

PRESENT STATUS OF RAZORBILLS *ALCA TORDA* IN RUSSIA: OCCURRENCE, POPULATION AND MIGRATIONS

ALEXANDER E. CHERENKOV¹, SERGEI A. KOUZOV², VLADIMIR Y. SEMASHKO³,
GRIGORI M. TERTITSKI⁴ & EVGENY V. SEMASHKO⁵

¹Lomonosov Moscow State University, Solovetskiy Branch of White Sea Biological Station, Zaozernaya str. 17-1-6, Solovetskiy, Arkhangelsk district, 164409, Russia

²Faculty of Biology and Soil Science, St. Petersburg State University, Universitetskaya 7/9, St. Petersburg, 199034, Russia

³Field Educational Centre "Ecosystem", Petrozavodskaya str. 28-3-115, Moscow, Russia

⁴Institute of Geography of the Russian Academy of Sciences, 29, Staromonetny, Moscow, 119017, Russia (tertitski@igras.ru)

⁵Festivalnaya str. 22-8-110, Moscow, Russia

Received 13 March 2016, accepted 18 May 2016

SUMMARY

CHERENKOV, A.E., KOUZOV, S.A., SEMASHKO, V.Y., TERTITSKI, G.M. & SEMASHKO, E.V. 2016. Present status of Razorbills *Alca torda* in Russia: occurrence, population and migrations. *Marine Ornithology* 44: 207–213.

Within the boundaries of Russia, Razorbills *Alca torda* breed on islands along the northeastern coast of the Kola Peninsula, on islands in the Kandalaksha and Onega bays in the White Sea, and, since the early 1990s, along the Russian coast of the Gulf of Finland. Currently, among these sites, 4000–4300 breeding pairs occur, or 6% of the total number of the *A. t. torda* subspecies. Over 80% of the Russian Razorbill population breeds on islands in Onega Bay, where the species' population has been increasing during the last 20 years. Data from ringing indicate that Razorbills breeding on islands in the Barents and White seas have wintering sites along the coasts of Norway, Denmark and Great Britain, indicating possible exchange among these breeding populations.

Key words: *Alca torda*, Barents Sea, Gulf of Finland, migrations, population overlap, Razorbill, White Sea

INTRODUCTION

Two subspecies of Razorbills are currently recognized: *Alca torda torda* and *A. t. islandica* (Vaurie 1965, Cramp 1985, Dickinson & Remsen 2013), and the eastern boundary of the range for *A. t. torda* lies within Russian territory (Fig. 1). The total population of that subspecies is estimated at 187 000–207 000 individuals or 62 000–70 000 pairs, a number that is increasing everywhere except in Norway and Greenland, where the dynamics are not

clear (Hentati-Sundberg 2011, Herrmann *et al.* 2013, Cherenkov *et al.* 2014, Barret *et al.* 2006). The most significant growth of the population (on the average, 3.4% yr⁻¹) has been recorded in Finland (Hario & Rintala 2014).

In the Barents Sea within the boundaries of Russia (Fig. 2), Razorbill breeding locations are found on islands along the northeastern coast of the Kola Peninsula as far east as Dvorovaya Guba Bay, and probably on the southern island of the Novaya



Fig. 1. Locations in northwestern Russia of areas shown in Figures 2, 3 and 4.

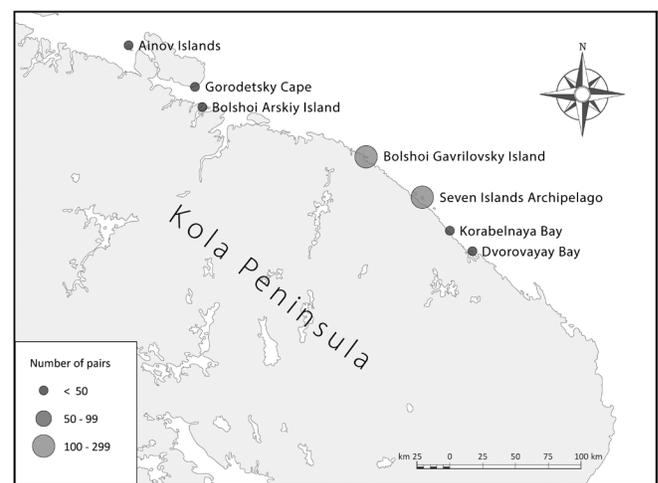


Fig. 2. Razorbill colonies on the northern (Barents Sea) coast of the Kola Peninsula; dot size indicates size of colony (see key on figure).

