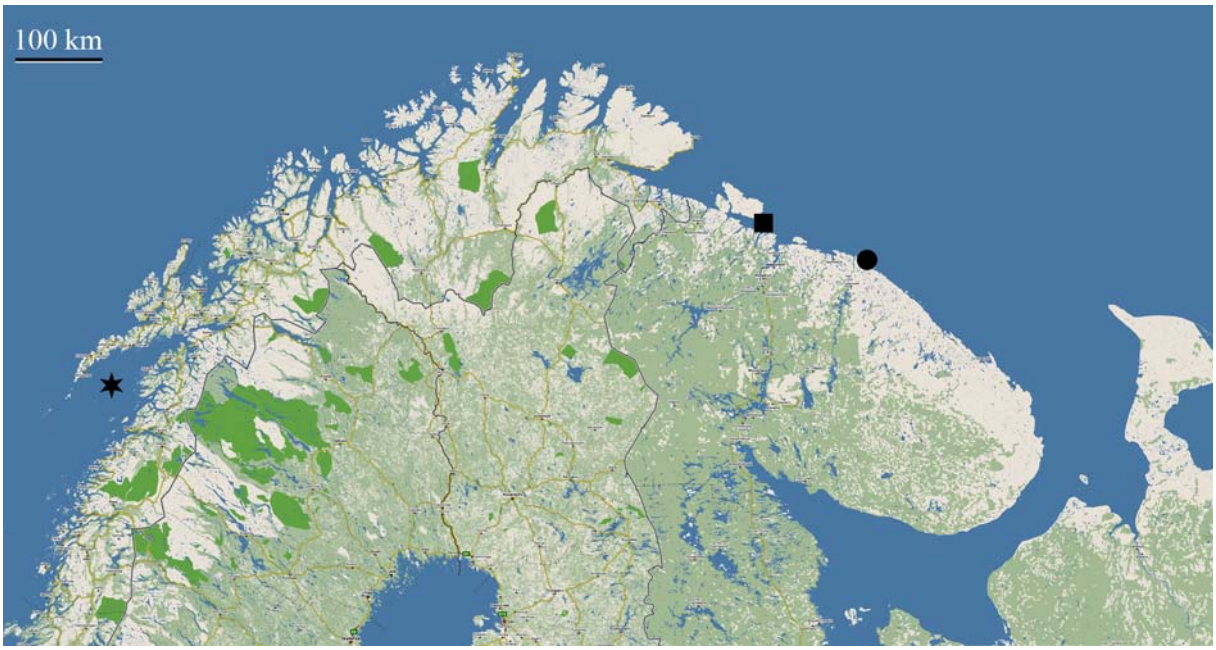

FIG. 1. Distribution of *Aporrhais pespelecani* in the Norwegian and Barents seas. Star – previous record of the species in Norway. Square – reported here finding in the Motovsk Bay. Circle – reported here finding in the Dalnezelenetskaya Bay.

РИС. 1. Распространение *Aporrhais pespelecani* в Норвежском и Баренцевом морях. Звездочка – опубликованное ранее нахождение в Норвегии. Квадрат – нахождение нами вида в Мотовском заливе, кружок – в Дальнезеленецкой Губе.

tratenko, 1998; Kantor, Sysoev, 2006], through Mediterranean, in the north-eastern Atlantic, around Great Britain and Ireland, in the North Sea, in the Baltic Sea (WORMS, World Register of Marine Species – http://www.marinespecies.org), and now east to the boreal-subarctic Murman coast in the Barents Sea.

The broad distribution of *A. pespelecani* is undoubtedly facilitated by the planktonic larva and feeding habit – the species is a deposit feeder and therefore can easily find suitable habitat.

Rather few species of gastropods were recorded recently for the first time at the Murman coast of Russia. These are 4 species of nudibranchs [Martynov *et al.*, 2006], undoubtedly migrating eastward due to the warming of the Arctic ocean. *Littorina arcana* Hannaford Ellis, 1978 was also recently recorded for the first time in Yarnyshnaya Bay, neighboring the Dalnezelenezkaya Bay [Granovitch, Sokolova, 2001].

The nudibranchs has very short life cycle and therefore they are indicators of the short-term and rapid changes of the environments. The finding of *Littorina arcana* may not be the true extension of the distribution area of the species. This species might be mixed before with similar species of *Littorina*, particularly with common and broadly distributed *L. saxatilis* (Olivi, 1792).

The finding of the *Aporrhais*, on the contrary, is undoubtedly the true extension of the area of the large long-living species of Gastropoda, since its large characteristic shell can not be confused with any other marine gastropods and undoubtedly was never found before in the Barents Sea. Due to the large quantities and adult sizes of the specimens found in Motovsk Bay it is clear, that the population exists already for a number of years.

There is no doubt that more species of molluscs will be recorded in the Barents Sea due to the temperature raise, which may be overlooked at present.

