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FEATURES OF HYDROPHILIC BIRDS WINTERING AT SEA COASTS OF SOUTHERN CRIMEA UNDER CONDITIONS OF THE MILD WINTER 2019/2020

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In the Southern Crimea, the main winter habitat for hydrophilic birds is the coastal zone. In this area, species and quantitative composition of birds has been studied quite fully, *inter alia* under extreme cold conditions. A comparison of features of bird wintering in warm and cold winters is of interest since it allows to clarify the effect of weather conditions on the state of ornithological complexes and dynamics of intra-regional bird migrations. The aim of this research was to identify the species composition, abundance, and biotopic distribution of hydrophilic birds in the Southern Crimea under mild winter conditions. The study was carried out in the area from the Primorsky village near Feodosiya to Sevastopol (about 250 km) in the winter 2019/2020 characterized by prevalence of positive temperatures. The main coastal biotopes were surveyed: water areas off the open sea coasts, closed bays, and liman lakes. Off the open coasts, 24 species were revealed; this is significantly less than in cold seasons (for comparison: 41 species wintered there in the cold winter 2012). Lari and Anseriformes prevailed in species diversity. High abundance and active longshore migration of Levantine shearwater and great cormorant were recorded. The abundance of Anseriformes, coot, and some gull species was lower than in cold winters. In Sevastopol bays, 29 species were registered (for comparison: 35 species wintered there in cold January 2008). Anseriformes and Lari prevailed in species diversity, while coot and black-headed gull prevailed in abundance. On liman lakes, 24 wintering species were noted; coot and Anseriformes, mainly common pochard, prevailed in abundance. In total, 44 bird species (61.1% of wintering in the area) representing 11 orders were recorded in all the studied biotopes in the mild winter 2019/2020. The features of this winter were high abundance of Levantine shearwater and wintering of red-throated diver, parasitic jaeger, and Bewick’s swan.

Keywords: hydrophilic birds, Southern Crimea, wintering, mild winter, open coasts, closed bays, liman lakes, species composition, abundance

The coastal zone of the Southern Crimea with the adjacent marine area is the main winter habitat for hydrophilic birds. Weather conditions in the Northern Black Sea Region determining the nature and intensity of intra-regional bird migrations are among the key factors affecting quantitative

and qualitative composition of winter ornithological complexes in this zone. Specifically, during extreme cold snaps accompanied by freeze-up and snowfalls in the Northern Crimea and Sivash area, a mass bird migration to non-freezing water areas off the southern coasts occurs, and this is a characteristic feature of wintering in Crimea [Pusanow, 1933]. In winter seasons with moderate temperature, the coasts of the Southern Crimea are significantly inferior to the coasts of the Northern Crimea both in species diversity and abundance of wintering birds.

To date, the species composition and quantitative characteristics of winter ornithological complexes off the coast of the Southern Crimea have been studied quite fully [Andryushchenko et al., 2012; Beskaravayny, 2008, 2013; Beskaravayny, Kostin S., 1999; Mosalov et al., 2002], with the focus on wintering under cold conditions [Andryushchenko et al., 2012; Beskaravayny, 2010]. To clarify the effect of weather conditions on the species composition and abundance of wintering birds, as well as to reveal the patterns of their long-term dynamics, it is interesting to compare the features of wintering in cold and warm winters. The aim of this work is to identify the species composition, abundance, and biotopic distribution of hydrophilic birds wintering off the coast of the Southern Crimea under mild weather conditions, on the example of the winter season 2019/2020.

MATERIAL AND METHODS

The material was collected in 2019/2020 in the Southern Crimea area from the Primorsky village near Feodosiya to Sevastopol (about 250 km along the coastline). All the main biotopes of marine origin where hydrophilic birds use to winter were covered with observations – water areas off the open sea coasts, closed bays, and liman lakes. The objects of observations and counting were mainly representatives of the orders Gaviiformes, Podicipediformes, Procellariiformes, Pelecaniformes, Ciconiiformes, Anseriformes, Gruiformes, and Charadriiformes. We also counted some species from other orders that are ecologically closely related to near-aquatic biotopes: the marsh harrier *Circus aeruginosus* (Linnaeus, 1758), common kingfisher *Alcedo atthis* (Linnaeus, 1758), and reed bunting *Emberiza schoeniclus* (Linnaeus, 1758).

Species counted from the second half of December to the first decade of February (the period when the autumn migration is over and the spring migration has not yet begun) were attributed to wintering species. Observations and quantitative counting were carried out mainly in January. Three areas were covered (Fig. 1): eastern (waters of the western Feodosiya Gulf, vicinity of Feodosiya, the Karadag Nature Reserve, and the Kurortnoye village), central (vicinity of Yalta and the Cape Martyan Nature Reserve), and western (Sevastopol). On the water areas off the open sea coasts, birds were counted on six alongshore routes 1–4.2 km long, with a coastal strip analyzed about 1 km wide. Individuals sitting on the water area and on the coast and individuals migrating along the coastline were counted separately.

