Spring migration stopovers of swans *Cygnus* sp. in the Russian part of the Gulf of Finland

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Abstract

During spring migration each year swans were counted every 5 days at two of the most important stopover sites for these species in the eastern part of the Gulf of Finland near St Petersburg, Russia. Swans were counted on the Kurgalsky Peninsula in 2005–2017 and on the northern coast of the Neva Bay in 2009–2017. The maximum number of swans recorded on the Kurgalsky Peninsula each year during the study varied widely, with Bewick's Swan *Cygnus columbianus bewickii* numbers ranging from 43–1,310 individuals and Whooper Swans *C. cygnus* varying from 35–747 individuals, whilst Mute Swan *C. olor* counts ranged from 68–394 individuals. The seasonal maximum number of swans on the northern coast of the Neva Bay in 2009–2018 also varied markedly, as Bewick's Swan counts varied from 35–460 birds and Whooper Swan counts ranged from 5–65 individuals, whilst the number of Mute Swans did not exceed seven individuals. In 2018, counts were carried out at almost all known stopover sites for migratory swans along the coast of the Gulf of Finland. Most were used by swans in 2018, but swan abundance was low compared to the published data from previous decades, with maximum species-specific counts in 2018 of 68 Mute Swans, 86 Whooper Swans and 103 Bewick's Swans. On comparing our data with previous studies, we consider that the number of swans in the Russian part of the Gulf of Finland has decreased since the 20th century, with the large stopovers of ≥ 1,000 swans having largely disappeared. The most likely cause of the decline in numbers, recorded both for Bewick's Swans and for Whooper Swans, is the industrial development of the region. Construction work on the coast in the areas adjacent to the swan migration sites can have a negative impact on birds, primarily due to the reclamation of the wetland habitat and increased water turbidity.

Key words: Bewick's Swan, industrial development, Mute Swan, number, population size, Whooper Swan, water turbidity.

The Gulf of Finland is an important stopover area for migrating birds, as well as for species nesting on the bay (Malchevsky & Pukinsky 1983; Cherenkov *et al.* 2016; Kouzov *et al.* 2018; Noskov *et al.* 2016; Zaynagutdinova & Mikhailov 2019). Three species of swans occur in the region during the spring and autumn migration periods: the Mute Swan *Cygnus olor*, Whooper Swan *C. cygnus* and Bewick's Swan *C. columbianus bewickii*, with the Mute Swan having bred regularly on the Kurgalsky Peninsula reed beds since 1999 (Kouzov 2009). Two Mute Swan nests were found on Kotlin Island in the Saint Petersburg region during 2017 (Fedorov 2018). The Whooper Swan, a common species in the region, migrates along the Baltic Sea to breed in the taiga and tundra habitats of Northwest Europe, with some birds also known to breed irregularly in the Leningrad Oblast (Malchevsky & Pukinsky 1983; Hokhlova & Artemjev 2002). The Northwest European Bewick's Swan population is however the more numerous of the two migratory swan species in the Russian part of the Gulf of Finland (Malchevsky & Pukinsky 1983), where it migrates along the Baltic Sea before heading across Karelia and along the White and Barents Sea coast to breed on the tundras of European arctic Russia. The Northwest European Bewick's Swan population is of conservation concern because its numbers have declined since 1995 (Beekman *et al.* 2019), and maintaining a network of key staging areas in the Baltic countries is crucial for enabling the birds to refuel over several weeks in both autumn and spring, (Nagy *et al.* 2012).

