

Bird and Mammal at-sea Distribution Along the North-East Passage off Siberia

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Abstract

Quantitative seabird and marine mammal at-sea distribution was determined along the North-East Passage, off Siberia, in August 2017. A total of 18,400 seabirds were tallied during 340 transect counts, belonging to 31 species. Some bird species were numerically dominant: fulmar *Fulmarus glacialis*, Brünnich's guillemot *Uria lomvia*, short-tailed shearwater *Puffinus tenuirostris* and crested auklet *Aethia cristatella* representing more than 90 % of the total.

Humpback *Megaptera novaeangliae* and bowhead whales *Balaena mysticetus* formed the bulk of the 100 large whales, as well as 40 white-beaked dolphins *Lagenorhynchus albirostris*, concentrated in a major hotspot. Two species represented 97 % of the 910 identified pinnipeds: harp seal *Phoca goenlandica* and walrus *Odobenus rosmarus*. Polar bear *Ursus maritimus* was detected as 75 individuals, while more than 3,500 were noted on Wrangel Island, out of effort. The major factors affecting top predators' quantitative distribution were the geographic differences between seas, and the importance of a major hotspot for humpback whales and harp seals.

Keywords: Seabird and Marine Mammal At-Sea Distribution, North-East Passage, Siberia

Introduction

In the frame of our long-term study on the at-sea distribution of "top predators" - seabirds and marine mammals - in polar ecosystems, our main aims are to study the environmental factors explaining their distribution at sea, as well as to detect possible temporal and spatial evolutions, with special attention to global climatic changes.

Materials and methods

Seabird and marine mammal quantitative at-sea distribution was studied during the cruise on board a small tourist's ship (110 m long, 50 passengers) along the North-East Passage from Anadyr to Murmansk, from 1 to 27 August 2017. Mean speed was 10.1 kn. Transect counts were conducted from the bridge (11 m above sea level) without width limitation during 30 min periods, on a continuous basis as ship operations, light and visibility conditions allowed. When detected, followers were included as far as possible once per count only. More details on our counting method have been described and discussed previously [1, 2, 3, 4]. Taking into account the importance of followers and the great heterogeneity in the distribution of top predators, basic data are presented in this article, without correction e.g. for the diving pattern of the animals. Nor are calculations such as density included. Ice coverage was low,

consisting of old broken pack ice, with the exception of solid pack ice south of Severnaya Zemlya and to some extent Franz-Josef Land (Figure 1).

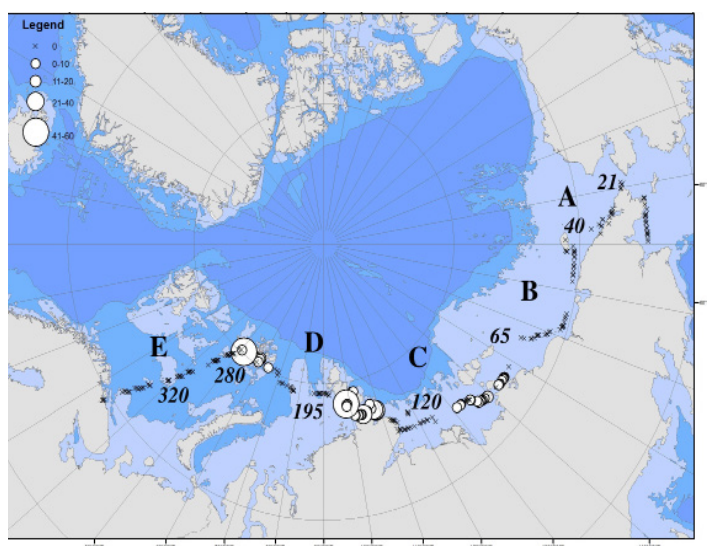


Figure 1: Transect counts for seabirds and marine mammals along the North-East Passage, 1 to 27 August 2017: ice cover, main zones, count number (see text); the change of colour between light and dark blue corresponds to the 200 m iso-depth