Zemlya Archipelago (Tatarinkova & Golovkin 1990, Krasnov *et al.* 1995, Strøm *et al.* 1995, Tertitski *et al.* 2000, Kalyakin 2001). In the White Sea (Fig. 3), Razorbills breed on islands in Kandalaksha and Onega bays (Bianki 1967, Cherenkov *et al.* 2014). Razorbill colonies have been present in the Russian part of the Gulf of Finland, on the Bolshoi Fiskar and Virgins archipelagos, since the early 1990s (Fig. 4). Whether Razorbills were breeding in the region earlier has remained unproven owing to insufficient ornithological observations between 1940 and 1987. In the first half of the 20th century, Finnish authors drew the eastern limit of the species' range along the present-day Russian-Finnish boundary (Suomalainen 1937). Estonian ornithologists who performed studies in the southern sector of the Gulf of Finland in the early 1970s did not find them on the islands off the Kurgalsky Peninsula or on other islands of the region (Renno 1976); in May 1962, however, an adult bird ringed in Finland was caught near Bolshoi Fiskar Island, Kola Peninsula, Barents Sea.

It is still unclear what the species' status is on Lake Ladoga. All of the authors who have written about Razorbills breeding on the lake (Paatela 1947, Neufeldt 1958, Koskimies 1979, Malchevsky & Pukinsky, 1983) have referred to the papers by I. Hilden (1921a, b). The latter reported (based on interviews with local people) that the Razorbill was a common breeding species occurring in abundance on Yalayansari (Jalajansaari) Island. Later publications lack data on the bird breeding on the islands in Lake Ladoga (Malchevsky & Pukinsky 1983, Zimin *et al.* 1993, Medvedev & Sazonov 1994, Mikhaleva & Birina 1997, Boyarinova & Kavokin 1998). Equally absent are data on migrant and vagrant individuals in this region.

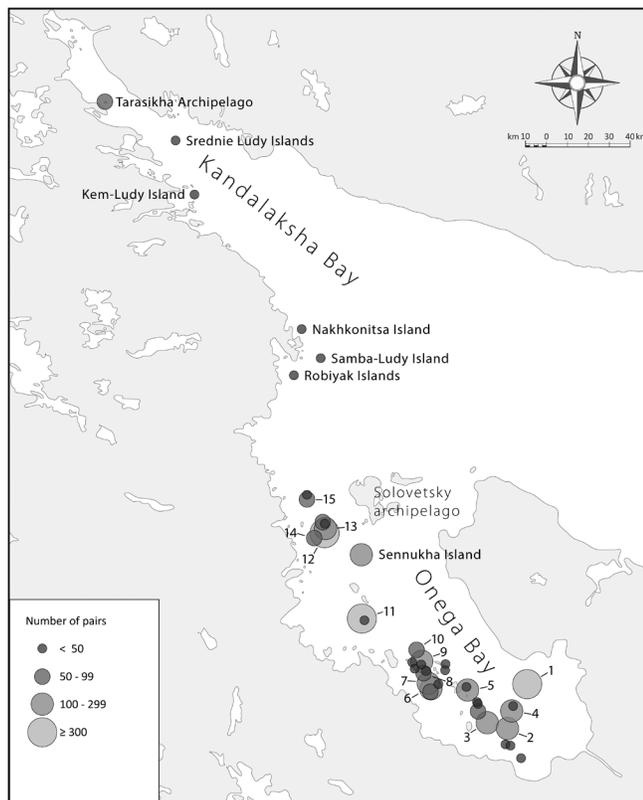


Fig. 3. Razorbill colonies on White Sea islands; dot size indicates size of colony (see key on figure). Numbers on the map correspond to those in Table 1.

MATERIALS AND METHODS

When visiting islands in the Onega Bay, we counted or estimated the number of Razorbills, both on the water and in aerial flocks circling above the colony. To obtain the number of nesting pairs, the total number of recorded birds was multiplied by a coefficient of 0.67 (Walsh *et al.* 1995). Surveys were carried out in the last 10 days of June or in the first 5 days of July. On Malaya Sennukha Island, observations were performed yearly (except 1993 and 1998), while other colonies were surveyed every 3–5 years (Table 1). In addition to our own materials obtained in 1988–2015, we used data acquired by V.V. Bianki (1963, unpubl. data) in the early 1960s. About 460 islands altogether have been surveyed in the Onega Bay (not counting the Solovetski Islands), 63 of which were regular Razorbill breeding localities.

Data were collected as a part of studies of waterfowl breeding populations and migrations in the Gulf of Finland as follows: during 1990–1999 and 2005–2015 on the Kurgalsky Peninsula and on small islands off its coasts; and in 2010–2015 on Bolshoi and Maly Fiskars islands, and in archipelagos Dolgiy Rif and Dolgiy Kamen', Ryabinnik, Gogland, and Sommers. Some islands were surveyed in 2012–2015, including Nerva, Bolshoi and Maly Tuters, Seskar, Moshchny (Lavansaari), Maly (Peninsaari), Vigrund, Northern and Southern Virgins (Viirit) and Rodsher islands. The islands known as breeding areas were examined from the third week of May to the beginning of June, from the third week of June to early July, and again in the third week of July. Surveys included a complete search for nests and nestlings on islands and counts of adult birds on the water. If no eggs or nestlings could be found (for example, in a deep and narrow crevice between rocks), bird presence was established by droppings and feathers at the hole entrance. In addition, 23 sea counts were performed from vessels in the eastern part of the Gulf in 2010–2015, from the beginning of May to the third week of November. Finally, we analyzed most of the published data as well as records of the expeditions of 1991–1992, 1994–1995 and 2005–2006 in the archives of the Laboratory of Ecology and Protection of Birds, St. Petersburg State University.