The Russian coast in the eastern part of the Gulf of Finland has long been regarded as one of the most important spring staging sites for swans (Malchevsky & Pukinsky 1983), although the swans stop to feed on vegetation in its natural shallow waters in autumn as well as in spring (Buzun 2001; Rychkova 2009; Rymkevich *et al.* 2009; Kouzov 2010; Kouzov & Kravchuk 2010a, b). Here swans feed exclusively on aquatic vegetation and do not utilise terrestrial habitats, which provide important food resources (*e.g.* pasture, growing cereals and crops left after the harvest) in much of the winter range (Dirksen *et al.* 1991; Laubek 1995; Wood *et al.* 2019). Replenishment of energy reserves is essential not only for the successful continuation of migration but also for successful reproduction, and thus affects the total population size (Beekman *et al.* 1991; Rees & Bowler 1991; Nolet & Drent 1998; Rees & Beekman 2010; Nolet & Gyimesi 2013). The abundance of suitable feeding areas at spring staging sites therefore can be considered one of the essential requirements for the stability of the migratory swan populations (*e.g.* Nagy *et al.* 2012).

Some of the stopover sites used by the swans are protected as nature reserves (Table 1). At the same time, continuous industrial development has taken place along the coast of the Gulf of Finland, and this process was especially intensive during the 2000s (Table 1). Most industrial facilities are located close to the swans' migration areas (Fig. 1) and so have the potential to affect these sites, particularly when construction work is underway.

The aim of this study was to use recent monitoring data to determine which spring staging areas the three swan species are currently using. These data were also analysed

Table 1. The location of swan migration stopovers, protected areas and infrastructure developments on the eastern part of the Gulf of Finland. Information on the time of construction work was taken from the official websites of the infrastructure facilities (www.dambaspb.ru, www.mfspb.ru, www.nch-spb.com, www.nord-stream2.com, www.pasp.ru, www.port-bronka.ru, www.portspb.ru, www.ust-luga.ru, www.bpearl.net, www.portvisotsk.ru, www.gazprom-arena.com, www.lakhta.center, www.yacht-club-spb.ru, www.ptport.ru, www.portlog.ru and www.nord-stream.com).

Migration stopover	No. in map (in Fig. 1)	Protected area	Infrastructure developments (years of construction work in 21st century)
Kurgalsky Peninsula	1–6	Kurgalsky Reserve	NordStream 2 AG (2018–present) Port Ust-Luga (2001)
Chaika	15	Lebyazhy Reserve	Port Bronka (2011)
Bronka	16	Lebyazhy Reserve	Saint Petersburg Flood Prevention Facility Complex (2010–2011)
Kronshtadtskaya Koloniya	17	Southern coast of the Neva Bay Reserve	
Kotlin Island	28	Western Kotlin Reserve	
Vasilyevsky Island	29		Western High-Speed Diameter (2013–2016) Sea Facade Area (*c.* 2009–present) Sea Port of Saint Petersburg Passenger Port of Saint Petersburg (2009)
Krestovsky Island	30		Gazprom Arena (2007–2017) Western High-Speed Diameter (2013–2016)
Lakhta	22		Lakhta Center (*c.* 2012–present) Yacht Club Hercules (2009)
Olgino	23	Northern coast of the Neva Bay Reserve	
Lisy Nos	24	Northern coast of the Neva Bay Reserve	
Strelna	21	Southern coast of the Neva Bay Reserve	Baltic Pearl Area (2005–present) Sea Channel to Konstantinovsky Palace (2006)
Primorsk	26	Berezovye Islands Reserve	Port Primorsk (2000–2011)
Vyborg Bay	27	Vyborg Reserve	Port Vysotsky (2004) Port Vyborg NordStream (2010)