Results and Discussion

A synopsis of seabird and marine mammal observations registered during the expedition is presented in Table 1. A total of 18,400 seabirds belonging to 32 species were tallied during 340 transect counts, i.e. a mean of 54 per count. Five species represented more than 90 % of the total: 4,310 fulmars *Fulmarus glacialis* (3,100 light L morphs, 1,070 dark D morphs), 3,600 Brünnich's guillemots *Uria lomvia*, 3,540 kittiwakes *Rissa tridactyla*, 3,370 short-tailed shearwaters *Puffinus tenuirostris* and 2,145 crested auklets *Aethia cristatella*. The other species with numbers lower than 650 each, were largely coastal ones. Sixty humpback whales *Megaptera*

novaeangliae and 24 bowheads *Balaena mysticetus* formed the bulk of the 100 identified large whales; 40 white-beaked dolphins *Lagenorhynchus albirostris* were tallied as well. The most numerous pinnipeds were 500 harp seals *Pagophila groenlandicus* and 380 walrus *Odobenus rosmarus*, representing 97 % of the 910 identified species. Seventy-five polar bears *Ursus maritimus* were recorded during counts. More than 3,500 individuals were observed out of effort (stationary ship), grazing on the slopes of Wrangel Island mountains, representing a significant part of the world population generally evaluated between 20,000 and 40,000 individuals [e.g. 5].

Table 1: Seabirds and marine mammals tallied along the North-East Passage, August 2017, n = number of 30 min transect counts, N = total number recorded; mean per count

	Zone n Ice %	All 339 1.6 N	mean
White-billed diver	<i>Gavia adamsii</i>	1	
Arctic diver	<i>Gavia stellata</i>	3	
Diver sp	<i>Gavia sp</i>	4	
Fulmar LL morph	<i>Fulmarus glacialis</i>	39	0.12
L morph	<i>Fulmarus glacialis</i>	3110	9.00
D morph	<i>Fulmarus glacialis</i>	1072	3.00
DD morph	<i>Fulmarus glacialis</i>	91	0.27
Fulmar all	<i>Fulmarus glacialis</i>	4312	13.0
Short-tailed shearwater	<i>Puffinus tenuirostris</i>	3367	10.0
Leach's storm-petrel	<i>Oceanodroma leucorhoa</i>	2	
Gannet	<i>Sula bassana</i>	1	
Pelagic cormorant	<i>Phalacrocorax pelagicus</i>	9	
Pomarine skua	<i>Stercorarius pomarinus</i>	96	0.28
Great skua	<i>Catharacta skua</i>	1	
Arctic skua	<i>Stercorarius parasiticus</i>	38	0.11
Long-tailed skua	<i>Stercorarius longicaudus</i>	12	
Skua sp	<i>Stercorarius sp</i>	55	0.16
Herring gull	<i>Larus argentatus</i>	74	0.22
Lesser black-backed gull	<i>Larus fuscus</i>	2	
Great black-backed gull	<i>Larus marinus</i>	2	
Common gull	<i>Larus canus</i>	10	
Sabine's gull	<i>Xema sabini</i>	1	
Glaucous gull	<i>Larus glaucoides</i>	37	0.11
Ivory gull	<i>Pagophila eburnea</i>	30	0.09
Kittiwake	<i>Rissa tridactyla</i>	3540	10.0
Arctic tern	<i>Sterna paradisaea</i>	6	
Black guillemot	<i>Cephus grylle</i>	161	0.47

