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CETACEANS OF THE BARENTS SEA: FAUNA AND POPULATION STATUS AT THE BEGINNING OF THE XXI CENTURY

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The Polar branch of Russian Federal Research Institute of Fisheries and Oceanography (VNIRO) carries out annually comprehensive surveys in the Barents Sea. This allows obtaining relevant data on distribution and occurrence of marine mammals, in particular cetaceans – the key link in the World Ocean ecosystem. In recent years, marine mammals monitoring has become increasingly important due to climate change and temperature rise in seas and oceans, that can result in habitat displacement and even possible extinction of certain species. This article summarizes the results of the vessel surveys of cetaceans carried out by the Polar branch of VNIRO in the Barents Sea in 2010–2019, as well as provides retrospective data on baleen whales (Mysticeti) and toothed whales (Odontoceti). Based on vessel survey material and taking into account data from literature sources, the current composition of the Barents Sea cetacean fauna is presented; at the beginning of the XXI century, it may include up to 16 species of 7 families. The analysis of vessel survey data made it possible to determine the status of marine mammals of this water area and to identify the frequency of their occurrence. The article presents population abundance for most species of baleen and toothed whales and shows the most likely spots of cetacean occurrence. According to the data obtained, white-beaked dolphin *Lagenorhynchus albirostris* is the most abundant, frequently sighted, and a year-round species: it accounts for more than 80 % of the total number of surveyed animals and about 50 % of all sighted cetaceans. Beluga whale *Delphinapterus leucas* and harbor porpoise *Phocoena phocoena* are also classified as permanent residents of the water area, and their localization is mainly confined to the Kola Peninsula coastal zone. May to October, the Barents Sea is regularly visited by species arriving from other Atlantic Ocean areas for feeding: minke whale *Balaenoptera acutorostrata*, fin whale *Balaenoptera physalus*, and humpback whale *Megaptera novaeangliae*. Narwhal *Monodon monoceros* and northern bottlenose whale *Hyperoodon ampullatus* are rarely sighted in the Russian Arctic western area.

Keywords: marine mammals, cetaceans, Cetacea, vessel surveys, distribution, occurrence, abundance, Barents Sea

The Barents Sea is one of the most productive areas of the World Ocean. High estimates of zooplankton biomass are recorded here, and a large number of commercial fish species is registered: Atlantic cod *Gadus morhua*, haddock *Melanogrammus aeglefinus*, capelin *Mallotus villosus*, Arctic cod *Boreogadus saida*, Atlantic herring *Clupea harengus*, *etc*. This makes the Barents Sea a preferred habitat for marine mammals staying. Cetaceans traditionally feed in the high-latitude areas of the North-East Atlantic, arriving there in spring from other Atlantic Ocean areas.

Analyzing literature data on cetacean species composition in the Barents Sea since the XX century, it is necessary to mention A. G. Tomilin's publication (1975) and the Atlas of Marine Mammals of the USSR, edited by V. A. Zemsky (1980), which describe 14 and 18 species, respectively. At the beginning of the XXI century, according to the works of V. N. Svetochev et al. (2003) and V. L. Mishin (2004), the Barents Sea cetacean fauna was represented by 18 and 17 species, respectively. According to K. M. Kovach et al. (2009), the cetacean fauna may include up to 15 species. The most up-to-date data on the species diversity of baleen and toothed whales in the area analyzed are presented in the Atlas of Marine Mammals of the Russian Arctic and the Far East (2017): 16 cetacean species can be sighted in the Barents Sea (Table 1).

Table 1. Cetacean fauna composition of the Barents Sea according to various literature sources

Species	Tomilin, 1975[1]	Atlas, 1980[2]	Mishin, 2004[3]	Kovacs et al., 2009[4]	Morskie mlekopitayushchie, 2017[4]
Atlantic white-sided dolphin *Lagenorhynchus acutus*	+	+	+	+	+
White-beaked dolphin *Lagenorhynchus albirostris*	+	+	+	+	+
Short-beaked common dolphin *Delphinus delphis*	–	+	+	+	+
Harbor porpoise *Phocoena phocoena*	+	+	+	+	+
Bottlenose dolphin *Tursiops truncatus*	–	+	+	–	–
Killer whale *Orcinus orca*	+	+	+	+	+
Long-finned pilot whale *Globicephala melas*	–	+	+	+	+
Beluga whale *Delphinapterus leucas*	+	+	+	+	+
Narwhal *Monodon monoceros*	+	+	+	+	+
Sperm whale *Physeter catodon*	+	+	+	+	+
Northern bottlenose whale *Hyperoodon ampullatus*	+	+	+	+	+
Blue whale *Balaenoptera musculus*	+	+	+	+	+
Fin whale *Balaenoptera physalus*	+	+	+	+	+
Sei whale *Balaenoptera borealis*	+	+	+	–	+
Minke whale *Balaenoptera acutorostrata*	+	+	+	+	+

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Species	Tomilin, 1975[1]	Atlas, 1980[2]	Mishin, 2004[3]	Kovacs et al., 2009[4]	Morskie mlekopitayushchie, 2017[4]
Humpback whale *Megaptera novaeangliae*	+	+	+	+	+
North Atlantic right whale *Eubalaena glacialis*	–	+	–	–	–
Bowhead whale *Balaena mysticetus*	+	+	+	+	+
In total	**14**	**18**	**17**	**15**	**16**

Note: the given species composition corresponds to the following time period: [1] – the beginning of the XX century; [2] – mid XX century; [3] – the end of the XX century – the beginning of the XXI century; [4] – the beginning of the XXI century.

