

Seabird and Marine Mammal at-sea Distribution in the Norwegian, Greenland and Wandel Seas, 2018

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Abstract

Quantitative seabird and marine mammal at-sea distribution was determined in the Norwegian, Greenland and Wandel seas in August 2018 on board the icebreaking RV *Polarstern*. A total of 7,380 seabirds belonging to 25 species were tallied during 380 transect counts lasting 30 minute each, i.e. a mean value of 19 per count. Cetaceans were represented by seven species (mean of 0.1 per count) and pinnipeds by four species (0.1 per count). Numbers of seabird species and of individuals were low in the Norwegian Sea and the Greenland Sea (12 and 14 species, 4 and 8 individuals per count). They were especially low in the Wandel Sea off North Greenland: seven seabird species (2 individuals per count), mainly ivory gull *Pagophila eburnea* and fulmar *Fulmarus glacialis*. Cetaceans were absent and pinnipeds represented by three species only (0.3 per count). These concentrations are extremely low even when compared to other areas of the high Arctic Ocean.

Keywords: Seabirds & Marine Mammals, at-sea Distribution, Wandel Sea

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 PS115/1 (ARK XXXII/2) expedition of the ice-breaking RV *Polarstern* in August 2018 from Tromsø, Norway, to the Wandel Sea, North-East Greenland, back to Longyearbyen, Spitsbergen (Fig. 1). Our counting methodology is adapted to polar marine ecosystems with (very) low densities. It also aims at limiting the influence of undetected followers being registered once per count maximum, i.e. per 30 min instead of per ten min in the “usual” method. Transect counts were conducted from the bridge (18 m above sea level) without width limitation during 30 min periods, on a continuous basis when light and visibility conditions allowed and when speed was higher than seven knots: results collected at lower speed e.g. during seismic measurements, are treated as “out of effort”. 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]. One observer was counting from the side of the bridge, thus covering an angle of

90° ahead, in four hour watches. Animals were detected with naked eye and observations confirmed with 10X40 binoculars when necessary. Ice conditions were especially low, with the ice-edge at 84°N (Fig. 2a) instead of 82°N e.g. in the nineties or for comparison in August 2009 (Fig. 2b) [3]. Moreover, multi-year ice till the nineties was basically replaced by first-year ice during winter afterwards.

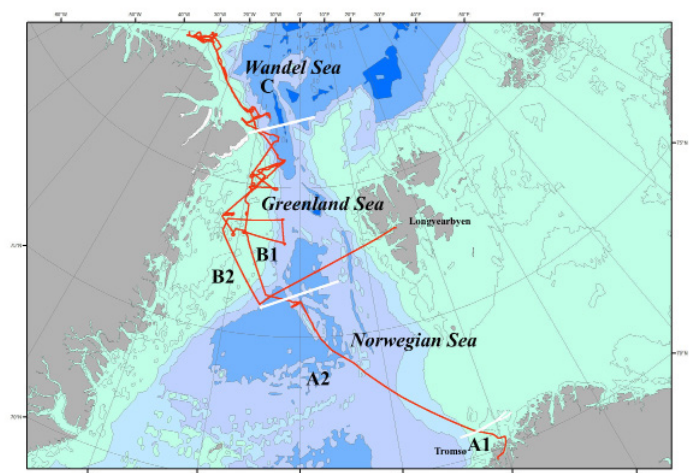


Figure 1: Expedition PS115-1 of RV *Polarstern*, August 2018: itinerary; main geographical zones based on data in [4] (see text)