Data on Razorbill numbers and distribution among the islands of the Barents Sea and the Kandalaksha Bay of the White Sea

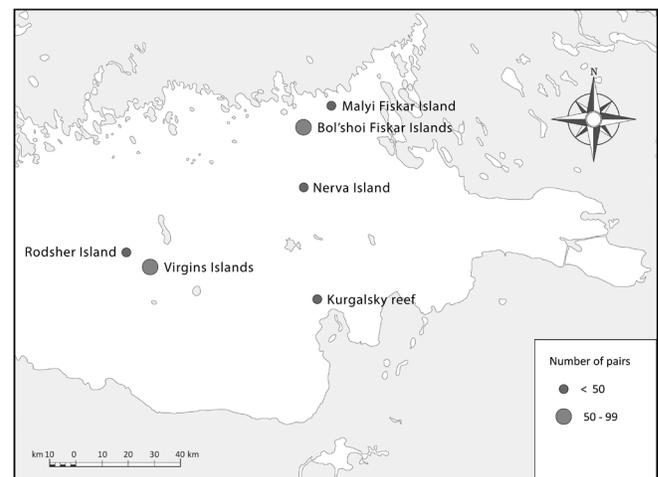


Fig. 4. Razorbill colonies on islands in the Russian portion of the Gulf of Finland; dot size indicates size of colony (see key on figure).

are taken from published papers. Information on recovered rings (110 recoveries), provided by the Bird Ringing Centre of Russia, is included in our analysis.

RESULTS

Population numbers and dynamics

The size of the Razorbill population in the Barents Sea (within the boundaries of Russia) is estimated at 300–350 pairs. At the Seven Islands archipelago, 347 pairs were recorded in 1929, 250 pairs in 1960 (Gerasimova 1962), only 76 pairs in 1991 (Krasnov *et al.* 1995), and 176 pairs in 2008 (Melnikov & Osadchii 2009). Ainov Islands, near the northernmost coast of Scandinavia, were inhabited by 35 pairs in the early 1960s; the population was reduced to three to eight pairs in 1960–1980 (Tatarinkova 1990), and no breeding pairs were recorded in 1998 and 2002 (Tatarinkova & Chemyakin 1999, Ivanenko 2007). On the Gavrilovsky Islands, the total Razorbill population was 25 pairs in 1960 (Gerasimova 1962) and 172 pairs in 1998 (Paneva 1999). A few tens of pairs were recorded nesting on Bolshoi Arskiy Island, Gorodetsky Point, in the Korabel'naya Guba and Dvorovaya Guba bays (Tertitski *et al.* 2000).

In Kandalaksha Bay of the White Sea, there were 25 breeding pairs recorded on Srednie Ludy Island and 50 pairs on Zayachyi Ludy (the Tarasikha archipelago) (Bianki 1967); 27 pairs were observed on Srednie Ludy in 1992 (Koryakin *et al.* 2000), and 66 pairs were recorded on the Tarasikha archipelago in 1998 (Shklyarevich 1999). In 2006, 80 pairs were found on the islands off the Karelia coast between the Kandalaksha and Onega bays (Fig. 3).

In Onega Bay of the White Sea, the breeding areas are concentrated in the southern portion, from the Borshovtsy Islands to Pur-Luda and Nyapa; they also occur among islands farther off, in the Kem Skerries islands group (where one of the largest colonies included 650 pairs); other breeding colonies are known in the bay center, on Salma-Ludy and Sennukha islands. The colonies are long-lived; some have been known for >100 years, for example, those described by I.K. Tarnani (1892) on Sennukha Islands (he erroneously called these the Top Islands) and on Sredniy Martyan Island (in all probability, Sredniy Island in Kem Skerries). Information about Razorbill nesting on the Solovetski Islands (Dementyev 1951, Kozlova 1957), however, appears to be erroneous. The species has not been recorded breeding there during the last 30 years of continuous observations and surveys of these islands (Cherenkov *et al.* 2014).

In the early 1960s, the Razorbill population in Onega Bay was estimated at 1600 pairs (Bianki 1963, 1967). In 1991–1999 we counted about 2650 pairs, and the total number (taking into consideration unexplored islands) was estimated at about 2750 pairs. As recent records show, the population is growing and has reached about 3600 pairs at present. A comparison of data for particular islands shows distinct population growth during recent decades, the birds' numbers having increased more than twofold since the 1960s. Although the number of breeding birds in individual colonies (in the larger ones, in particular) has grown markedly, it is noteworthy that the number of colonies has not changed (Table 1, Fig. 5).