The aim of this work was to assess the current state of cetacean populations in the Barents Sea. To do this, the following tasks had to be solved:

- to determine the current species composition of baleen and toothed whales;
- to study their distribution and occurrence;
- to estimate the abundance of cetaceans;
- to reveal the pattern of their occurrence in the sea area.

MATERIAL AND METHODS

The article is based on the data of the vessel surveys of 2010–2019 of the Polar branch of Russian Federal Research Institute of Fisheries and Oceanography (VNIRO), obtained mainly beyond the territorial waters, with the author participating, as well as on literature material.

To date, vessel surveys of cetaceans are carried out as part of annual comprehensive research in the Barents Sea in winter (February to March)[1], spring-summer (May to July)[2], and autumn (August to October)[3].

The survey period, as well as the routes of the research vessels, may change year to year due to weather, ice cover conditions, *etc*. As an example, Fig. 1 shows the survey routs of the RV "Vilnius" and "Fridtjof Nansen" during the comprehensive research in 2016; it is clearly seen that the survey has covered most of the Barents Sea area.

Vessel research of marine mammals was carried out by the method developed in the Polar branch of VNIRO (Zyryanov, 2004).

For each cetacean species, summarized data on the mass fraction and occurrence is presented (Table 2). The species mass fraction (%) is taken as a ratio of the number of surveyed marine mammals of one species to the total number of cetaceans of other species. Occurrence (%) is the ratio of the number of sightings (observations) of one cetacean species to the sum of all sightings of other species. To calculate the occurrence and mass fraction of most cetacean species, we used the data of the vessel surveys of the Polar branch of VNIRO. For those species that were not sighted during the research or were registered only once, literature material was used.

[1]Regularly since 2012, within N69°–N76°, E30°–E52°.
[2]Regularly since 2008, within N69°–N74°, E20°–E45°.
[3]Regularly since 2004, within N69°–N82°, E35°–E75°.