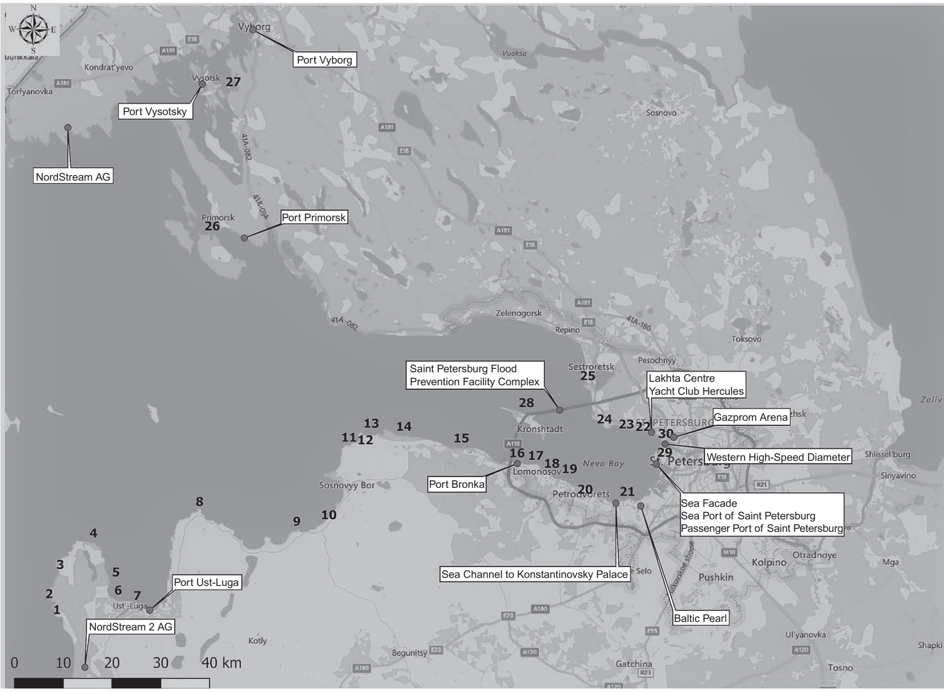

Figure 1. Map of the distribution of the swans' stopover sites (numbered 1–30) and infrastructure development (boxed text) in the Russian part of the Gulf of Finland.

together with earlier published data to assess trends in numbers of swans using different sites in the region. Additionally, we describe variation in the number of birds recorded in the two areas where most swans occurred, along the southwest and northeast coasts of the Gulf of Finland.

Methods

Swans were counted every 5 days during spring migration at the Kurgalsky Peninsula (sites 1–6 in Fig. 1) in 2005–2017, and at the Olgino and Lisy Nos villages and Lakhta area (sites 22–24) in 2009–2017. The count programme commenced before the arrival of the first swans each year and ended after they had completed their passage through the region. In all tables, peak numbers of swans are given for each area.

To achieve more comprehensive survey coverage, in 2018 the counts were carried out at almost all of the sites known to be used by swans, along the whole of the Russian coast of the Gulf of Finland (Pogrebov *et al.* 2006; Nagy *et al.* 2012). The surveys did not include visits to islands, however, with the exception of Kotlin Island. At the most important sites in terms of swan numbers (Pogrebov *et al.* 2006; Nagy *et al.* 2012), counts were carried out 3–5 times over the survey period in 2018, with one count made at the more remote sites where the numbers of swans was low according to previous studies (Malchevsky

& Pukinsky, 1983; Pogrebov *et al.* 2006; Nagy *et al.* 2012; Fig. 1). Surveys were conducted by a team of five counters between April 8–May 22 (Appendix 1). Observations commenced prior to the ice-melt, in order to ensure that the first birds that appeared were not missed. The first open water began to appear on April 15, whilst the first swans began to appear in mid-April. The counts were completed when the last birds left the region (with the exception of the non-migratory Mute Swan). The Gulf of Finland is the edge of the breeding range of Mute Swan (Kouzov 2009; Fedorov 2018); some stay for breeding, but there were no observations of marked birds to allow identification of those passing through on migration. We therefore counted all Mute Swans observed during the migration period, as well as the two other migratory species.

In addition to analysing changes in swan numbers recorded during our study, we compared the maximum counts with data published from earlier studies on swan migration through the region, to provide a longer-term perspective of swan-use of sites in the Russian part of the Gulf of Finland. In 2012, a total count was made of waterfowl at Neva Bay (Rymkevich *et al.* 2012), which allowed a comparison with the more comprehensive data from surveys conducted in this area in 2012 and 2018. The ice-melt in 2012 was late (Rymkevich *et al.* 2012), as in 2018, and the spring weather conditions were generally similar in these years.