On the water areas of coastal liman lakes and closed bays, all the observed individuals were counted. In total, 2 lakes and 5 bays were surveyed. To compare quantitative characteristics of ornithological complexes, we used such parameters as the relative abundance (*per* 1 km^2 of a water area) and the Shannon diversity index (H) [Pesenko, 1982]. Calculations were carried out in Microsoft Excel.

Binoculars with 10× magnification were used for observations and counting. In some cases, photographing was used. The weather conditions are characterized according to the data of the website [Weather Forecast and Archive, 2020].

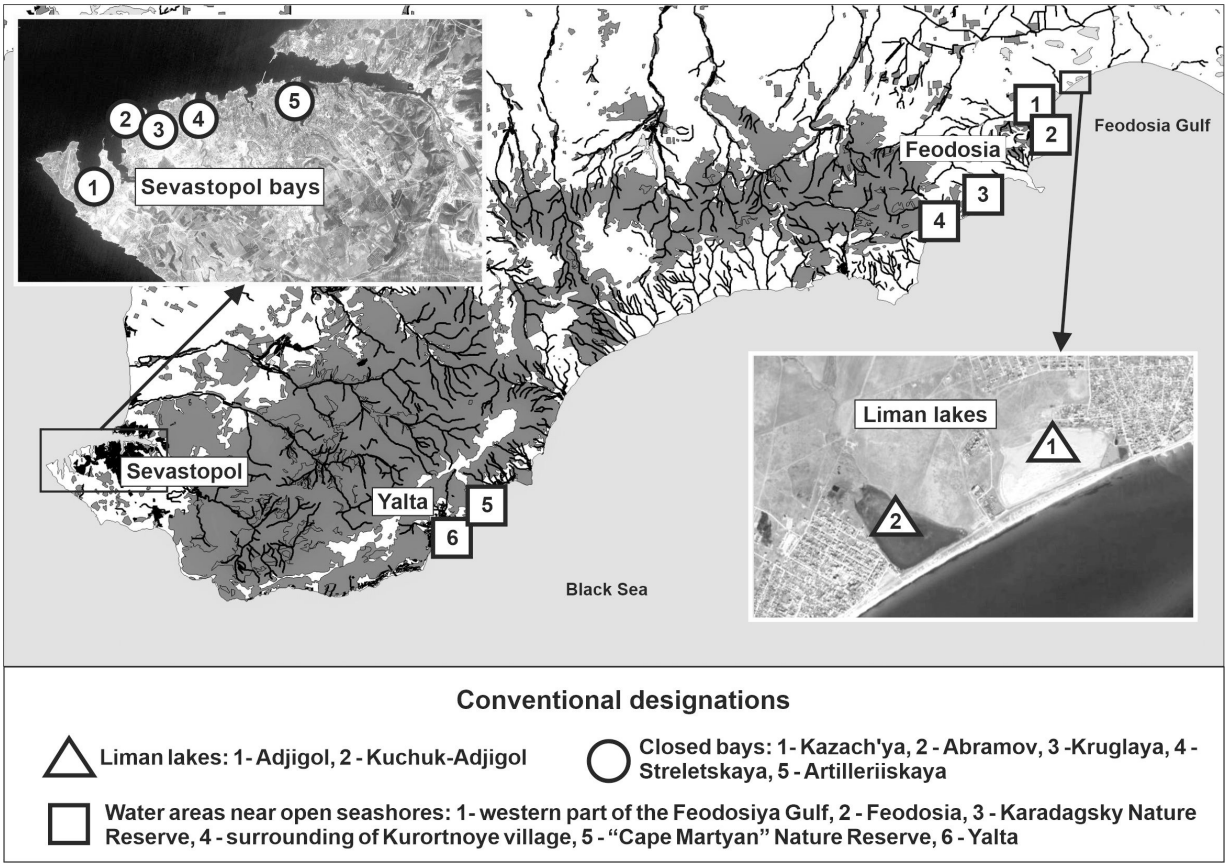

Fig. 1. Schematic map of the area with the spots of bird counting

Wintering conditions for hydrophilic birds in 2019/2020. The coastal zone of the Southern Crimea includes a wide range of stations of marine origin; those have been classified and described in detail in the work published earlier [Beskaravayny, 2008]. Within the boundaries of the studied area, we consider the following main types of habitats for hydrophilic birds.

1. Water areas off the open sea coasts.

1.1. Water area near deeper coasts. For a considerable distance, it is adjacent to the coastline of the Southern Crimea. This water area is characterized by the largest bottom slope (usually 1–2°; the depth within the coastal strip analyzed reaches 30–50 m) and prevalence of pebble bottom substrate and pebble beaches.

1.2. Water area near shallow coasts. It washes the Feodosiya Gulf which is characterized by sand-and-shell beaches and a slight slope (< 1°) of the silty-sand bottom (the depth within the coastal strip analyzed reaches 14–15 m).