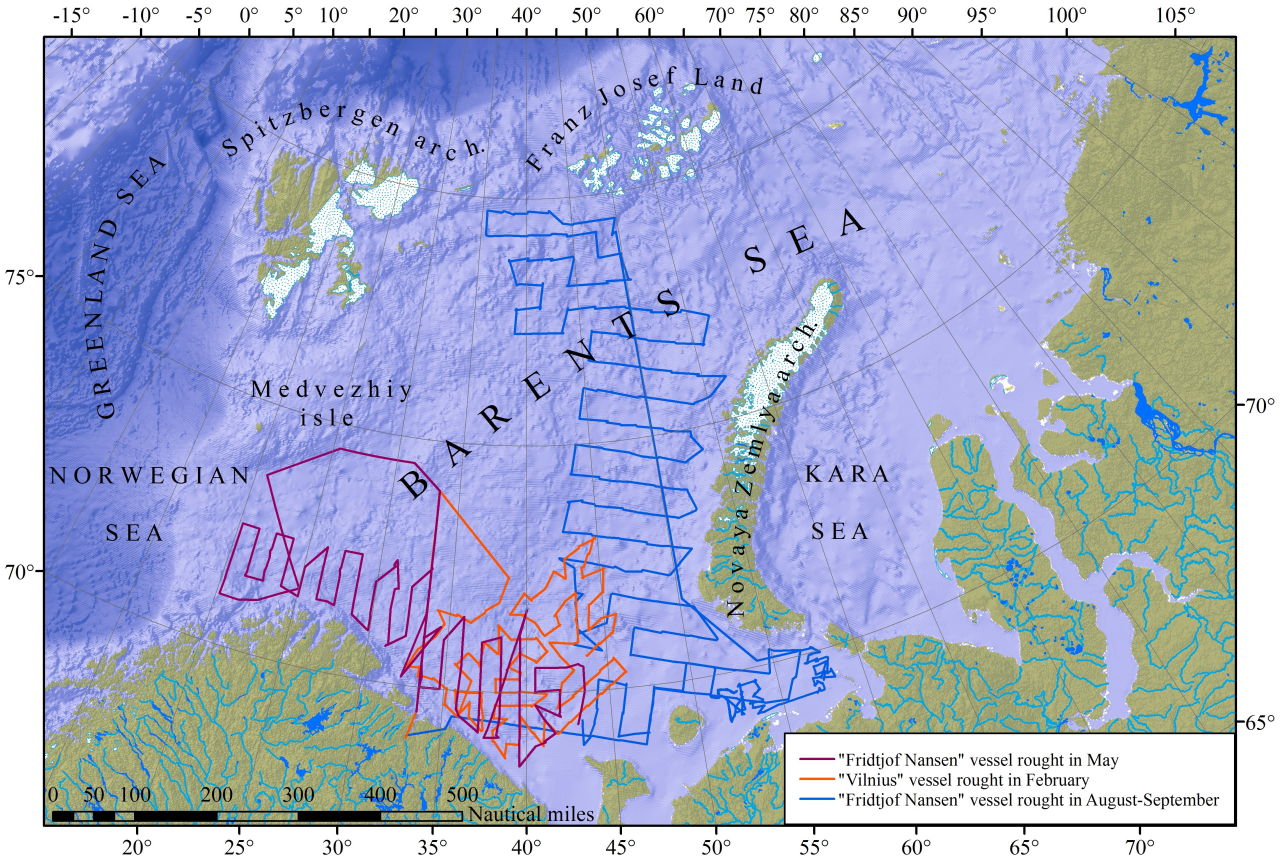

Fig. 1. Routes of the research vessels during the annual comprehensive surveys carried out by the Polar branch of VNIRO on the example of ecosystem surveys (2016)

RESULTS AND DISCUSSION

The Barents Sea cetacean fauna can be conditionally divided into three groups: permanent residents, seasonal migrants, and occasional visitors.

Permanent residents inhabit the sea area all year round. This group includes white-beaked dolphin, beluga whale, and harbor porpoise.

White-beaked dolphin is an inhabitant of the northern Atlantic Ocean; it occurs throughout all the Barents Sea (Fig. 2) and all year round. As a rule, it is distributed over the sea area in groups of 4–10 individuals. Sometimes, large pods are registered, up to several hundred individuals. Such sightings are related to dense aggregations of their main forage fish – capelin and Atlantic herring. The last time, a large pod (up to 500 individuals) was recorded in February 2018 at the Nordkinskaya Bank, in the southwestern sea area.

Considering the results of the vessel surveys over the past decade, we can say that white-beaked dolphin is the most abundant (82 %) and frequent (49 %) cetacean species (Table 2). According to our data, the total abundance of *L. albirostris* in the Barents Sea is about 50–60 thousand individuals (Klepikovsky et al., 2017), which corresponds to the Norwegian expert evaluation of previous years (Øien, 1993).

Beluga whale is a widespread species in the Arctic waters; it can be found in the Barents Sea all year round (Lukin & Ognetov, 2009). In total, not less than 20 isolated populations of this toothed whale are identified, with a total abundance up to 200 thousand individuals (Lowry et al., 2020).

Table 2. Species mass fraction and occurrence based on the vessel surveys of the Polar branch of VNIRO and literature material (2010–2019)

Species	Mass fraction, %	Occurrence, %
White-beaked dolphin *Lagenorhynchus albirostris*	82.18	49.14
Minke whale *Balaenoptera acutorostrata*	4.67	21.78
Fin whale *Balaenoptera physalus*	2.79	10.26
Humpback whale *Megaptera novaeangliae*	4.70	10.07
Harbor porpoise *Phocoena phocoena*	3.25	5.13
Killer whale *Orcinus orca*	0.79	1.18
Beluga whale *Delphinapterus leucas*	0.72	0.86
Sperm whale *Physeter catodon*	0.16	0.72
Bowhead whale *Balaena mysticetus*[1]	0.46	0.66
Northern bottlenose whale *Hyperoodon ampullatus*	0.13	0.13
Narwhal *Monodon monoceros*[2]	0.16	0.07

Note: [1] – based on the data of the Polar branch of VNIRO and literature material (Goryaev, 2017, 2019 ; Gavrilo & Ershov, 2010); [2] – based on literature material alone (Gavrilo & Ershov, 2010).