In the east of the Gulf of Finland, Razorbills are concentrated on Bolshoi Fiskar and Virgins archipelagos and on Rodsher Island

TABLE 1
Changes in Razorbill population in the largest colonies in Onega Bay, the White Sea

Number	Islands	Years															
		1960s ^a	1988	1990	1991	1992	1993	1995	1997	1998	1999	2002	2004	2005	2006	2007	2010–2013
1	Pur-Luda	175	ND	ND	ND	ND	180	ND	ND	ND	180	ND	ND	ND	550	750	500
2	Nyapa	70	ND	ND	ND	30	ND	ND	ND	ND	90	ND	ND	ND	ND	ND	125
3	Morzhenets	90	ND	ND	ND	ND	150	ND	ND	ND	280	ND	ND	80	180	100	250
4	Tonkaya Osinka	20	ND	ND	ND	70	90	ND	ND	ND	110	ND	100	70	80	95	180
5	Prokhod	60	ND	ND	ND	65	ND	ND	ND	ND	75	ND	170	100	50	115	160
6	Sredniy Kivrei	60	ND	ND	ND	ND	120	ND	ND	ND	125	ND	120	ND	ND	ND	ND
7	Ploskiy Kivrei	80	ND	ND	140	ND											
8	Yatko-Ludy	50	ND	ND	135	ND	ND	ND	ND	ND	165	ND	ND	ND	ND	58	>70
9	Golomyannaya Stepanova	40	ND	ND	ND	240	ND	ND	ND	ND	150	ND	ND	ND	ND	ND	>150
10	Sennaya Luda	30	ND	ND	65	80	60	ND	ND	ND	70	ND	100	50	ND	35	70
11	Salma-Ludy	99	ND	ND	ND	90	180	ND	ND	250	ND	155	320	170	345	200	400
12	Verkhniy	>100	ND	300	350	ND	ND	410	350	ND	500	ND	ND	650	ND	ND	700 ^b
13	Sredniy	ND	40	ND	ND	ND	ND	ND	100	ND	ND	ND	ND	110	ND	ND	110 ^b
14	Severnaya Tupichikha	ND	80	ND	80	ND	ND	ND	90	ND	75	ND	ND	105	ND	ND	85 ^b
15	Ryavo-Luda	ND	ND	ND	ND	ND	130	160	ND	ND	ND	ND	60	70	200	85	ND

ND = no data.

^a Bianki 1963; Bianki *et al.* 2006, unpublished data by V.V. Bianki.

^b Counts 2013.

(more than 95% of the total population) (Table 2). Those islands are situated in the deeper parts of the Gulf (Fig. 4). The first Razorbill breeding area found was on Remisaar Island on the Kurgalsky Reef, with eight to 10 pairs nesting there yearly in 1988–1990 (Bubyreva *et al.* 1993). Five nesting pairs were recorded on the Virgins Archipelagoes in 1991 (Noskov *et al.* 1993). In 1995, 14 nests were found in the Bolshoi Fiskar Archipelago (Iovchenko *et al.* 2004), and three more were found on Vigrund Island. In 2010, 54 nests were found on Rodsher Island. This chronology seems to be related to the dates the islands were first surveyed, rather than to the process of the species’ dispersal. As an example of actual dispersal, three nests were found on Maly Fiskar Island in 2005 and one nest was found on Nerva Island in 2012, both locations where previous surveys had not found any Razorbills.

Except for Remisaar Island on the Kurgalsky Reef, where the Razorbill stopped breeding after 1996 (Mandryka *et al.* 2013), the colonies on the remaining islands have persisted to the present day (Table 2). The temporary disappearance of breeding birds from Yuzhny Virgin and Rodsher islands in 2012 (Table 2) may be attributed to foxes *Vulpes* sp., which reached the islands across the frozen bay. The breeding bird population was restored soon after the foxes disappeared, which suggests a sizeable reserve of birds in the population.

Razorbill population dynamics reveal a long-term growing trend, despite noticeable interannual fluctuations (Kouzov *et al.* 2013). A short-term extrapolation of the data suggests 90–100 pairs nesting in the east of the Gulf of Finland in 1995, 120–170 pairs in 2010–2012 and 150–210 pairs in 2013–2015. These estimates are lower than those by other authors: 150 pairs in 1995–1996 (Iovchenko *et al.* 2004) and 200 pairs in 2010–2012 (Vysotskiy & Verevkin, 2013).

To summarize population trends, results of the Razorbill surveys within Russian territory showed population growth on islands in the Gulf of Finland of the Baltic Sea and in the Onega Bay in the White Sea. On the islands in Kandalaksha Bay (White Sea), however, as well as on the Murman coast of the Barents Sea, the population size remained steady throughout the entire observation period (Table 3).

However, on the Murman coast we observed a redistribution of the population, with growth in the east and decrease in the west.

Migrations

Razorbills usually arrive at the Eastern Murman Islands at the end of April (Belopolski 1957). After the young birds go to sea in the autumn, migration begins immediately, with the Razorbills moving gradually towards wintering areas. Based on recovered ringed birds, the main wintering region for Razorbills that nest on islands off the Kola Peninsula is along the coast of Norway. Of 17 Razorbills ringed in the Barents Sea, 14 were found during the non-nesting period in Norway, two in Denmark and one in Germany.