Specific biotopes are water areas adjacent to the coasts of large cities – Feodosiya in the western Feodosiya Gulf and Yalta in the central Southern coast. The sea pollution and the construction of artificial beaches result in the change or destruction of benthic communities which form a natural food base. On the other hand, birds find alternative food sources in cities – food waste and feeding.

2. Closed bays. Birds were counted in the Kazachya, Abramov, Kruglaya, Streletskaya, and Artilleriiskaya bays located on the northern coast of the Heracles Peninsula, within the city of Sevastopol. With a width of 0.2–1.9 km, these bays are cut into the coastline for 0.4–2.2 km. In mouth areas, the depth is 15–20 m; in upper areas inhabited by at least 90% of birds, the depth does not exceed 3 m. In some bays, there are fragments of reed communities.

3. Liman salt lakes Adzhigol and Kuchuk-Adzhigol near the eastern Feodosiya. They are separated from the sea by sandy barriers 100–120 m wide. Due to low precipitation in 2019, the area of these lakes was relatively small in the winter 2019/2020 (Adzhigol Lake, 0.25 km^2; Kuchuk-Adzhigol Lake, 0.30 km^2), and the depth was about 0.5 m. These lakes can serve as winter habitats for birds only during frost-free periods, when they are not covered in ice.

After the most significant cold snap of the early XXI century (in late January–February 2012) [Andryushchenko et al., 2012], winter seasons were characterized by the lack of deep and prolonged temperature drops. Over the past seven years (2014–2020), average air and sea surface temperature in January in bird counting areas was as follows: in Feodosiya, + 2.2 and +8.9 °C, respectively; in Yalta, +4.2 and +9.8 °C; in Sevastopol, +3.8 and +9.4 °C. On average for three areas, the values were +3.4 and +9.4 °C, respectively. In the main period of bird counting (January 2020), the results of which are given in this article, the average air temperature for the area was +4.0 °C; water temperature was +10.1 °C [Weather Forecast and Archive, 2020]. These values correspond to indicators of a mild winter for the Southern coast of Crimea. Positive temperature prevailed in the Northern Crimea and Sivash area as well – in the areas of mass wintering of hydrophilic birds. The periods with sub-zero air temperature were short; those occurred mainly in January and February (as a rule, not lower than –2 °C and no more than 3 consecutive days). A cold snap with snowfall in the Southern Crimea (–6…–9 °C) and in northern areas (down to –12 °C) occurred on 7–10 February.

RESULTS AND DISCUSSION

Ornithological complex of the water area off the open coasts. In this biotope, the formation of the winter ornithological complex began in mid-September, with the arrival of regular small aggregations of the mallard *Anas platyrhynchos* Linnaeus, 1758 (13 individuals) and black-headed gull *Larus ridibundus* Linnaeus, 1766 (30) in the vicinity of Feodosiya. In October, the great crested grebe *Podiceps cristatus* (Linnaeus, 1758) was recorded (first date was 14 October), and the black-throated diver *Gavia arctica* Linnaeus, 1758 was noted (20 October). On 10 November, the mute swan *Cygnus olor* (Gmelin, 1789) and coot *Fulica atra* Linnaeus, 1758 were registered in the vicinity of Feodosiya. With a significant delay, compared to the arrival in previous years, the arrival of the black-necked grebe *Podiceps nigricollis* Brehm, 1831 was recorded – on 8 November (the average long-term date is 5 October [Beskaravayny, 2008]). In the period from mid-December to late January, the maximum abundance of the Levantine shearwater *Puffinus yelkouan* (Acerbi, 1827) was noted. By mid-March, the mute swan and mallard mostly left their wintering grounds. From the second half to the end of this month, there was the gradual departure of the black-headed gull.

In total, 24 species were revealed off the open sea coasts in winter 2019/2020 (taking into account the Arctic skua *Stercorarius parasiticus* (Linnaeus, 1758) registered near Sevastopol on 19.12.2019 and the Levantine shearwater and common shelduck *Tadorna tadorna* (Linnaeus, 1758) observed only flying over the water area). Out of them, 4 species (the red-necked grebe *Podiceps grisegena* (Boddaert, 1783), Levantine shearwater, Arctic skua, and little gull *Larus minutus* Pallas, 1776) were specific for this ornithological complex (Table 1). This accounts for 37.5% of the total number of species known for this biotope (at least 64) [Andryushchenko et al., 2012; Beskaravayny, 2008; Beskaravayny, Kostin S., 1999; Mosalov et al., 2002], and the value is much lower than in seasons with extreme cold snaps. Specifically, during the latest cold snap (January–February 2012), wintering of 41 species was recorded in this biotope [Andryushchenko et al., 2012].