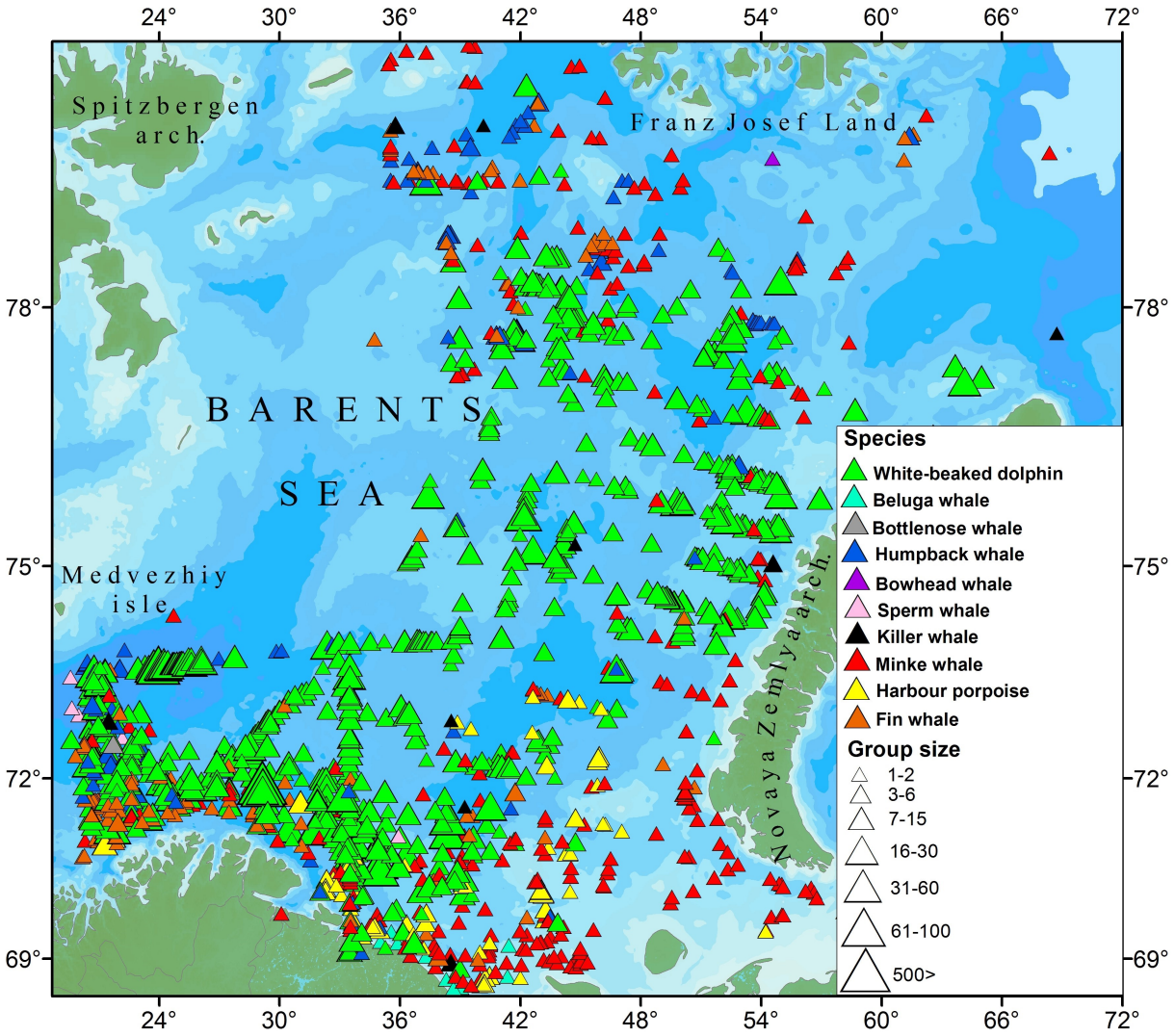

Fig. 2. Cetacean fauna of the Barents Sea based on the vessel surveys of the Polar branch of VNIRO (2010–2019)

The population structure of beluga whale inhabiting the western sector of the Russian Arctic is poorly studied, and the exact species abundance is not known (NAMMCO, 2018). According to some data, in summer in the Barents Sea there may be up to 10 thousand individuals (Kovacs et al., 2009), while in winter not more than 3–4 thousand remain (Matishov & Ognetov, 2006). During the surveys, beluga whales were mainly sighted in southeastern coastal areas (Fig. 1). *D. leucas* occurrence in relation to other cetaceans was less than 1 % (Table 2); however, despite a small number of surveyed animals over a long time period, the species cannot be classified as a rare one. The vessel surveys considered in this article were carried out mainly beyond the 12-mile zone, in open water; therefore, whales, that usually adhere to the coastline and ice edge (beluga whale, narwhal, and bowhead whale), were rare or nonexistent. Analyzing the data of coastal surveys carried out annually by the Polar branch of VNIRO, we can say that in the summer period beluga whale is quite common in southern and southeastern coastal areas of the Barents Sea. Its highest occurrence is observed during the migration period, April to July: beluga whale can be found in the areas adjacent to Franz Josef Land and Novaya Zemlya archipelagos, as well as in other areas (Kleinenberg et al., 1964).

Harbor porpoise is a typical species for coastal and southern Barents Sea areas. It has a small body size and a low dorsal fin; so, it can be sighted only under good weather conditions. The species prefers coastal waters and does not enter north of N76°; however, there is a recorded case of its occurrence beyond N80° (Gavrilo, 2008). According to the vessel surveys, harbor porpoise stays in the sea area February to October, which confirms the literature data on its year-round presence in the Barents Sea (Mlekopitayushchie Sovetskogo Soyuza, 1976 ; Kovacs et al., 2009). *P. phocoena* was mainly sighted in the southern sea areas, up to N74° (Fig. 2), where up to 15 individuals usually fed on Atlantic herring, capelin, and cods. According to 10-year survey data, the species mass fraction and occurrence were of 3 and 5 %, respectively (Table 2). According to annual surveys carried out by the Polar branch of VNIRO in the territorial waters, the highest occurrence of *P. phocoena* is observed in coastal sea areas, where in summer the animal is recorded along the entire Murmansk coast. The species abundance for the Barents Sea can be estimated at 11–12 thousand individuals (Klepikovsky et al., 2017 ; Kovacs et al., 2009).

Seasonal migrants arrive in the Barents Sea in the spring-summer period from the Atlantic for feeding (in autumn, they migrate in the opposite direction). This group includes most of the Barents Sea cetaceans. At this time, with varying degrees of probability, the following baleen and toothed whales can be sighted in the sea area: humpback whale, fin whale, bowhead whale, minke whale, sperm whale, northern bottlenose whale, killer whale, and narwhal.