We have no precise data on the timing of Razorbill arrival in the White Sea colonies, as the latter are practically inaccessible in spring. In Kandalaksha Bay, the Razorbill appears at the nesting places in the second week of May at the latest (Biarki 1967). Their arrival in Onega Bay usually falls on the first half of May, as indicated by the initiation of egg laying. In all probability, bird appearance on particular islands depends on local ice conditions. At present, as indicated by the peak of hatching, the majority of birds breeding in the colonies of Onega Bay should depart on their

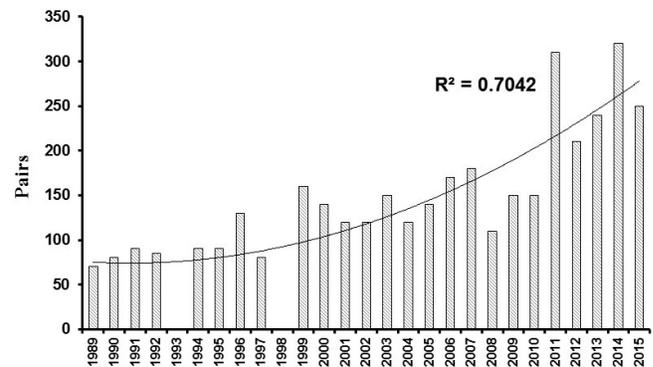


Fig. 5. Changing population of Razorbills on Little Sennukha Island (Onega Bay, White Sea).

TABLE 2
Counts of Razorbill nests in the eastern part of the Gulf of Finland

Island	Years													
	1988–1990	1991–1992	1993	1994	1995	1996	2005	2006	2010	2011	2012	2013	2014	2015
Kurgalsky Reef	8–10	6–7	6	3	5	1	0	0	0	0	0	0	0	0
Virgins	ND	5	ND	ND	66	ND	ND	ND	81	56	28	60	79	83
Rodsher	ND	ND	ND	ND	ND	ND	ND	ND	54	37	0	19	26	36
Bolshoi Fiskar	ND	ND	ND	ND	14	ND	ND	41	23	28	71	27	58	68
Maly Fiskar	ND	ND	ND	ND	0	ND	3	10	2	3	5	4	5	4
Nerva	ND	ND	ND	ND	ND	ND	ND	ND	0	0	1	1	2	4
Total	8–10	11–12	6	3	85	1	3	51	160	124	105	111	170	195

ND = no data.

summer-autumn migration during the second half of July. By the middle of August, practically all Razorbills have departed. As shown by ringing results, wintering areas of Razorbills from the White Sea and the Barents Sea have considerable overlap, both being along the Norwegian coast. Of 84 Razorbills ringed in Kandalaksha and Onega bays, 68 were recovered in Norway, seven in Denmark, and the remaining five from Great Britain, Greenland, Faroe Islands, Holland and Sweden, yielding one ring recovery each.

Part of the Onega Bay population migrates promptly and may be found in their wintering area, on the southern coast of Norway, as early as mid-October. However, some can be found in the White Sea close to their nesting places at the same time or even somewhat later. Razorbills were repeatedly recorded in September–October on the Solovetski and Kuzova islands; they are also known to occur during that period in Kandalaksha Bay and near Zhizhgin Island (Bianki 1967). The latest occurrences were recorded on the Solovetski Islands on 25 September 1983, 14 September 1987, 3 October 1990 and 26 October 2003, and on the Kuzova islands on 9 October 2002. When observing the autumn flight at the end of September–early October in 1999 and 2004, 68 and 85 birds were counted, respectively (Lehikoinen *et al.* 2006). Among those recorded on 4–7 October 2004, 46 individuals were moving west or southwest, which does not fit into the general picture of the species' migration and was probably related to searching for food. All of the birds for which age could be determined appeared to be yearlings. It is not inconceivable that the Razorbills recorded in the inner regions of the White Sea in September–October were young birds that had gone astray from the main flyway.

In the Gulf of Finland, some birds remained in the open water area as far east as the Tolbukhin Lighthouse (near the entrance to Nevskaya Guba). Their departure for wintering areas was noted during the first week of October (Kouzov *et al.* 2013). During a single day, one to eight birds were observed flying westward over the open water. The last migrating individuals were recorded during mid-November. In warm winters, the Razorbills may occasionally stay in the open water in the Gulf of Finland for the entire winter. In the absence of observations, however, this is conjecture.

DISCUSSION

By the middle of the 20th century, it was generally agreed that the main part of the Razorbill population in Russia was confined to the East Murman islands (Dementyev 1951). That assumption was evidently due to the absence of data on their populations on islands in Onega Bay. At present, the population of this species in Russia may be estimated at 4 000–4 300 breeding pairs, or 6% of the total number of the *A. t. torda* subspecies (Hentati-Sundberg 2011), with about 3 600 pairs nesting in Onega Bay. Thus, the trend of Razorbill population change in Russia is in line with changes in

the population of subspecies *A. t. islandica*. This suggests that the population growth in Russia reflects the general situation. However, the Onega Bay Razorbill population may have grown owing to the decline of a local White Sea fishery, with questions remaining concerning overlap in the time and routes of migrations, as well as overlap of wintering locations for various portions of the population. A flock of eight Razorbills was noted during an aerial count of birds in Onega Bay during 29–30 March 2009 (Krasnov & Gavrilov, pers. comm.). This suggests that some birds could occasionally winter on the White Sea, although the great majority migrate to the main wintering locations, in the Norway or Barents seas (Tatarinkova & Golovkin 1990). However Razorbills may come to the Murman coast together with murre *Uria* spp. in February (Krasnov, pers. comm.), penetrate the northern part of the White Sea, and finally reach the inner areas of the bays.