Table 1. Abundance of wintering birds off the open sea coasts in 2019/2020

Species	Coastal water areas with great depths (Southern coast)			Coastal water areas with shallow depths (Feodosiya Gulf)		Counted in total, 14.5 km
	Eastern area – the Karadag Nature Reserve and the vicinity of the Kurortnoye village, 5 km	Central area		Vicinity of the Primorsky village, 4.2 km	Feodosiya, 2.3 km	
		The Cape Martyan Nature Reserve, 2 km	Yalta, 1 km			
Gavia arctica	15 / 3.0	–	–	47 / 11.2 (11)	1 / 0.4	63 (11)
Podiceps nigricollis	21 / 4.2	–	3 / 3.0	7 / 1.7	28 / 12.2	59
Podiceps grisegena	–	–	–	1 / 0.2	–	1
Podiceps cristatus	2 / 0.4 (3)	24 / 12.0	10 / 10.0	4 / 1.0	4 / 1.7	44
Puffinus yelkouan	–	(~ 4,000)	–	–	–	(4,000)
Phalacrocorax carbo	(4)	590 / 295 (855)	1 / 1.0	96 / 22.9 (11)	1 / 0.4	688 (870)
Phalacrocorax aristotelis	68 / 13.6	60 / 30.0 (90)	10 / 10.0	–	1 / 0.4	139 (90)
Cygnus olor	–	–	–	3 / 0.7	13 / 5.7	16
Tadorna tadorna	–	–	–	(20)	–	(20)
Anas platyrhynchos	110 / 22.0	2 / 1.0	37 / 37.0	–	160 / 69.6	309
Aythya ferina	–	–	18 / 18.0	–	–	18
Aythya fuligula	–	–	5 / 5.0	–	70 / 30.4	75
Mergus serrator	5 / 1.0	–	–	–	–	5
Fulica atra	–	–	74 / 74.0	–	228 / 99.1	302
Gallinula chloropus	–	–	–	–	1 / 0.4	1
Larus minutus	1 / 0.2	–	–	–	–	1
Larus melanocephalus	1 / 0.2	–	–	–	–	1
Larus ridibundus	–	–	~ 2,500 / 2,500.0	41 / 9.8	439 / 190.9	2,980
Larus cachinnans / *Larus michahellis*	19 / 3.8	~ 400 / 200.0	5 / 5.0	15 / 3.6 (10)	25 / 10.9	464 (10)
Larus canus	–	–	20 / 20.0	5 / 1.2	28 / 12.2	53
Thalasseus sandvicensis	–	–	4 / 4.0	3 / 0.7	–	7
Alcedo atthis	–	–	–	–	1 / 0.4	1
Total number of species (excluding flying birds)	10	6	13	11	15	21
Total number of individuals (excluding flying birds)	242	1,076	2,687	222	1,000	5,227
Abundance *per* 1 km^2 (excluding flying birds)	48	538	2,687	53	435	360
The Shannon index	1.46	0.95	0.38	1.59	1.58	1.54

Note. Data on the abundance are given as follows: counted individuals, in total / in terms of 1 km^2 of water area; in brackets, individuals flying over the sea and the coast. Data on the abundance of two closely related gull species, *Larus cachinnans* and *L. michahellis*, are summarized due to the difficulty of their identification from a long distance.

In terms of species richness, Lari prevailed (8 species out of 12 known for this biotope), as well as Anseriformes (6 out of 28; during the cold snap in 2012, 20 species were recorded). Other orders were represented by 1–3 species. A characteristic feature of this and other winters similar in terms of weather conditions was the absence of most Anseriformes (the whooper swan *Cygnus cygnus* (Linnaeus, 1758), Eurasian teal *Anas crecca* Linnaeus, 1758, red-crested pochard *Netta rufina* (Pallas, 1773), greater scaup *Aythya marila* (Linnaeus, 1761), common goldeneye *Bucephala clangula* (Linnaeus, 1758), smew *Mergellus albellus* (Linnaeus, 1758), *etc.*) which winter off the southern coasts only during extreme cold snaps and freezing of shallow waters at their traditional wintering grounds in the Northern Black Sea Region. The absence of several species in some areas of the central Southern coast, where they used to winter regularly, is worth noting as well. Specifically, the black-throated diver and red-breasted merganser *Mergus serrator* Linnaeus, 1758 were not revealed in the coastal water areas of the Cape Martyan Nature Reserve and Yalta (the average long-term winter density in previous periods was 3.1 and 3.9 ind.·km^{-1}, respectively [Beskaravayny, 2008]). These species were registered only in the east of the region. In the Cape Martyan vicinity, the black-necked grebe was not recorded either, though it used to be one of the most permanent elements of the winter ornithological complex (the average long-term density is 4.1 ind.·km^{-1}).

In terms of abundance, fish-feeding or predominantly fish-feeding species (the Levantine shearwater and cormorants; off the eastern coasts, the black-throated diver) prevailed in different spots of the water area, as well as species of a wide trophic spectrum (the yellow-legged gull *Larus michahellis* J. F. Naumann, 1840 and Caspian gull *Larus cachinnans* Pallas, 1811). In the central Southern coast, due to significant aggregations of these species (except for the black-throated diver), the total abundance of wintering birds was maximum. A noticeable increase in the abundance of the black-headed gull in the vicinity of Yalta compared to the value in the period of depression in the late 1990s–early 2000s was registered, when 68–306 individuals wintered there [Beskaravayny, 2008; Kostin S. et al., 1998]. An aggregation of several tens of thousands of the Levantine shearwater was also observed in the open sea near Sevastopol on 23.01.2020 (M. Stefanovich, personal communication).