Humpback whale is the most abundant baleen whale species, accounting for about 5 % of the total number of surveyed animals (Table 2). According to the vessel surveys, humpback whales are annually recorded in the Barents Sea May to October; however, according to satellite tagging data for the Svalbard archipelago area in 2018, some individuals may stay in the western sea areas at least until the end of December (Øien & Biuw, 2018). The highest number of the species sightings is registered in the southwestern and northern sea areas (Fig. 2): whales were recorded singly and in pairs, less often in groups of 3–14 individuals, in aggregations of capelin and macroplankton. The total abundance of *M. novaeangliae* in the North-East Atlantic waters during the feeding period is more than 10 thousand individuals (Leonard & Øien, 2019), and up to 1.5 thousand humpback whales may visit the Barents Sea (Klepikovsky et al., 2017).

Fin whale is a typical species for the Barents Sea. As shown by satellite tagging for the Svalbard archipelago area in autumn, most fin whales begin winter migration to warmer Atlantic waters in September-October; some whales may stay at high-latitude areas of the North-East Atlantic

for winter (Lydersen et al., 2020). During vessel surveys, whales were recorded May to October singly and in pairs, way less often in groups of 3–5 individuals. The species was most frequently registered in the southwestern and northern sea areas (Fig. 2), which are related to aggregations of Atlantic herring, capelin, and macroplankton – fin whale usual diet (Aguilar & García-Vernet, 2018). During the feeding period, more than 11 thousand herring whales are feeding in the North-East Atlantic (Leonard & Øien, 2019). According to our expert evaluation, not more than 1 thousand individuals visit the Barents Sea annually (Klepikovsky et al., 2017).

Bowhead whale is an endemic species in the Arctic and Subarctic seas; it is the only baleen whale that can be sighted in the Arctic all year round. Vessel surveys showed a low species occurrence; thus, in August 2010 in the northeastern Barents Sea, polar whales were sighted only once – 2 individuals (Fig. 2). Franz Josef Land archipelago area is the spot of the most regular sightings of bowhead whale of the Svalbard species population (Belikov, 1985 ; De Korte & Belikov, 1994), the abundance of which, according to various estimates, can range from 100 (Boertmann et al., 2015) to more than 340 individuals (Vacquié-Garcia et al., 2017). In 2010, a total of 20 individuals were recorded in western Franz Josef Land archipelago area during aerial surveys (Gavrilo & Ershov, 2010). Analyzing recent literature data, we can highlight the results of vessel surveys carried out by the Murmansk Marine Biological Institute in the spring-summer periods of 2016 and 2018, during which 11 and 2 polar whales, respectively, were registered at ice edge in the northeastern Barents Sea (Goryaev, 2017, 2019). Yu. I. Goryaev considers the sighting of this species to be due to more favorable ice conditions in these areas with an overall low level of ice cover in their habitats; moreover, the researcher hypothesizes about possible wintering of bowhead whales in the ice adjacent to the Novaya Zemlya archipelago (Goryaev, 2017). Satellite tagging in May – June 2017 west of the Svalbard archipelago area (the Fram Strait) showed that some polar whales in the summer months migrate for wintering to Franz Josef Land archipelago. They spend the winter months in close proximity to the archipelago; with spring onset, they migrate southward, up to N78° (Kovacs et al., 2020).

Minke whale is a widespread species; it can be sighted in all oceans and at almost all latitudes – from S70° to N80° (Cooke, 2018). According to survey results, it is the most frequently sighted baleen whale in the Barents Sea: species occurrence is about 22 % (Table 2). During the surveys, whales were recorded May to October, mostly singly, and over the entire sea area. In northern areas, most *B. acutorostrata* occurrences were registered in aggregations of capelin and juvenile Arctic cod; in southern areas – in aggregations of Atlantic herring, juvenile cods (*Melanogrammus aeglefinus* and *Gadus morhua*), *etc.*; and in southeastern areas – in aggregations of Arctic cod, Atlantic herring, and sand lance *Ammodytes tobianus*. According to various estimates, the total abundance of minke whale arriving for feeding in the Barents, Norwegian, and North seas can range from 81 thousand individuals (Bøthun et al., 2009) to 90 thousand (Solvang et al., 2015); based on our data, not more than 10–13 thousand minke whales may visit the Barents Sea (Klepikovsky et al., 2017).

Sperm whale can be classified as an uncommon species (Table 2) with a local distribution. The animal was mainly sighted in the southwestern sea areas (northeastern Kopytov water area and the southern slope of the Medvezhinskaya Bank) (Fig. 2), where it was feeding on cephalopods and some demersal fish species. It is worth noting that sperm whales are more and more often recorded by Norwegian colleagues in the western Barents Sea in autumn during joint Russian-Norwegian ecosystem surveys (Survey Report, 2020). However, the main feeding spots are in the deep water in the southeastern Norwegian Sea, in particular in the Bleik Canyon area, near the Lofoten Islands, where dozens of individuals feed

in summer and autumn (Rødland & Bjørge, 2015). According to research data of 2014–2018 (Leonard & Øien, 2019), up to 6 thousand sperm whales may visit the Norwegian Sea and adjacent water areas annually.