Atlantic puffin	<i>Fratercula arctica</i>	4	
Little auk	<i>Alle alle</i>	649	1.90
Brünnich's guillemot	<i>Uria lomvia</i>	3630	10.7
Common guillemot	<i>Uria aalge</i>	32	0.09
Horned puffin	<i>Fratercula corniculata</i>	4	
Pigeon guillemot	<i>Cepphus columba</i>	96	0.28
Tufted puffin	<i>Lunda cirrhata</i>	60	0.18
Crested auklet	<i>Aethia cristatella</i>	2144	6.32
Least auklet	<i>Aethia pusilla</i>	2	
Parakeet auklet	<i>Cyclorhynchus psittacula</i>	3	
Σ birds		18380	54
Humpback whale	<i>Megaptera novaeangliae</i>	59	0.37
Grey whale	<i>Eschrichtius robustus</i>	8	
Bowhead	<i>Balaena mysticetus</i>	24	0.07
Blue whale	<i>Balaenoptera musculus</i>	5	
Minke whale	<i>Balaenoptera acurostrata</i>	1	
White-beaked dolphin	<i>Lagenorhynchus albirostris</i>	43	0.13
Large whale sp		18	
Σ cetaceans		158	0.46
Harp seal	<i>Pagophilus groenlandicus</i>	508	1.50
Bearded seal	<i>Erignathus barbatus</i>	19	
Ringed seal	<i>Pusa hispida</i>	3	
Walrus	<i>Odobenus rosmarus</i>	379	1.12
Piniped sp	<i>Pinipedia sp</i>	35	0.1
Σ pinipeds		947	2.8
Polar bear	<i>Ursus maritimus</i>	74	0.7