Quantitative prevalence of several species, characteristic of the open sea coasts, determined the low value of the Shannon index (1.54) – the indicator reflecting diversity and evenness of the ornithological complex. The minimum value was recorded in the vicinity of Yalta (0.38) because of a sharp prevalence of the black-headed gull. High variability in the relative abundance and diversity of ornithological complexes in the open water areas is due to a relatively short stay of flocks of migratory birds there, especially the Levantine shearwater, great cormorant *Phalacrocorax carbo* (Linnaeus, 1758), yellow-legged gull, and Caspian gull.

Out of abundant bird species in the open water areas, the great cormorant and Levantine shearwater should be noted, which performed active longshore migrations throughout the winter season. Specifically, longshore feeding migrations of cormorants were observed in the area from Yalta, where in January their intensity was more than 500 ind.·h^{-1}, to Sevastopol, where the abundance off the open sea coasts reached 2.2 thousand individuals. The following observations can illustrate the intensity of shearwater migrations: on 20 December, in 5 minutes, about 3 thousand birds flew south-westward off the coast of Karadag; on 27 January, the flight intensity eastward and westward in the vicinity of Yalta was 1,240 and 2,270 ind.·h^{-1}, respectively.

In the east of the region, a relatively high abundance of the black-throated diver was recorded. In the vicinity of Feodosiya and in some areas of the wild coast (the Karadag Nature Reserve), high concentrations of the mallard were registered. The group of dominants near the large cities – Feodosiya and Yalta – was supplemented by the coot and black-headed gull. These species, as well as the mute swan, common pochard *Aythya ferina* (Linnaeus, 1758), tufted duck *Aythya fuligula* (Linnaeus, 1758), and common gull *Larus canus* Linnaeus, 1758, occurred only or mainly within the city water areas (see Table 1).

In general, during a mild winter, the ornithological complex of open coasts is characterized by a relative scarcity of species composition, sporadic distribution, and low, compared to that for cold winters, abundance of most Anseriformes, coot, and some gulls. To confirm, let us compare the abundance of several species in the central area, the vicinity of Yalta (Fig. 2), during a mild winter (2020) and an extremely cold winter (2012) [Andryushchenko et al., 2012]. In 2012, cold span lasted from late January to mid-February (in the Northern Black Sea Region, the temperature dropped to −18…−27 °C). Water bodies were covered with ice until mid-March, and this caused a mass bird migration to southern coasts [Andryushchenko et al., 2012].

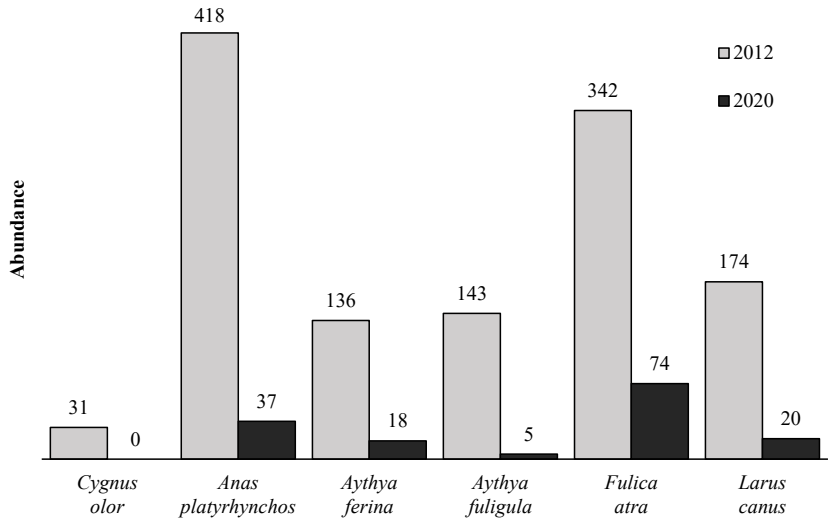

Fig. 2. Comparison of the abundance of several most common bird species wintering near Yalta under extreme cold winter conditions (January–early February 2012) [Andryushchenko et al., 2012] and mild winter conditions (January 2020)

Ornithological complex of closed Sevastopol bays. In the bays of the northern Heracles Peninsula, the formation of the winter ornithological complex began with an arrival of the great crested grebe (21 September) and a noticeable increase in the abundance of the mallard in September. Next month, the tufted duck (6 October) and common pochard (13 October) arrived. In the middle – the second half of this month, the abundance of the coot and black-headed gull (the second species is known to summer there) increased significantly. In November, there were the first records of the mute swan (6 November) and common gull (24 November). In the first half of December, the abundance of these two species, as well as the great crested grebe and great cormorant, increased noticeably; the abundance of the mallard, common pochard, and black-headed gull reached its maximum. In January, the highest abundance of the great cormorant and tufted duck was recorded. At the end of the first decade of February, which coincided with a short-term cold snap, the abundance of the great crested grebe, coot, and common gull was maximum. In February, the departure of the great cormorant, common

pochard, tufted duck (the last date was 10 March), and coot began. The great crested grebe, mute swan, and mallard began to leave the bays in the second half of February. The departure of the black-headed gull and common gull began in March, and the last date was 4 April. In the middle – the second half of March, most of the birds left the bays.