Northern bottlenose whale has recently been sighted rarely. In 2010–2019, only two sightings, with a total of 10 individuals, were recorded in the southwestern Barents Sea (Fig. 2), while in 1990–1993, 10 sightings of northern bottlenose whale were registered (Boiko, 2000). There is a known case of a dead whale found on the Rybachy Peninsula coastline in 2012; the animal was subsequently classified by specialists of the Polar branch of VNIRO. The main occurrence areas of this toothed whale are west of E16°, in the deep water (the western slope of the Medvezhinskaya Bank and western Kopytov water area), where northern bottlenose whales sometimes feed together with sperm whales on aggregations of halibut and squid (according to data from Russian fishing vessels). The total abundance of this toothed whale visiting the North-East Atlantic may account for about 8 thousand individuals (Leonard & Øien, 2019); the exact abundance of northern bottlenose whales in the Barents Sea is unknown.

Killer whale is a common, not numerous species; during the surveys, it was widely distributed over the Barents Sea area (Fig. 2). Whales were sighted both singly and in groups of 2–6 individuals; the occurrence of the species compared to other cetaceans was slightly higher than 1 % (Table 2). At the end of February 2019, a group of 8 killer whales was sighted by Murmansk fishermen off the Kola Peninsula coast; it is likely to be due to the availability of their favorite feed object – Atlantic herring *Clupea harengus* (following it, killer whales annually migrate from the East Atlantic). In the spring-summer period, the visits of killer whale to the Barents Sea may also be related to harp seal *Pagophilus groenlandicus* arriving from the White Sea Throat and beginning summer migration. Thus, in 2003, killer whales were recorded in spots of harp seal aggregations (Mishin, 2004). The total abundance of *O. orca* visiting the North-East Atlantic can be estimated at 15 thousand individuals (Leonard & Øien, 2019).

Narwhal inhabiting the western sector of the Russian Arctic is likely to belong to the Svalbard species population (Hobbs et al., 2019). Data on narwhal occurrence in the Barents Sea come mainly from annual monitoring cruises and tour cruises carried out by the Russian Arctic National Park. All sightings of this species in Russian waters are recorded in hard-to-reach areas of Franz Josef Land archipelago and are confined to ice edge. Narwhals sometimes visit the deep-water Cambridge Channel, *inter alia* the Dezhnev Bay off the southeastern Zemlya Aleksandry Island (Timoshenko, 2006). In September 2009, a dozen narwhals were sighted in the Topographs Bay in aggregations of Arctic cod (Gavrilo & Ershov, 2010). The lack of sightings of these whales during the vessel surveys, as well as scarce literature data on their occurrence, make it possible to classify narwhal as a rare species with a local distribution. The abundance of whales inhabiting the Svalbard archipelago areas may be more than 800 individuals (Vacquié-Garcia et al., 2017).

Occasional visitors are predominantly thermophilic species not typical for the Barents Sea; their rare visits could result from a deeper penetration of warm Atlantic waters and a wide distribution of food resources.

Blue whale is periodically sighted in small numbers by Norwegian colleagues in the deep water in the northern and western edges of the Svalbard archipelago in aggregations of krill (Survey Report, 2019). The proximity of whale occurrence areas to the Barents Sea, the conditional boundaries of which in northwestern area lie at the Leigh-Smith Cape on the Nordaustlandet Island (Svalbard archipelago) (Dobrovolskii & Zalogin, 1982), allows suggesting possible single visits of blue whales to the northwestern sea areas.

Atlantic white-sided dolphin, unlike white-beaked dolphin, prefers warmer waters of the Atlantic Ocean; so, it is an occasional visitor in the Barents Sea. Nevertheless, as literature data show, rare visits of Atlantic white-sided dolphin to the western sea areas are possible (Survey Report, 2017 ; Goryaev, 2017).

Short-beaked common dolphin is a fairly abundant species in the North-East Atlantic, and its distribution to the northeast is limited by the waters of Norway western coast and by N70° (Murphy et al., 2013). However, the study of video footage, made by the search and rescue team of the Ministry of Emergency Situations of Russia in the Kola Bay in the summer 2018, allows suggesting possible rare visits of short-beaked common dolphin to the southern Barents Sea.

Sei whale is the most thermophilic baleen whale species; as a rule, it inhabits warmer Atlantic waters. In the first half of the XX century, it was widely distributed over the Barents Sea, reaching Murmansk coast (Boiko, 2000). Currently, due to low abundance, it is practically not observed. The only sighting of this whale over the past decade was recorded in August 2015 by Norwegian colleagues during a joint Russian-Norwegian ecosystem survey (Complete Report, 2016).

Long-finned pilot whale is one of the most common cetacean species in the North-East Atlantic, with the main occurrence areas being confined to Greenland and Iceland waters (Pike et al., 2019). Sometimes, it visits the eastern Norwegian Sea (Nøttestad et al., 2015) – an area, which seems to be the border of the species range. Over the past decade, there is only one record of long-finned pilot whale sighting in the Barents Sea (Complete Report, 2016), which was most likely occasional.

Thus, taking into account the results of vessel surveys, as well as some literature data, we may conclude the possible presence in the Barents Sea of up to 16 cetacean species of 7 families: Balaenidae, Balaenopteridae, Delphinidae, Monodontidae, Phocoenidae, Physeteridae, and Hyperoodontidae.