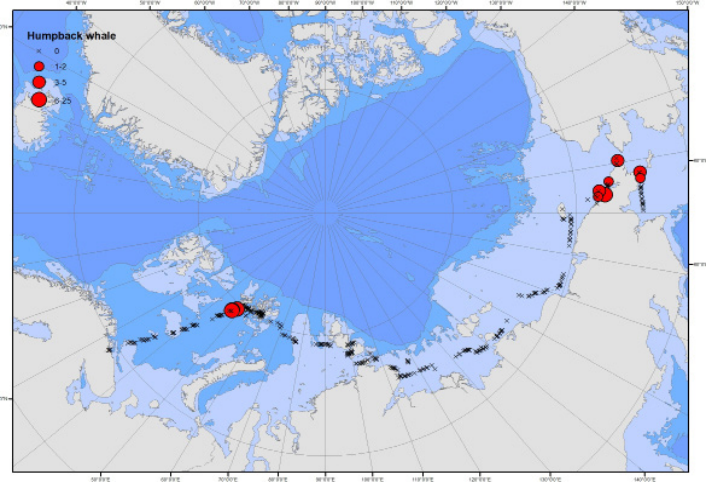
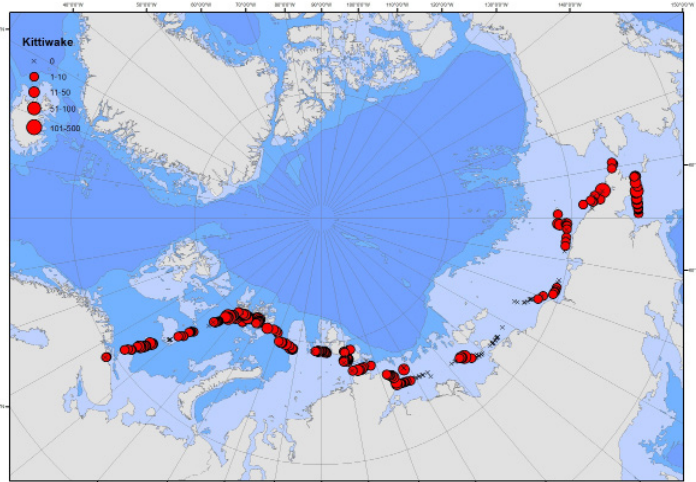
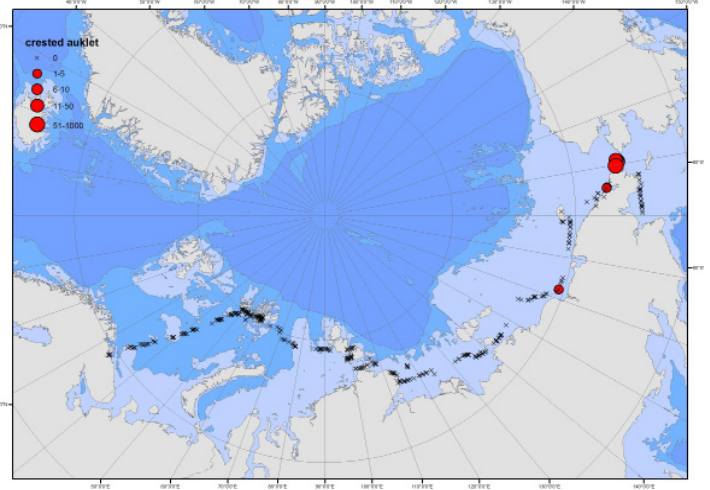
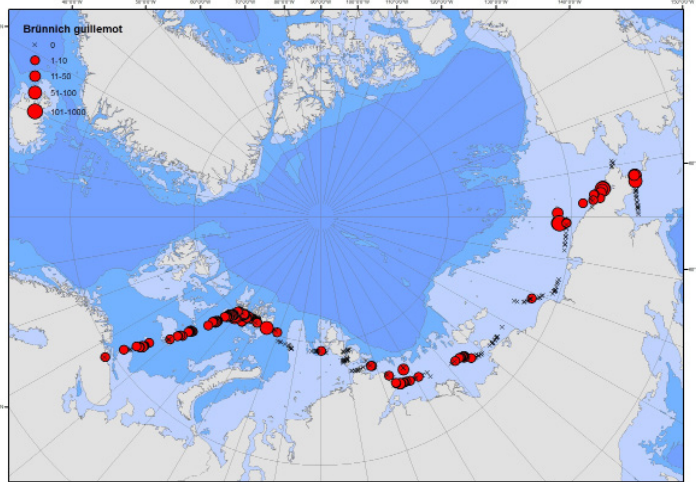
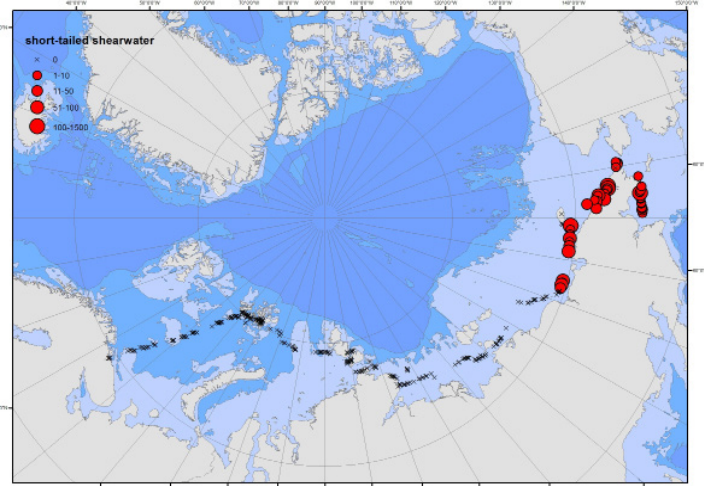
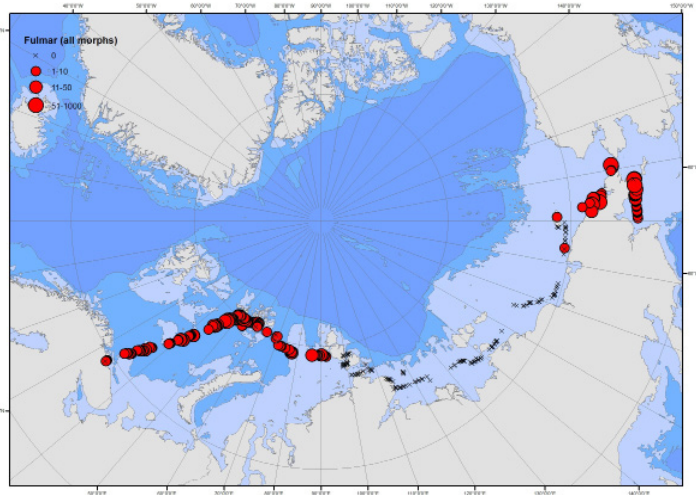
Seabird distribution was clearly influenced by geographical features. Six zones were thus recognised, corresponding to the different seas covered by the study. Zone A covers the Bering and Chukchi seas, excluding the strictly coastal area around Wrangel Isl; zone B the East Siberian Sea; zone C the Laptev Sea and zone E the Barents Sea (Figure 1). The data for the most numerous species plus the Arctic gulls as bio-indicators are shown in Table 2 and (Figure 2). The differences between zones are striking for all seabirds (in mean value per count): 180 in A, 56 in E, 35 in B and C, 23 in D. Differences were also noted in the number of species, from 15 in zone A to 9 in zone D. Moreover, species composition also strongly varies, the most numerous species being fulmar in A (including a few DD and LL morphs: Figure 3) and E, but close to absent in B, C and D. Short-tailed shearwater dominated in A, B and C – including a flock of 1,500 at count 53 –, crested auklet flying in large flocks in A, kittiwake and Brünnich's guillemot in A and E. Special observations concern the first observations of juvenile kittiwakes *Rissa tridactyla pollicaris* on 24 August at counts 299 and 307 (Figure 4). First juvenile Brünnich's guillemots accompa-