In the composition of the ornithological complex of Sevastopol bays, 29 species were registered in the winter 2019/2020 (Table 2), or 59.2% of the total number of species (49) recorded in this biotope for all the years of observations [Beskaravayny, 2013; Giragosov et al., 2015, 2021; our unpublished data]. For comparison: after a long cold snap in Crimea in the first half of January 2008 (down to −14 °C in Simferopol) [Weather Forecast and Archive, 2020], at least 35 species wintered in this area [Beskaravayny, 2013].

Table 2. Abundance of wintering birds in closed Sevastopol bays and on liman lakes near Feodosiya in the winter 2019/2020

Species	Sevastopol bays						Liman lakes near Feodosiya		
	Kaz., 1.14 km^2	Abr., 0.05 km^2	Kr., 0.66 km^2	Str., 0.78 km^2	Art., 0.13 km^2	Counted in total, 2.75 km^2	Kuchuk-Adzhigol, 0.3 km^2	Adzhigol, 0.25 km^2	Counted in total, 0.55 km^2
Gavia stellata	–	–	1	–	–	1	–	–	–
Gavia arctica	–	10	1	1	–	12	–	–	–
Podiceps ruficollis	16	–	3	6	–	25	–	–	–
Podiceps nigricollis	1	3	6	–	–	11	5	–	5
Podiceps auritus	1	–	1	–	–	2	–	–	–
Podiceps cristatus	317	–	90	1	–	408	14	–	14
Phalacrocorax carbo	153	4	13	19	5	189	–	–	–
Phalacrocorax aristotelis	1	2	–	–	–	3	–	–	–
Botaurus stellaris	–	–	–	–	–	–	1	–	1
Egretta alba	–	–	–	–	–	–	6	–	6
Ardea cinerea	2	–	1	1	–	4	6	–	6
Anser anser	–	–	–	–	–	–	50	–	50
Cygnus olor	2	–	18	–	–	20	71	1	72
Cygnus cygnus	–	–	–	–	–	–	14	–	14
Cygnus bewickii	–	–	–	–	–	–	5	–	5
Tadorna tadorna	–	–	–	–	–	–	48	21	69
Anas platyrhynchos	44	–	145	2	–	191	160	21	6
Anas crecca	14	–	1	–	–	15	2	–	2
Anas strepera	–	–	–	–	–	–	~40	–	~40
Anas penelope	1	–	–	–	–	1	2	–	2
Anas clypeata	–	–	–	–	–	–	15	–	15
Netta rufina	–	–	1	–	–	1	50	–	50
Aythya ferina	47	–	41	8	–	96	470	–	470
Aythya fuligula	64	–	46	10	97	217	39	–	39
Mergus serrator	3	–	–	–	–	3	–	–	–

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Species	Sevastopol bays						Liman lakes near Feodosiya		
	Kaz., 1.14 km^2	Abr., 0.05 km^2	Kr., 0.66 km^2	Str., 0.78 km^2	Art., 0.13 km^2	Counted in total, 2.75 km^2	Kuchuk-Adzhigol, 0.3 km^2	Adzhigol, 0.25 km^2	Counted in total, 0.55 km^2
Circus aeruginosus	–	–	–	–	–	–	1	–	1
Rallus aquaticus	–	–	1	–	–	1	–	–	–
Gallinula chloropus	2	–	5	7	–	14	–	–	–
Fulica atra	1,150	–	306	187	362	2,005	670	6	676
Tringa totanus	1	–	–	–	–	1	–	–	–
Calidris alpina	3	–	–	–	–	3	–	–	–
Gallinago gallinago	–	–	–	–	–	–	1	6	7
Larus melanocephalus	–	–	8	2	–	10	–	–	–
Larus ridibundus	40	2	245	194	121	602	18	32	50
Larus cachinnans	25	9	78	53	5	170	–	2	2
Larus michahellis								–	–
Larus canus	61	2	66	6	13	148	–	–	–
Thalasseus sandvicensis	4	–	1	–	–	5	–	–	–
Alcedo atthis	–	–	–	1	–	1	–	–	–
Emberiza schoeniclus	–	–	–	–	–	–	–	≥ 20	≥ 20
Total number of species	23	8	23	16	7	29	22	8	24
Total number of individuals	1,953	32	1,078	498	603	4,164	1,688	109	1,797
Abundance *per* 1 km^2	1,715	696	1,624	643	4,674	1,513	5,627	436	3,267
The Shannon index	1.49	1.72	2.07	1.50	1.09	1.82	1.84	1.74	1.96

Note. Sevastopol bays: Kazachya (Kaz.); Abramov (Abr.); Kruglaya (Kr.); Streletskaya (Str.); Artilleriiskaya (Art.).