The current cetacean composition and some peculiarities of the residence of baleen and toothed whales in the Barents Sea are presented in Table 3.

Since the beginning of the XX century, the Barents Sea cetacean fauna has undergone changes both in species composition (varying 14 to 18 species) and population abundance. The lowest biodiversity of cetaceans was recorded at the beginning of the last century (Tomilin, 1975). However, at that time, there was no information on the sightings of short-beaked common dolphin and long-finned pilot whale, whose visits to the southwestern sea areas were, nevertheless, possible, as was pointed out by K. M. Kovach et al. (2009) as well. At the same time, the fauna proposed by Norwegian colleagues does not include sei whale. It should be noted that for the entire survey period (2010–2019), we have registered neither long-finned pilot whale nor sei whale; however, in view of some literature data, possibility of rare visits of these species to the western sea areas can be assumed. The highest species diversity of cetaceans was recorded in the middle of the XX century (Atlas, 1980): at that time, North Atlantic right whale, blue whale, and bottlenose dolphin inhabited the Barents Sea; currently, they do not occur in this area. Moreover, several species of marine mammals, in particular bowhead whale, sei whale, long-finned pilot whale, and narwhal, were characterized by a wide distribution over the sea area, but the most abundant and frequently sighted species at present, white-beaked dolphin, was of a limited distribution. Later, sightings of several thermophilic species (bottlenose dolphin, long-finned pilot whale, and sei whale) in the Barents Sea were confirmed in the works of V. N. Svetochev et al. (2003) and V. L. Mishin (2004), with blue whale sightings being also mentioned. The most up-to-date information on the Barents Sea cetaceans is given in the Atlas of Marine Mammals of the Russian Arctic and the Far East (2017), which describes 16 species for the Barents Sea; our data correlate well with the results published in the Atlas.

Table 3. Cetacean fauna composition and some peculiarities of their residence in the Barents Sea (based on the vessel surveys of the Polar branch of VNIRO and literature sources of 2010–2019)

Species	Status of species / frequency of occurrence / type of distribution	The most likely sighting areas
Toothed whales (Odontoceti)		
White-beaked dolphin	PR / abundant / widespread	Everywhere
Atlantic white-sided dolphin	OV	Western areas
Harbor porpoise	PR / abundant / local	Coastal areas of the Kola Peninsula, southern areas
Short-beaked common dolphin	OV	Southwestern areas
Killer whale	SM / common / widespread	Everywhere, up to ice edge
Beluga whale	PO / common / local	Coastal areas of the Kola Peninsula (southern and southeasten areas)
Narwhal	SM / rare / local	Franz Josef Land archipelago (ice edge)
Sperm whale	SM / uncommon / local	Southwestern area (deep water), Bear Island
Northern bottlenose whale	SM / rare / local	Southwestern area (deep water), Bear Island
Long-finned pilot whale	OV	Western areas
Baleen whales (Mysticeti)		
Fin whale	SM / abundant / widespread	Everywhere
Humpback whale	SM / abundant / widespread	Everywhere
Blue whale	OV	Northwestern area, Nordaustlandet Island
Minke whale	SM / abundant / widespread	Everywhere
Bowhead whale	SM / uncommon / local	Northeastern area: Franz Josef Land archipelago and Novaya Zemlya archipelago (ice edge)
Sei whale	OV	Western areas

Note. Species by the type of residence: PR – permanent resident; SM – seasonal migrant; OV – occasional visitor, cetacean species, which does not inhabit the Barents Sea permanently in any season (is not typical for this water area). Species by the frequency of occurrence: abundant – is regularly observed during vessel surveys; common – is registered periodically, with the frequency of occurrence of 1–5 %; uncommon – is recorded sometimes in the Barents Sea, with the frequency of occurrence of 0.2–0.9 %; rare – single observations, with the frequency of occurrence less than 0.2 %.

We assume that up to 16 species of baleen and toothed whales can be currently sighted in the Barents Sea. However, it should be noted that only 11 species can be classified as typical ones for the area – except for Atlantic white-sided dolphin, short-beaked common dolphin, long-finned pilot whale, and sei whale (more thermophilic species, whose range is currently bounded by the eastern Norwegian Sea), as well as blue whale (at high latitudes, it occurs in the Arctic Ocean). Long-term surveys have shown that the highest occurrence of marine mammals is usually recorded in the spring-summer period, when conditions in the Barents Sea are the most favorable and a wide distribution of their food resources is observed.

Thus, comparison of retrospective materials with the data of current studies shows certain changes in the ranges of several cetacean species. These changes are likely to result from a decrease in the population abundance of baleen and toothed whales due to whaling in 1910–1972; this is indicated by the literature material (Mikhalev, 2009). According to official data alone, more than 220 thousand whales and dolphins were hunted in the northern Atlantic Ocean during that period, *inter alia* sei whales, blue whales, and long-finned pilot whales (Ivashin et al., 1972). The second reason for the ongoing changes in the ranges of marine mammals seems to be associated with climatic factors, which largely determine both seasonal and long-term distribution of cetaceans, as well as their migrations. Studies conducted by Australian scientists using the Model of Intermediate Complexity for Ecosystem assessments (MICE) have shown a significant decrease by the end of the XXI century in the abundance of blue whales, fin whales, and southern right whales of the Pacific population, as well as fin whales and humpback whales inhabiting Southern Atlantic and the Indian Ocean (Tulloch et al., 2019). The authors of the article associate the predicted decrease in the abundance of baleen whales with a reduction of krill *Euphausia superba* biomass due to global warming. The subsequent progressive interspecific competition of baleen whales for food resources may lead to changes in the migration routes of cetaceans and in their food spectrum.