It is also not clear to what extent the populations are isolated from each other. In one case, an adult male Razorbill found in the colony on Severnaya Tupichikha Island in Onega Bay on 24 July 1986 had been ringed as a fledgling on 26 July 1982 on Gagarkina Luda in Kandalaksha Bay. Therefore, assuming a conservative philopatry, the birds of Kandalaksha and Onega bays form a single reproductive population. To cite another example, a bird ringed as a nestling on 23 July 1961 on Krestovaya Salma-luda (64°32'N, 35°36'E) in Onega Bay was caught on 2 August 1970 near Tuters Island (59°51'N, 27°10'E) in the Gulf of Finland. This fact, together with the occasional occurrence of birds on the inner lakes of Finland (Lehikoinen *et al.* 2006), indicates that at least some of the birds fly over land and, therefore, gene exchange is quite possible between populations inhabiting the Baltic and White seas. To clarify these issues, specific research using GLS loggers or satellite transmitters, along with genetic studies, are needed.

ACKNOWLEDGEMENTS

We thank the Bird Ringing Centre of Russia for permission to use information on recoveries. We are very grateful to Dr. Henry Pihlström from University of Helsinki for his help with Finnish references. The comments of Maria Gavrilov improved the paper immensely.

REFERENCES

- BARRETT, R.T., LORENTSEN, S-H. & ANKER-NILSSEN, T. 2006. The status of breeding seabirds in mainland Norway. *Atlantic Seabirds* 8: 97–126.
- BELOPOLSKI, L.O. 1957. *Ecology of Colonial Seabirds of the Barents Sea*. Moscow-Leningrad: USSR Academy of Sciences Press.
- BIANKI, V.V. 1963. Number and distribution of the seabirds in the western part of the White Sea. In: NIKOLAEV, I.I. (Ed.) *Problems with Using the Economic Resources of the White Sea and Inn Water Reservoirs of Karelia*. Moscow-Leningrad: USSR Academy of Sciences Press.
- BIANKI, V.V. 1967. *Waders, Gulls and Alcids of the Kandalaksha Bay*. Transactions of Kandalaksha State Reserve 6. Murmansk, USSR: Murmansk Book Publishers.
- BIANKI, V.V., SEMASHKO, V.Y. & CHERENKOV, A.E. 2006. Birds of the Onega Bay of the White Sea (the present state and number dynamics). In: GAGINSKAYA A.R., NOSKOV G.A., RYMKEVICH T.A. (Eds.) *Study of the Dynamics of Migratory Bird Populations and its Trends in North-West Russia*, Fifth issue. St. Petersburg: Tuskarora Press.

TABLE 3
Population size and trends of Razorbill in Russia

Region	Number (pairs)	Trend
Kola Peninsula	300–350	None
Kandalaksha Bay	90–100	None
Onega Bay	3 500–3 700	Increasing
Gulf of Finland	150–210	Increasing
Total in Russia	4 000–4 300	Increasing