nied by an adult were tallied from 24 August at count 305 on. Other species were four long-tailed ducks *Clangula hyemalis* at count 81, and eider ducks: a flock of 150 king eiders *Somateria spectabilis* (mainly females) at count 149, a spectacled eider *Somateria fischeri* at count 24, and an unidentified female eider at count 98.

A similar situation was registered for cetaceans: humpback whale in A and E, bowhead and white-beaked dolphin in E and for pinipeds: harp seal in E, walrus in B, C and E. More than 10 adult belugas *Delphinapterus leucas* and 25 large seals *Phoca largha* and were tallied in the harbour of Anadyr, out of effort.

Numbers of seabirds and marine mammals were very low in the shallow East Siberian, Laptev and Kara seas and clearly higher in the Bering/ Chukchi and Barents seas. So was the number of species. As a whole, these data and the ones already collected in the high Arctic [6, 7, 8] basically fit the model on bird species diversity by Humphries and Huettmann, including the slightly higher number of species around Wrangel Isl [9].

Figure 2: Distribution maps of the main seabird and marine mammal species along the North-East Passage, 1 to 27 August 2017: fulmar *Fulmarus glacialis*, all morphs (a), Brinnich's guillemot *Uria lomvia* (b), kittiwake *Rissa tridactyla* (c), short-tailed shearwater *Puffinus tenuirostris* (d), crested auklet *Aethia pusilla* (e), humpback whale *Megaptera novaeanglia* (f), white-beaked dolphin *Lagenorhynchus albirostris* (g), walrus *Odobenus rosmarus* (h) (see Table 2)