As known, fluctuations in the Arctic water temperature, observed with some periodicity (Sherstyukov, 2016), as well as changes in the Barents Sea hydrological regime, directly affect both distribution of cetacean food recourses and its quantitative and qualitative composition (Boitsov et al., 2005 ; Bochkov, 2005 ; Prokopchuk & Trofimov, 2019). The occurrence of thermophilic marine mammals in the Barents Sea, which are not typical for the area, can be explained by the formation in a certain time period of more favorable oceanographic conditions for their habitation and a wide distribution of food resources.

As we can see, the Barents Sea cetacean fauna composition can vary over time. Annual vessel surveys of marine mammals, carried out by the Polar branch of VNIRO and covering most of the Barents Sea area, allow not only monitoring the state of cetacean populations, the key link in the ecosystem of seas and oceans, but also predicting their development trends. This is of great importance in the context of ongoing climatic changes and active hydrocarbon exploration in the World Ocean.

Conclusions:

1. Over the last century, the Barents Sea cetacean fauna has undergone certain changes, varying 14 to 18 species. Vessel surveys carried out in 2010–2019 and analysis of literature material made it possible to identify 16 species of baleen and toothed whales of 7 families, of which only 11 can be classified as typical species for the sea area. The changes in the abundance and species composition of baleen and toothed whales are likely to be related to both active whaling in 1910–1972 and periodically changing oceanographic conditions in the Barents Sea, which directly affect the distribution of food resources of cetaceans.

2. The distribution of cetaceans was studied, and the most probable areas of baleen and toothed whale sighting were determined. By the frequency of occurrence, all cetaceans were divided into four groups: abundant, common, uncommon, and rare species.
3. The abundance of most cetacean species was estimated, and the status of baleen and toothed whales in the Barents Sea was determined. As established, white-beaked dolphin, beluga whale, and harbor porpoise can be sighted in the Barents Sea all year round.
4. White-beaked dolphin was determined as the most abundant and widespread species: it accounts for 82 % of the total number of surveyed animals and 49 % of all cetacean sightings.

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КИТООБРАЗНЫЕ БАРЕНЦЕВА МОРЯ: ФАУНА И СОСТОЯНИЕ ПОПУЛЯЦИЙ В НАЧАЛЕ XXI ВЕКА

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Комплексные научно-исследовательские работы, ежегодно проводимые Полярным филиалом ВНИРО (ПИНРО имени Н. М. Книповича) в Баренцевом море, позволяют получать актуальную информацию о распределении и встречаемости морских млекопитающих, в частности китообразных, которые являются важнейшим звеном в экосистеме Мирового океана. В последние годы необходимость проведения мониторинга морских млекопитающих приобретает всё бóльшую актуальность в связи с изменением климата и повышением температуры морей и океанов, что может привести к смещению ареалов и даже к возможному исчезновению тех или иных видов. В настоящей работе обобщены результаты судовых учётов китообразных, выполненных Полярным филиалом ВНИРО в Баренцевом море в 2010–2019 гг., а также приведены ретроспективные данные по фауне усатых (Mysticeti) и зубатых (Odontoceti) китов. На основе материалов судовых исследований и с учётом сведений из литературных источников определён современный состав китообразных Баренцева моря, который в начале XXI века может быть представлен 16 видами китообразных из 7 семейств. Анализ материалов судовых учётов позволил определить статус пребывания морских млекопитающих в акватории моря и выявить частоту их встречаемости. Приведена численность популяций большинства видов усатых и зубатых китов, указаны наиболее вероятные места их встреч. По данным исследований, самым массовым, часто и круглогодично встречающимся видом определён беломордый дельфин *Lagenorhynchus albirostris*: на его долю приходится более 80 % от общего количества учтённых морских млекопитающих и около 50 %

от всех встреченных китообразных. К постоянно присутствующим в акватории моря видам также отнесены белуха *Delphinapterus leucas* и обыкновенная морская свинья *Phocoena phocoena*, места́ локализации которых приурочены преимущественно к прибрежной зоне Кольского полуострова. С мая по октябрь в акватории Баренцева моря регулярно встречаются виды, прибывающие сюда для нагула из других районов Атлантики, — малый полосатик *Balaenoptera acutorostrata*, финвал *Balaenoptera physalus* и горбач *Megaptera novaeangliae*. Крайне редко в западном секторе Российской Арктики можно увидеть нарвала *Monodon monoceros* и высоколобого бутылконоса *Hyperoodon ampullatus*.

Ключевые слова: морские млекопитающие, китообразные, Cetacea, судовые учёты, распределение, встречаемость, численность, Баренцево море