Relatively high ecological diversity of the ornithological complex of the bays, which includes species typical of shallow waters (many Anseriformes and waders), reed beds (grebes, herons, coot, *etc.*), and open water areas (cormorants and gulls), is due to both significant intrabiotopic differentiation and their connection with the open sea. Six species were specific: the red-throated diver *Gavia stellata* (Pontoppidan, 1763), little grebe *Podiceps ruficollis* (Pallas, 1764), Slavonian grebe *Podiceps auritus* (Linnaeus, 1758), water rail *Rallus aquaticus* Linnaeus, 1758, common redshank *Tringa totanus* (Linnaeus, 1758), and dunlin *Calidris alpina* (Linnaeus, 1758).

In terms of the number of species, Anseriformes (8 out of 22 known here) and Lari (6 out of 8) prevailed. The whooper swan, Eurasian wigeon *Anas penelope* Linnaeus, 1758, red-crested pochard, common goldeneye, smew, *etc.*, which are common only during cold snaps, were not recorded at all or were rare. Compared to the data of counting after the cold snap in January 2008, the abundance of the common pochard, coot, and common gull in January 2020 was 2.5–3 times lower, and the abundance of the mute swan was 7 times lower.

In most bays, the coot and black-headed gull significantly prevailed. In the Kazachya Bay, the group of dominants was supplemented by the great crested grebe and great cormorant; in the Kruglaya Bay, by the mallard.

Conditions for birds were the most favorable in the Kazachya and Kruglyaya bays, which are distinguished by a variety of biotopes (reed beds and vast shallow waters with different types of sediments), variety of food resources (communities of phyto- and zoobenthos and rich ichthyofauna), and presence of rarely visited coastal areas within the boundaries of regime enterprises. For these reasons, the ornithological complexes of these two bays were characterized by high levels of diversity and were the leading ones both in terms of species richness and absolute abundance of birds (see Table 2).

A small number of wintering species in the Artilleriiskaya Bay results from the lack of shallow waters and riparian vegetation at the concreted shores, as well as from intensive shipping there. However, with a rather low abundance of individuals, the relative abundance (density) of birds in this bay was the highest – due to its small area.

In the Streletskaya Bay, the second largest among the surveyed bays, but subjected to negative factors (intensive shipping and arrangement of most of the coastline with berths), the relative abundance of birds was the lowest. Similar conditions determined the scarcity of the species composition and low relative abundance of birds in the small and more open, compared to others, Abramov Bay. In the composition of its ornithological complex, species typical of open coasts prevailed quantitatively (see Table 2).

Ornithological complex of liman lakes. On the lakes in the vicinity of Feodosiya, an increase in the abundance of the mute swan, common pochard, and tufted duck became noticeable in the first decade of October; of the mallard, in the middle of this month. In early January, the maximum abundance of the red-crested pochard was recorded, and the arrival of graylag goose *Anser anser* (Linnaeus, 1758) was established. In mid-January, the maximum abundance of the mute swan, mallard, common pochard, and coot was noted, and the first arrivals of the whooper swan and Bewick's swan *Cygnus bewickii* were registered (Fig. 3). By late January, the abundance of the tufted duck reached its maximum; in early February, Eurasian teal and common shelduck had the highest abundance. At the same time, the arrival of the gadwall *Anas strepera* Linnaeus, 1758 and Eurasian wigeon was registered. By the first decade of March, the abundance of the common pochard and coot decreased noticeably; by mid-March, the abundance of the mute swan and red-crested pochard dropped.

Fig. 3. Bewick's swans (*Cygnus bewickii*) and whooper swan (*Cygnus cygnus*) on Kuchuk-Adzhigol Lake near Feodosiya, 27.01.2020, photo by M. Kosareva

A total of 24 species were registered on the lakes during the winter 2019/2020 (see Table 2), or 58.5% of the total number of species recorded during wintering (41). The species composition was characterized by a significant number of species of the reed complex (13) and by high specificity (10 species: the Eurasian bittern *Botaurus stellaris* (Linnaeus, 1758), great egret *Egretta alba* (Linnaeus, 1758), greylag goose, whooper swan, Bewick's swan, gadwall, Northern shoveler *Anas clypeata* Linnaeus, 1758, marsh harrier, common snipe *Gallinago gallinago* (Linnaeus, 1758), and reed bunting).

The number of species, absolute abundance, and relative abundance of birds on the more full-flowing Kuchuk-Adzhigol Lake were significantly higher than on Adzhigol Lake. The ornithological complex was formed mostly by Anseriformes (11 species). In terms of abundance, throughout the wintering period, the common pochard, mallard, and coot prevailed. Short-term aggregations of the gadwall and Bewick's swan were the largest known for these species in the Southern Crimea.

Conclusion. Under the conditions of mild winter prevailing in the Northern Black Sea Region in 2019/2020, at least 44 species of hydrophilic birds from 11 orders, or 61.1% of all species known to winter in this area (72), wintered off the sea coasts of the Southern Crimea [Andryushchenko et al., 2012; Beskaravayny, 2008; Beskaravayny, Kostin S., 1999; Kostin Yu., 1983; Mosalov et al., 2002].