- BOYARINOVA, Y.G. & KAVOKIN, K.V. 1998. Notes on birds of Lehmalahhti Gulf (north-western part of Ladoga Lake). *Russian Journal of Ornithology* 51: 23–27.
- BUBYREVA, V.A., BUZUN, V.A., VOLKOVICH, N.M., KOUZOV, S.A., SHAPOVALOVA, O.V. & SCHUKIN, A.K. 1993. *Report of Kurgalsky expedition of the St. Petersburg Naturalists Society during the field season in 1992*. Vestnik St. Petersburg State University, Series 3, Biology 2: 111–117.
- CHERENKOV, A.E., SEMASHKO, V.Y. & TERTITSKI, G.M. 2014. *The Birds of Solovetsky Islands and Onega Bay of the White Sea: Materials and Researches (1983–2013)*. Arkhangelsk, Russia: Severodvinsk Press.
- CRAMP, S. (Ed.) 1985. *The Birds of the Western Palearctic*. Volume 4: Terns to Woodpeckers. Oxford: Oxford University Press.
- DEMENTIEV, G.P. 1951. *Order Auks (Alciformes). The Birds of the USSR*. V. II. Moscow: Soviet Science Press.
- DICKINSON, E.C. & REMSEN JR., J.V. (Eds.). 2013. *The Howard & Moore Complete Checklist of the Birds of the World*. 4th Edition, Vol. 1. Eastbourne, UK: Aves Press.
- GERASIMOVA, T.D. 1962. The status of the seabird colonies at the Murman Coast. *Ornitologiya* 4: 11–14.
- HARIO, M. & RINTALA, J. 2014. *Population Trends of Archipelago Birds along Finnish Coasts during 1986–2013*. Linnut-yearbook 2013. BirdLife Suomi-Finland. [Available online at: http://www.birdlife.fi/julkaisut/vuosikirja/pdf/Linnut_VK2013_046-053_saaristolinnusto.pdf. Accessed 21 June 2016.]
- HENTATI-SUNDBERG, J. 2011. *Arctic seabirds breeding in the African-Eurasian Waterbird Agreement (AEWA) Area*. CAFF's Circumpolar Seabird Expert Group (CBird). CAFF Assessment Series Report No. 1. Akureyri, Iceland: CAFF International Secretariat.
- HERRMANN, C., RINTALA, J., LEHIKONEN, A., PEDERSEN, I.K., HARIO, M., KADIN, M. & KORPINEN, S. 2013. *Abundance of Waterbirds in the Breeding Season*. HELCOM Core Indicator Report. [Available online at: http://www.helcom.fi/Core%20Indicators/HELCOM-CoreIndicator-Abundance_of_waterbirds_in_the_breeding_season.pdf. Accessed 21 June 2016.]
- HILDÉN, I. 1921a. Havaintoja linnustosta Laatokan ulkosaarilla. *Luonnon Ystävä* 25: 53–57.
- HILDÉN, I. 1921b. Lintutieteellisiä havaintoja Jaakkimasta ja Juuasta. *Meddelanden af Societas pro Fauna et Flora Fennica* 47: 59–62, 218–219.
- IOVCHENKO, N.P., GAGINSKAYA, A.R., NOSKOV, G.A. & REZVYI, S.P. 2004. The results of avifauna survey of the islands in the Gulf of Finland in 1994–1995. Birds and mammals in north-west Russia. *Proceedings of Biological Research Institute of St. Petersburg State University* 48: 100–120.
- IVANENKO, N.Y. 2007. Changes in avifauna of the Bolshoi Ainov Island (the Barents Sea, the Varanger Fjord). In: MATISHOV, G.G., LEBEDEVA, N.V., SAVITSKI, R.M. (Eds.) *Methods and Theoretical Aspects of Seabird Studies*. Rostov-on-Don, Russia: Southern Scientific Centre of the Russian Academy of Sciences Press.
- KALYAKIN, V.N. 2001. New data on bird fauna of Novaya Zemlya Archipelago and Franz-Josef Land. *Ornitologiya* 29: 8–28.
- KORYAKIN, A.S., SEMASHKO, V.Y., CHERENKOV, A.E. & BAKKEN, V. 2000. The White Sea. In: BAKKEN, V. (Ed.). *Seabird Colony Databases of the Barents Sea Region and the Kara Sea*, 2nd edition. Rapport 115. Tromsø, Norway: Norsk Polarinstitute.
- KOSKIMIES, P. 1979. Karjalan linnustosta: Karjalan kannaksen seka Laatokan, Aunuksen ja Aanisen Karjalan linnustollisista erikoispiirteista. *Ornis Karelica* 3: 68–89.
- KOUZOV, S.A., SHILIN, M.B. & CHUSOV, A.N. 2013. Variety and vulnerability of ornithofauna in the eastern part of the Gulf of Finland in the region of Nord stream sea gas pipeline. *Proceedings of the Russian State Hydrometeorological University* 31: 120–137.
- KOZLOVA, E.V. 1957. *Charadriiformes: suborder Alcidae*. Fauna of the USSR, new series. Vol. 2, no. 3. Moscow-Leningrad: Academy of Sciences Press.
- KRASNOV, Y.V., MATISHOV, G.G., GALAKTIONOV, K.V. & SAVINOVA, T.N. 1995. *The Colonial Seabirds of Murman*. St. Petersburg: Nauka Press.
- LEHIKONEN, A., KONDRATYEV, A., ASANTI, T., GUSTAFSSON, E., LAMMINSALO, O., LAPSHIN, N., PESSA, J. & RUSANEN, P. 2006. *Survey of Arctic Bird Migration and Staging Areas at the White Sea, in the Autumns of 1999 and 2004*. The Finnish Environment 25/2006. Helsinki: Finnish Environment Institute.
- MALCHEVSKY, A.S. & PUKINSKY, Y.B. 1983. *Birds of Leningrad Region and Neighborhood Areas. History, Biology, and Conservation*. Vol. 1. Non-passerines. Leningrad: Leningrad University Press.
- MANDRYKA, O.V., SHILIN, M.B., KOUZOV, S.A. & LUKIANOV, S.V. 2013. Kurgalsky reef: modern state, biodiversity, and biocenosis vulnerability. *Proceedings of the Russian State Hydrometeorological University* 31: 104–119.
- MEDVEDEV, N.V. & SAZONOV, S.V. 1994. Water and shorebirds of the Valaam and West archipelago, Lake Ladoga. *Russian Journal of Ornithology* 3: 71–81.
- MELNIKOV, M.V. & OSADCHIY, A.V. 2009. Locality reports. Sem'Ostrovov Archipelago, the Barents Sea, Russia. *Arctic Birds* 11: 4–6.
- MIKHALEVA, E.V. & BIRINA, U.A. 1997. Birds of the Valaam Archipelago (annotated list of species). *Russian Journal of Ornithology* 9: 11–21.
- NEUFELDT, I.A. 1958. On avifauna of the Southern Karelia. *Proceedings of the Zoological Institute Academy of Sciences of the USSR* 25: 183–254.
- NOSKOV, G.A., FEDOROV, V.A., GAGINSKAYA, A.R., SAGITOV, R.A. & BUZUN, V.A. 1993. On the avifauna of islands in the Eastern part of the Gulf of Finland. *Russian Journal of Ornithology* 2: 163–175.
- PAATELA, I. 1947. Laatokan itarannikon linnustosta. *Ornis fennica* 24 (3/4): 93–105.
- PANEVA, T.D. 1999. Gavrilovskiy Archipelago: Charadriiformes. Alcae. In: KORYAKIN, A.S. (Ed.). *The Nature Chronicle by Kandalaksha Reserve for 1998*. Annual Report. Book 44. Vol. 2: 660–666. Compact disk. Kandalaksha: Kandalaksha State Nature Reserve.
- RENNO, O. 1976. Avifauna of the islands in the southern part of the Gulf of Finland. *Ornis fennica* 53: 128–131.
- SHKLYAREVICH, F.N. 1999. Kandalaksha Bay: Charadriiformes. Alcae. In: KORYAKIN, A.S. (Ed.). *The Nature Chronicle by Kandalaksha Reserve for 1998*. Annual Report. Book 44. Vol. 1: 380. Compact disk. Kandalaksha: Kandalaksha State Nature Reserve.
- STRØM, H., ØIEN, I.J., OPHEIM, J., KUZNETSOV, E.A. & KHAKHIN, G.V. 1995. *Seabird Censuses on Novaya Zemlja 1995*. Report 3. Klæbu, Norway: Norwegian Ornithological Society.
- SUOMALAINEN, H. 1937. Über die Verbreitung der marinen Schärenvögel in Finnischen Meerbusen. *Ornis fennica* 14: 18–26.
- TARNANI, I.K. 1892. The bird kingdom of Solovki. *Vestnik Pitsevodstva* 10: 423–431, 11: 455–462.