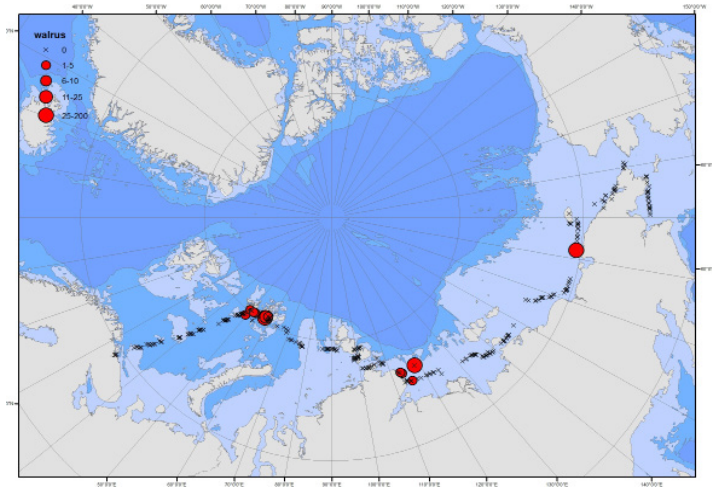
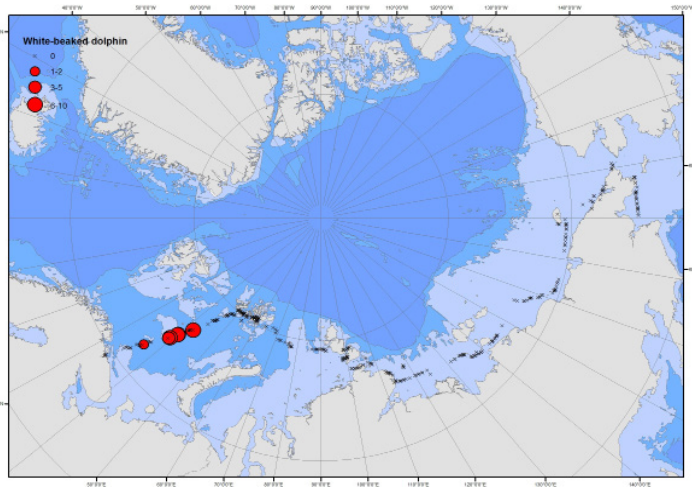


Table 2: Seabirds and marine mammals tallied along the North-East Passage, August 2017, most numerous species + Arctic gulls, excluding the coastal counts around Wrangel Isl; n = number of 30 min counts, N = total number recorded; mean per count

	Zone	A*		B*		C*		D*		E*	
	<i>n</i>	42		66		89		21		127	
	Ice %	0		1.3		3.3		0		1.3	
	Water temperature SST °	8		4.5		1.7		1.4		1.9	
		N	mean	N	mean	N	mean	N	mean	N	mean
Fulmar LL morph	<i>Fulmarus glacialis</i>	39	1.0	0		0		0		0	
L morph	<i>Fulmarus glacialis</i>	1817	45	1		1		83	4.0	1268	10
D morph	<i>Fulmarus glacialis</i>	65	1.6	0		5		62	3.0	1008	8
DD morph	<i>Fulmarus glacialis</i>	90	2.2	0		0		0		0	
Fulmar all	<i>Fulmarus glacialis</i>	2031	50	1		8		145	6.9	2276	18
Short-tailed sheawater	<i>Puffinus tenuirostris</i>	1530	37	1857	28	1885	21	0		0	
Pomarine skua	<i>Stercorarius pomarinus</i>	5	0.1	1		44	0.5	21	1.0	48	0.4
Arctic skua	<i>Stercorarius parasiticus</i>	0		4		21	0.2	1		17	
Long-tailed skua	<i>Stercorarius longicaudus</i>	1		1		3		3		8	
Skua sp	<i>Stercorarius sp</i>	0		2		30	0.3	6		27	0.2
Herring gull	<i>Larus argentatus</i>	32	0.8	13	0.2	33	0.3	0		9	
Common gull	<i>Larus canus</i>	10		0		0		0		0	
Sabine's gull	<i>Xema sabini</i>	1		0		0		0		0	
Glaucous gull	<i>Larus glaucooides</i>	10		13	0.2	21	0.2	0		6	
Ivory gull	<i>Pagophila eburnea</i>	0		0		22	0.2	4		8	
Kittiwake	<i>Rissa tridactyla</i>	643	16	165	2.5	656	7.4	287	14	2325	18
Black guillemot	<i>Cephus grylle</i>	0		8		109	1.2	6		59	0.5
Little auk	<i>Alle alle</i>	8		0		0		4		610	5.0
Brünnich's guillemot	<i>Uria lomvia</i>	633	15	45	0.7	233	2.6	2		1627	13
Common guillemot	<i>Uria aalge</i>	31	0.8	0		0		0		1	
Pigeon guillemot	<i>Cephus columba</i>	91	2.2	0		0		0		0	