Results

The number of swans recorded on the Kurgalsky Peninsula (sites1–6) during 2005–2018 varied widely: Bewick's Swan numbers ranged from 43 individuals in 2018 to 1,310 in 2016, Whooper Swan numbers from 35 in 2013 to 747 in 2015, and Mute Swans from 68 in 2018 to 394 in 2008. Lowest numbers of swans were observed in 2005–2006, 2011–2013 and 2018 (Fig. 2a).

The number of swans on the northern coast of the Neva Bay (22–24) also varied greatly, over the shorter study period of 2009–2018, with Bewick's Swan counts varying from 35 in 2013 to 460 in 2012, Whooper Swans ranging from five individuals in 2013 to 65 in 2016, and the number of Mute Swans did not exceed seven individuals. The highest numbers of swans were observed in 2012 and in 2014–2017, whilst the lowest numbers of swans were observed in 2009, 2011, 2013 and 2018 (Fig. 2b).

In 2018, Bewick's Swans and Whooper Swans were first seen at Chaika (site 15) on 15 April, with last sightings on 11 May at Sergievka (site 19) for Bewick's Swans and on 1 May at Vyborg Bay for Whooper Swans. Mute Swans were first seen on 13 April at Lisy Nos (site 24) and last seen on 11 May at Sergievka (site 19). Relatively large flocks (> 100 swans) were encountered on the Kurgalsky Peninsula (1–6), in Chaika, and at Lisy Nos. No more than 16 swans were observed on Kotlin Island (site 28). At other points, < 10 swans were observed (Table 2).

On considering published information together with our own data, to compare the numbers of swans counted in the 21st century with records from the second half of the 20th century, we see that the large stopovers with > 1,000 swans have largely disappeared. The staging site with the highest abundance of swans currently is