The qualitative and quantitative scarcity of ornithological complexes in such winters is most noticeable on water areas off the open sea coasts. This, along with the weather factor, is due to relative monotony and low food supply of biotopes. There, less than half of the species known for these biotopes is recorded. The abundance of most Anseriformes, the coot and some gulls is lower compared to that in cold winters. In some areas, several regularly wintering species are not registered at all (the black-throated diver, black-necked grebe, and red-breasted merganser).

The role of these water areas as a winter habitat for hydrophilic birds increases only during cold snaps, when the freezing of water bodies in the north of the peninsula and in continental areas causes a mass bird migration to southern coasts. Specifically, in some areas of the central Southern coast, the abundance of background species in the warm winter 2019/2020 was 8 times lower than that during the extremely cold winter 2011/2012.

Ornithological complexes associated with water areas more or less isolated from the open sea were represented more fully (about 60% of the total species composition). The maximum species and ecological diversity of birds was established for closed Sevastopol bays, which are protected from winter storms and are characterized by diversity of biotopes. However, with a rather high abundance in 2020, the abundance of some background species compared to that for the cold winter 2008 was 2.5–7 times lower. A large number of species of the reed complex and the highest specificity of the species composition can be considered as characteristic features of the ornithological complex of liman lakes which are completely isolated from the sea.

Anseriformes, with their relative qualitative scarcity (14 species, or 50% known in the area), however, prevailed in the number of species (except for water areas near open shallow coasts). By the abundance, representatives of this order – the mallard and common pochard – were in the group of dominants on the Kuchuk-Adzhigol Lake near Feodosiya and in most Sevastopol bays. Lari – the second group in terms of species diversity – were presented more fully (8 species, or 61.5%). Their abundance was high in Sevastopol bays, in the vicinity of other large cities (the black-headed gull), and in some non-urbanized areas of the coast (the yellow-legged gull and Caspian gull). Among the prevailing species, there were also the great cormorant, Levantine shearwater (on open water areas), and coot (in bays and on liman lakes).

A very high abundance of the Levantine shearwater and a significant increase in the abundance of the black-headed gull in the vicinity of Yalta were characteristic features of the winter period 2019/2020. Of interest are the registrations of the red-throated diver and Arctic skua which are known in winter in Crimea from single observations [Kostin Yu., 1983]. Wintering of five Bewick's swans in the south of the peninsula confirms the tendency for this species to increase in the abundance in the south of Russia and Ukraine since the first half of the1980s [Belik et al., 2012].

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ОСОБЕННОСТИ ЗИМОВКИ ГИДРОФИЛЬНЫХ ПТИЦ У МОРСКИХ БЕРЕГОВ ЮЖНОГО КРЫМА В УСЛОВИЯХ МЯГКОЙ ЗИМЫ 2019/2020 Г.

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Береговая зона — основное на юге Крыма зимнее местообитание гидрофильных птиц, видовой и количественный состав которых изучены достаточно полно, в том числе в условиях экстремальных похолоданий. Для выяснения влияния погодных условий на состояние орнитокомплексов и динамику внутрирегиональных перемещений птиц интерес представляет сравнение особенностей зимовки в тёплые и холодные зимы. Цель данной работы — выявить видовой состав, численность и биотопическое распределение гидрофильных птиц в южной части Крымского полуострова в условиях мягкой зимы. Исследования проведены в районе от посёлка Приморский у Феодосии до Севастополя (около 250 км) зимой 2019/2020 г., отличающейся преобладанием положительных температур. Обследованы основные береговые биотопы — акватории у открытых берегов, закрытые бухты и лиманные озёра. У открытых берегов выявлено 24 вида, что значительно меньше, чем в холодные сезоны (для сравнения: в холодную зиму 2012 г. здесь зимовал 41 вид). По разнообразию доминировали чайковые и гусеобразные; отмечены высокая численность и активная вдольбереговая миграция левантского буревестника и большого баклана, а также более низкая, чем в холодные зимы, численность гусеобразных, лысухи и некоторых чаек. В севастопольских бухтах выявлено 29 видов (для сравнения: в холодном январе 2008 г. — 35 видов). По разнообразию лидировали гусеобразные и чайковые, по численности — лысуха и озёрная чайка. На лиманных озёрах зимовало 24 вида, доминировали лысуха и гусеобразные, в основном красноголовая чернеть. Всего во всех исследованных биотопах в период мягкой зимы 2019/2020 г. обнаружено 44 вида птиц (61,1 % зимующих в регионе) из 11 отрядов. К особенностям зимы 2019/2020 г. относится высокая численность левантского буревестника; отмечена зимовка краснозобой гагары, короткохвостого поморника и малых лебедей.

Ключевые слова: гидрофильные птицы, Южный Крым, зимовка, мягкая зима, открытый берег, закрытые бухты, лиманные озёра, видовой состав, численность