Tufted puffin	<i>Lunda cirrhata</i>	60	1.5	0		0		0		0	
Crested auklet	<i>Aethia cristatella</i>	2143	52	1		1		0		0	
Nb identified species		15		11		12		9		12	
Σ birds		7356	179	2149	33	3280	37	482	23	7049	56
Humpback whale	<i>Megaptera novaeangliae</i>	20		0		0		0		39	0.3
Grey whale	<i>Eschrichtius robustus</i>	8		0		0		0		0	
Bowhead	<i>Balaena mysticetus</i>	3		0		0		0		21	0.3
Blue whale	<i>Balaenoptera musculus</i>	0		0		0		0		5	
White-beaked dolphin	<i>Lagenorhynchus albirostris</i>	0		0		0		0		43	0.3
Σ cetaceans		31	0.8	0		0		0		103	0.8
Harp seal	<i>Pagophilus groenlandicus</i>	0		0		0		0		508	4.0
Bearded seal	<i>Erignathus barbatus</i>	0		3		18		0		1	
Walrus	<i>Odobenus rosmarus</i>	0		75	1.1	128	1.4	0		252	2.0
Σ pinipeds		0		81	1.2	185	2.1	0		763	6.0
Polar bear	<i>Ursus maritimus</i>	0		0		3		0		2	

*: A: Bering and Chukchi seas; B: East Siberian Sea; C: Laptev Sea; D: Kara Sea; E: Barents Sea

Figure 3: Fulmar *Fulmarus glacialis*: LL morph (a) and DD morph (b), zone A (see text). Photos CJ



Figure 4: Juvenile kittiwake *Rissa tridactyla pollicaris*, 24 August. Photo CJ



The results are strongly influenced by the detection of a major hotspot at count 290 above the slope of a sand bank South-West of Franz Josef Land (FJL), including 25 humpback whales actively feeding in an area corresponding to the northern limit of their distribution, including at least one calf, 500 harp seals - apparently all immature - swimming on the back in large splashes in the same direction and thus clearly not feeding (Figure 5), 1,000 fulmars and 500 kittiwakes. Five blue whales *Balaenoptera musculus* were simultaneously present at some distance. This single hotspot contained all harp seals, half of all humpback whales and a significant part of the fulmars (25 %) and kittiwakes (14 %) tallied during the whole cruise. The importance of such hotspots was stressed already in previous studies in both polar areas [3, 9-13].



Moreover, undetected followers might lead to a strong over-estimation of their abundance as it is often the case for some species, e.g. the presence of 10 L fulmars and 10 kittiwakes at eight successive counts. A pomarine skua *Stercorarius pomarinus*, recognisable by a broken long tail-feather, was observed during a full day. The potential influence of followers concerns mainly tubenoses and *Laridae* and was stressed already [6]. It becomes especially obvious in areas with extremely low ships concentration (none seen during weeks).

Fig. 5. A pod of 500 immature harp seals *Phoca groenlandica*, in a hotspot at count 290 on 24 August 2017, Barents Sea (see text). Photos CJ



Conclusions

Seabird and marine mammal density and the number of species are low in the high Arctic. Along the North-East Passage – a very poorly studied area –, both were high in the Barents Sea (zone E) and the Bering/ Chukchi seas (A) but clearly lower in the central part, i.e. the shallow seas: East Siberian (B), Laptev (C) and Kara (D).

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