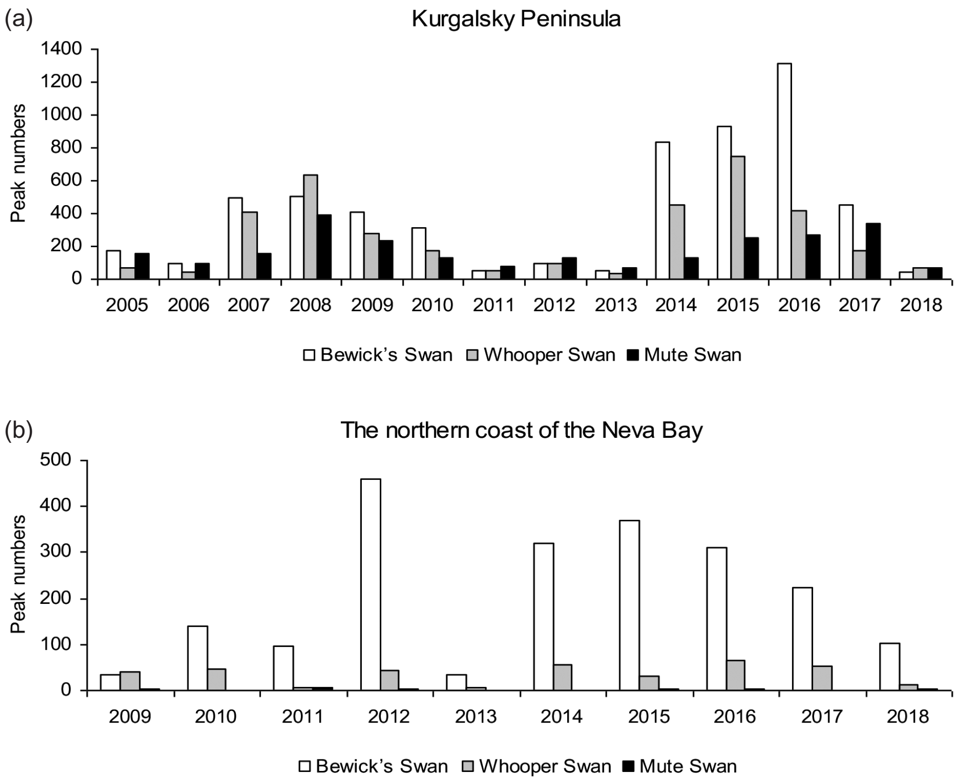

Figure 2. Maximum number of swans counted in (a) all stopovers near the Kurgalsky Peninsula (sites 1–6 in Fig. 1) in spring 2005–2018, and (b) all stopovers near the northern coast of the Neva Bay (Lakhta, Olgino, Lisy Nos; sites 22–24) in spring 2009–2018.

situated on the Kurgalsky Peninsula (1–6), where we recorded 1,310 Bewick's Swans in 2016 and 747 Whooper Swans in 2015 (Table 3). The high number of swans near Vasilyevsky Island, where 2,000 Bewick's Swans were observed in 1975 (Malchevsky & Pukinsky 1983), have now almost disappeared. Staging near Krestovsky Island, where 400 Whooper Swans were observed in 1975 (Malchevsky & Pukinsky 1983), also no longer seems to occur. In Lakhta, counts as high as 1,000 swans have not been seen since 2000 (Khrabry 2012).

The total count of waterfowl undertaken in the Neva Bay area in 2012 (Rymkevich *et al.* 2012), which allowed a comparison of the data from surveys conducted in 2012 and 2018, revealed that the number of swans in 2018 was lower than in 2012 (Table 4).

Discussion

Counts of swans carried out at their two most important staging areas on the Gulf of Finland – on the Kurgalsky Peninsula and Neva Bay – showed that peak numbers fluctuated markedly between years. Such

Table 2. Peak numbers of swans counted in the areas surveyed in 2018.

Number of the area on the map (Fig. 1)	Area	Bewick's Swan	Whooper Swan	Mute Swan	Unknown *Cygnus* sp.	All swans
1–6	Kurgalsky Peninsula (all areas)	43	71	68	0	182
7	The mouth of the River Luga	0	0	0	0	0
8	Kolganpya Cape	0	0	0	0	0
9	Sisto-Palkino	0	0	2	0	2
10	Kernovo	0	0	0	0	0
11	Kandikyulya	0	0	2	0	2
12	Batareynaya Bay	0	0	0	0	0
13	Shepelevsky lighthouse	0	0	2	0	2
14	Chernaya Lakhta	0	0	2	0	2
15	Chaika	17	86	2	0	105
16	Bronka	4	0	2	0	6
17	Kronshtadtskaya Koloniya	0	0	0	0	0
18	Martyshkino	2	0	0	0	2
19	Sergievka	5	0	2	0	7
20	Petrodvorets	0	0	0	0	0
21	Strelna	0	0	2	0	2
22	Lakhta	0	0	0	2	2
23	Olgino	0	0	0	0	0
24	Lisy Nos	103	13	2	0	118
25	Tarkhovka	0	0	0	0	0
26	Primorsk	5	0	0	0	5
27	Vyborg Bay	0	2	2	0	4
28	Kotlin Island	6	8	2	0	16

Table 3. Numbers of Bewick's Swans and Whooper Swans on the main stopovers in the eastern part of Gulf of Finland during 2018, in comparison with earlier studies.