- TATARINKOVA, I.P. & CHEMYAKIN, R.G. 1999. Ainov Islands: Charadriiformes. Alcae. In: KORYAKIN, A.S. (Ed.) *The Nature Chronicle by Kandalaksha Reserve for 1998*. Annual Report. Book 44. Vol. 2: 731-734. Compact disk. Kandalaksha: Kandalaksha State Nature Reserve.
- TATARINKOVA, I.P. & GOLOVKIN, A.N. 1990. The Razorbill. In: FLINT, V.E., GOLOVKIN, A.N. (Eds.) *Birds of the USSR. Alcids*. Moscow: Nauka Press.
- TATARINKOVA, I.P. 1990. Factors determining the variation in auk numbers in the Ainov Islands. In: Kutenkov, A.P. *Terrestrial Vertebrata Animals in the Reserves of the North of European Part of the Russian Federation*. Moscow: Central Research Laboratory of the Game Recourse Management and Nature Reserves of Russian Federation.
- TERTITSKI, G.M., BAKKEN, V., GAVRILO, M.V., KRASNOV, Y.V., NIKOLAEVA, N.G. & POKROVSKAYA I.V. 2000. The Barents Sea. In: BAKKEN, V. (Ed.). *Seabird Colony Databases of the Barents Sea Region and the Kara Sea*, 2nd edition. Rapport 115. Tromso, Norway: Norsk Polarinstitute.
- VAURIE, C. 1965. *The Birds of the Palearctic Fauna. Non Passeriformes*. i-xx, 1-763. London: H. F. & G. Witherby.
- VYSOTSKY, V.G. & VEREVKIN, M.V. 2013. Current status of seabirds and marine mammals of the Russian part of the Gulf of Finland. In: STANYUKOVICH, M.K. (Ed.) *Scientific Session on the Results of Work in 2012*. St. Petersburg: Zoological Institute of Russian Academy of Sciences Press.
- WALSH, P.M., HALLEY, D.J., HARRIS, M.P., DEL NEVO, A., SIM, I.M.W. & TASKER, M.L. 1995. *Seabird Monitoring Handbook for Britain and Ireland: A Compilation of Methods for Survey and Monitoring of Breeding Seabirds*. Peterborough, UK: Joint Nature Conservation Committee, Royal Society for the Protection of Birds, Institute of Terrestrial Ecology, and Seabird Group.
- ZIMIN, V.B., SAZONOV, S.V., LAPSHIN, N.V., KHOKHLOVA, T.Y., ARTEMIEV, A.V., ANNENKOV, V.G. & YAKOVLEVA, M.V. 1993. *Bird Fauna of Karelia*. Petrozavodsk, Russia: Karelian Research Centre Press.
-