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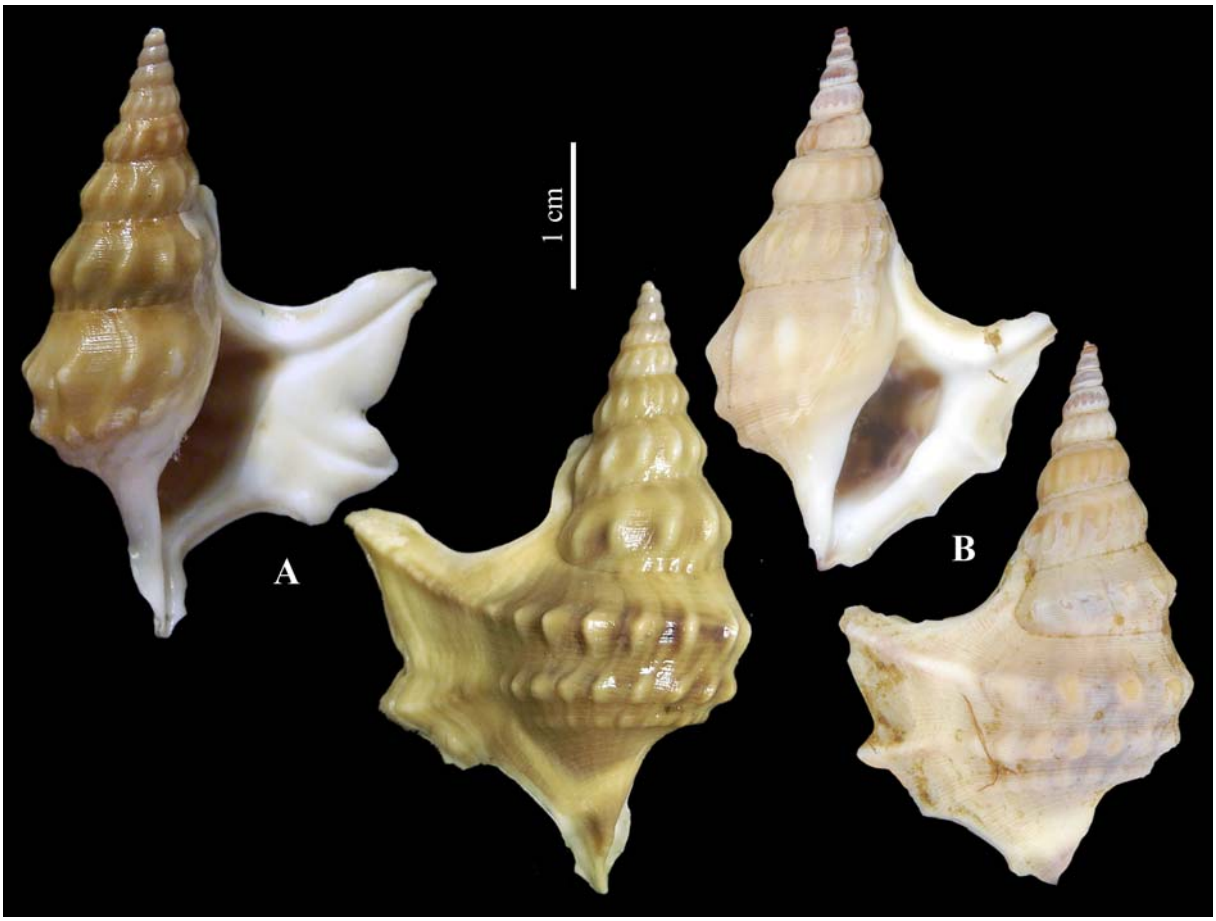

FIG. 2. Shells of *Aporrhais pespelecani* from the Barents Sea. A – shell length 42.5 mm, Motovsk Bay; B – shell length 37.5 mm, Dalnezelenetskaya Bay.

РИС. 2. Раковины *Aporrhais pespelecani* из Баренцева моря. A – высота раковины 42,5 мм, Мотовский залив; B – высота раковины 37,5 мм, Дальнезеленецкая Губа.

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Идущие на восток – изменения климата, демонстрируемые распространением брюхоногих моллюсков в Баренцевом море

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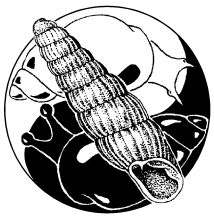
РЕФЕРАТ. *Aporrhais pespelecani* (Linnaeus, 1758) (сем. Aporrhaidae) впервые отмечен в Баренцевом море на восточном Мурмане. Находка популяции, вероятно, отражает повышение температуры воды и является существенным расширением (почти на 1000 км) ареала вида на восток. Кратко обсуждаются новые находки брюхоногих моллюсков в баренцевоморских водах России.



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