		Bewick's Swan				**Whooper Swan**			
		Previous studies				**Previous studies**			
No. of the area	**Area**	**Max. count**	**Year**	**References**	**Our data 2018**	**Max. count**	**Year**	**References**	**Our data 2018**
30	Krestovsky Island	0	1975	Malchevsky & Pukinsky 1983	0	400	1975	Malchevsky & Pukinsky 1983	0
29	Vasilyevsky Island	2,000	1975	Malchevsky & Pukinsky 1983	0	0	1975	Malchevsky & Pukinsky 1983	0
22	Lakhta	1,000	2000	Khrabry 2012	0	400	1975	Malchevsky & Pukinsky 1983	0
24	Lisy Nos	460	2012	Rymkevich *et al.* 2012	103	267	1999	Noskov *et al.* 2016	13
25	Tarkhovka	68	2012	Rymkevich *et al.* 2012	0	1	2015	Mikhailov 2015	0
29	Kotlin Island	117	2009	Kouzov, Kravchuk 2010	6	240	2006	Noskov *et al.* 2016	6
21	Strelna	96	2012	Rymkevich *et al.* 2012	0	270	2012	Rymkevich *et al.* 2012	0
17	Kronshtadtskaya koloniya	79	2012	Rymkevich *et al.* 2012	0	23	2003	Rymkevich *et al.* 2009	0
14, 15, 16	Bronka, Chaika, Chernaya Lakhta	1,700	2007	Rychkova 2009	21	390	2007	Noskov *et al.* 2016	86
1–6	Kurgalsky Peninsula	1,310	2016	Our data	48	747	2015	Our data	71

Table 4. The number of swans counted on the stopover sites in the Neva Bay in 2012 (Rymkevich *et al.* 2012) and 2018 (our data).

	Bewick's Swan		**Whooper Swan**		**Mute Swan**		***Cygnus* sp.**	
	2012	**2018**	**2012**	**2018**	**2012**	**2018**	**2012**	**2018**
Lisy Nos	460	103	45	13	2	2		
Tarkhovka	68	0	0	0	0	0		
Kotlin Island	11	6	24	8	0	2	42	
Chaika	12	17	0	86	0	2		
Bronka	32	4	40	0	2	2		
Kronshtadtskaya Koloniya	79	0	38	0	8	0		
Strelna	126	0	270	0	0	2		
Total	788	130	417	107	12	10	42	0

fluctuations are likely to be associated with weather and ice-melt conditions on the Gulf of Finland and at other important sites used during the spring migration (Malchevsky & Pukinsky 1983; Nuijten *et al.* 2014). Depending on the timing of the spring and ice-melt on the Baltic Sea, Lake Ladoga and the White Sea, swans can choose different migration strategies and may even skip stopovers on the Gulf of Finland. Spring 2018 was late, with large areas of open water not appearing on the gulf until mid-April, and complete ice-melt did not occur until late April. Accordingly, the migration of swans through the region was from mid-April onwards in 2018 although, perhaps because of the weather conditions, the number of swans at the staging sites was low.

The low numbers of swans recorded in 2018 was however evident in other years of the early 21st century. The complete disappearance of swans from some staging sites, together with the reduced swan numbers at other staging sites, are likely due to the intensive industrial development of the coast. The high number of swans which once occurred near Vasilyevsky Island (site 29) have now almost disappeared following land reclamation within the area encircled by the Western High-Speed Diameter highway. The first reclamation of land on Vasilyevsky Island was in the late 1960s and this practice has continued to the present time. The most extensive work, reclamation of the Sea Facade Area, commenced in 2009 and the area of reclaimed coastline has now reached *c.*170 ha. The stopover near Krestovsky Island (site 30) has also disappeared, and the Western High-Speed Diameter highway is now located in this area, with the central section (11.7 km) of the highway being built across the water in 2013–2016. Port Bronka, which comprises 206.9 ha of infrastructure and 120 ha of reclamation area, was also built on the coastal zone between 2011–2015. The area occupied by the port is partly located within the Kronshtadtskaya Koloniya staging area for waterbirds on migration.

Reclamation works have been carried out on Krestovsky Island and Vasilyevsky Island, as well as during the construction of Port Bronka, the Baltic Pearl Area, the Lakhta Centre, Yacht Club Hercules and the St. Petersburg Flood Prevention Facility Complex, sometimes with consequences for habitats in areas away from the development. For example, after the construction of the Saint Petersburg Flood Prevention Facility Complex was completed in 2011, the flow of water through the Neva Bay decreased, decreasing water depth and altering both the coastline and bathymetry (Maksimova *et al.* 2016). Moreover, conditions at the swans' stopovers are influenced not only by the loss of critical shallow water habitat, but also by an increase in water turbidity associated with construction which extends over long distances beyond the construction sites and hence covers a vast area of shallow water where key migratory stopover sites are located. Since most areas of the Gulf of Finland, especially the Neva Bay, are very shallow the turbidity of the water is intense and spreads across large areas. Increased water turbidity can affect the entire aquatic ecosystem, in particular by limiting light availability and so reducing the growth, survival, and spatial extent of aquatic plants (Bornette & Puijalon 2011). Fennel Pondweed *Potamogeton pectinatus*, one of the key food plants for swans during winter and migration (Beekman *et al.* 1991; Klaassen & Nolet 2007), is known to be sensitive to water turbidity (Kantrud 1990).

Further along the north coast of the Gulf of Finland, thousands of birds are no longer found in the Lakhta area (site 22 in Fig. 1). The flock of 400 Whooper Swans was observed there in 1975 (Malchevsky & Pukinsky 1983), whilst 1,000 Bewick's Swans were reported in 2000 (Khrabry 2012). Subsequently, the area has been affected by the construction of the Hercules Yacht Club in 2009, coastal reclamation for the Sea Facade in 2009, as well as the construction of the Lakhta Centre in 2012, and construction of the Western High-Speed Diameter in 2013. During construction work, a cloud of suspended sediment increased water turbidity in the neighbouring areas of Krestovsky Island (30), Lakhta (22), and the northern coast of the Neva Bay Reserve (sites 23, 24). The number of swans in the northern coast of the Neva Bay Reserve (sites 22–24) declined in the years following the start of the construction of Yacht Club Hercules (2009), Sea Facade (2009) and Western High-Speed Diameter (2013) (Table 5).

In addition to the reclamation of coastal territory, dredging work carried out to deepen the water in the area of the ports also leads to increases in water turbidity (Newell *et al.* 1998). In 2011, the construction of the port of Bronka began and its subsequent development was accompanied by dredging. The volume of sediment removed during the dredging was 29 million m^3. Dredging leads to an increase in the content of suspended substances in the aquatic environment and an increase in

Table 5. The number of swans on the northern coast of Neva Bay (locations 22–24 in Fig. 1) and the years of construction work near the northern coast of Neva Bay.

	Bewick's Swan	Whooper Swan	Mute Swan	Total	Construction
1999	50	267	0	317	
2003	74	0	0	74	
2009	35	41	2	78	Yacht Club Hercules (2009) Sea Facade (2009–present)
2010	141	47	0	188	
2011	97	6	7	110	
2012	460	45	2	507	Lakhta Centre (2012 – present)
2013	35	5	0	40	Western High-Speed Diameter (2013–2016)
2014	321	56	0	377	
2015	370	32	3	405	
2016	311	65	4	380	
2017	223	54	0	277	
2018	103	13	2	118	

turbidity, which occurs not only in the immediate area of the work but also extends to adjacent areas. In shallow waters, increases in turbidity occur rapidly. A study of the impact of the construction of Port Bronka on aquatic ecosystems revealed that degradation of benthic communities in the area has occurred, with decreases in the number of ichthyofauna as well as the number of fish-eating birds recorded (Zhigulsky *et al.* 2015). As water turbidity suppresses the development of aquatic plants, this in turn affects invertebrates and ultimately the number of fish and birds in the area (Zhigulsky *et al.* 2015).

The construction of St. Petersburg Flood Prevention Facility Complex, the Sea Channel to Konstantinovsky Palace, the Baltic Pearl Area, the St. Petersburg passenger port, the Gazprom Arena and the underwater sand dumps near Lakhta were accompanied by the dredging of a substantial volume of sediment, which also contributed to the strong increase in the turbidity of the waters (Korneev *et al.* 2014). Near the Lakhta area and Vasilyevsky Island, concentrations of suspended sediment exceeded 100 mg/l (Susloparova *et al.* 2013). At the same time, there was not only a deterioration of the environmental conditions in Neva Bay itself but also movements of polluted water to the west from the Flood Prevention Facility Complex (Korneev *et al.* 2014).

It can be assumed that the industrialisation of the coast of the Gulf of Finland could lead to a decrease in the number of swans, especially in Neva Bay. Most of the swan stopovers now coexist with major ports, all of which have either been built in the past 10 years or have significantly expanded their area over the past decade (Table 1). Yet despite the general declining trend in the number of swans observed on the Gulf of Finland near St. Petersburg, there are some examples of a recovery in swan numbers at specific sites. Following termination of construction works in the vicinity of villages along the northern coast of Neva Bay (at Lakhta, Olgino and Lisy Nos; sites 22–24), the number of swans has appeared to recover to late 20th century levels (Table 5). In 2009, when the construction of Sea Facade and Hercules Yacht Port was started the spring peak counts of Whooper Swans and Bewick's Swans in this area were only 18 and 20 birds respectively, whereas in 2012 (two years after the completion of the reclamation work) the number of Bewick's Swans was 460 birds (Tables 4 & 5), despite similar phenological conditions in these years. Recoveries of three ringed Bewick's Swans from the northern part of the Gulf of the Finland (in the Primorsk region), and a count of 305 near Olgino on 8 May 1987 which included two individuals identified in the UK the previous winter (Rees 1991), indicated that these were regular staging areas for Bewick's Swans during the late 20th century.

Thus, construction work on the coast in the areas adjacent to the swan migration stopovers can have a negative impact on birds, primarily due to the loss of the shallow water habitat used by swans, together with the increased water turbidity that decreases the availability of aquatic plants. In addition, the functioning of ports near key swan sites can cause noise and chemical pollution, as well as an increase in anthropogenic disturbance. Therefore, when carrying out construction work, it is necessary to assess the impact of water turbidity, reclamation and other risks to habitats on the adjacent coastal areas, in order to conserve the biodiversity of the unique natural complexes of the Baltic Sea. Meanwhile, given the loss of significant areas of migratory stopover sites, the establishment of artificial shallow-water habitats with good conditions for migratory birds to rest and feed in the Gulf of Finland, as well as the designation of new protected areas, is now highly desirable. Such new habitats could help to compensate for the habitat loss and degradation caused by the growth of the infrastructure development in the Gulf of Finland (Malchevsky & Pukinsky 1983; Chusov *et al.* 2017).

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Photograph: Bewick's Swan family on the Gulf of Finland, by Ben Cherry.

Appendix 1. Count areas and dates for surveys undertaken on the Russian part of the Gulf of Finland in spring 2018.

	Count area and number on the map (Fig.1)																											
	Kurgalsky Peninsula, Gakkovo	**Kurgalsky Peninsula, Konnovo**	**Kurgalsky Peninsula, Tiskolovo**	**Kurgalsky Peninsula, Kurgalsky Cape**	**Kurgalsky Peninsula, Luoto Cape**	**Kurgalsky Peninsula, Vybya River**	**The mouth of the Luga River**	**Kolganpya Cape**	**Sisto-Palkino**	**Kernovo**	**Kandikyulya**	**Batarejnaya Bay**	**Shepelevsky lighthouse**	**Chernaya Lakhta**	**Chaika**	**Bronka**	**Kronshtadtskaya koloniya**	**Martyshkino**	**Sergievka**	**Petrodvorets**	**Strelna**	**Lakhta**	**Olgino**	**Lisy Nos**	**Tarkhovka**	**Primorsk**	**Vyborg Bay**	**Kotlin Island**
Count date	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
8.04	■	■	■	■	■	■	■	■		■			■	■														
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