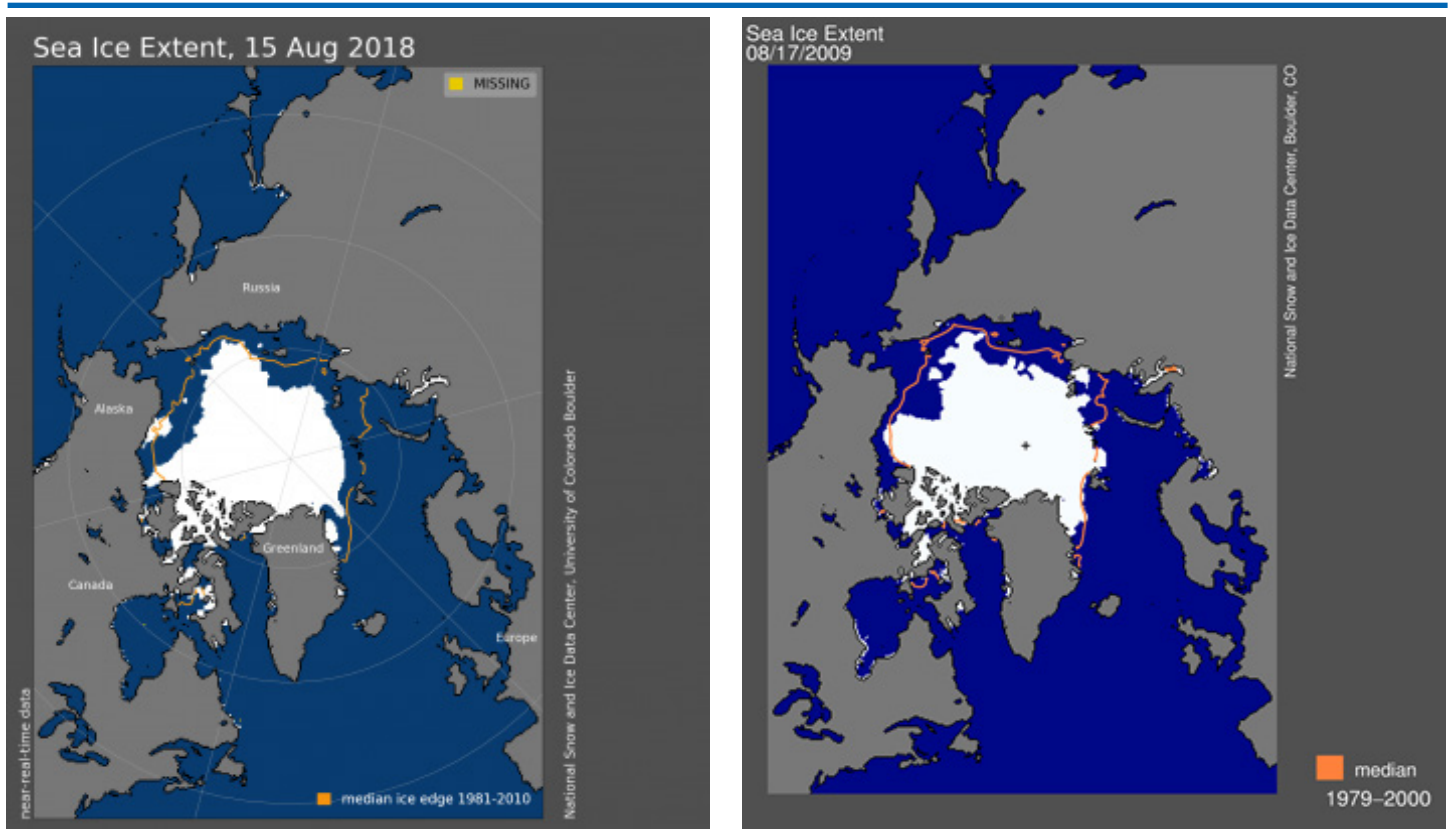
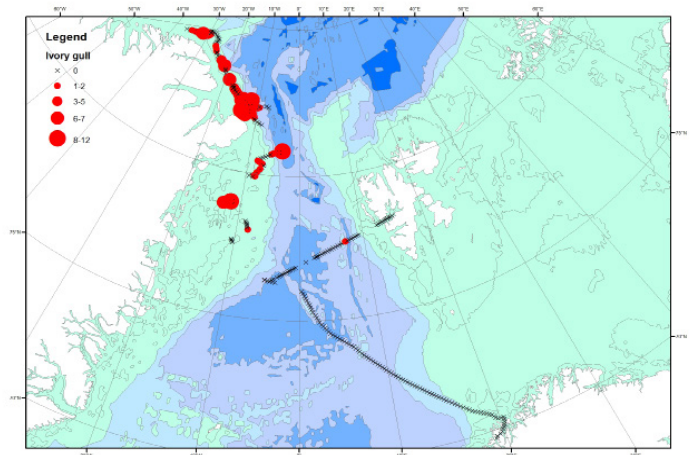
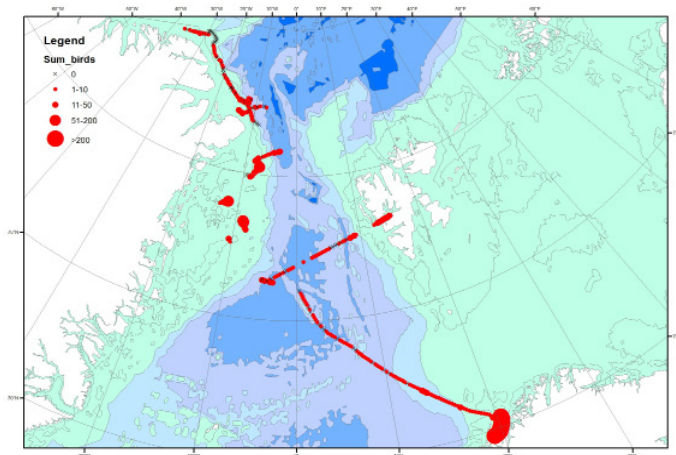


Figure 2: Ice conditions on 15 August 2018 (a) and on 17 August 2009 (b) for comparison (National Snow and Ice Data Centre)

Results

A synopsis of seabird and marine mammal observations registered during the expedition is presented in Table 1. A total of 7,380 seabirds belonging to 25 species were tallied during 380 transect counts, i.e. a mean of 20 per count. Geographical differences were important: excluding the strictly coastal area A1, 12 species were tallied in the Norwegian Sea (A2), (3.9 individuals per count), 14 species in the Greenland Sea and Fram Strait (eight per count) and seven species in the Wandel Sea (two per count). The most numerous species in the Norwegian Sea were the fulmar *Fulmarus*

glacialis (3.3 per count, 3.1 light L morph) and the puffin *Fratercula arctica* (1 per count), representing together 90% of the total. In the Greenland Sea, three species out of 14 were dominant in numbers representing 90% of the total of 9 per count: little auk *Alle alle* (4 per count), fulmar (2.2 per count, 1.4 L morph and 0.9 D morph) and ivory gull *Pagophila eburnea* (one per count). Numbers were much lower in the Wandel Sea, including many counts without any observation. The three same species out of seven represented 96% of the total of 2 per count: ivory gull (1.3 per count) fulmar (0.6 per count) and little auk (0.1 per count) (Fig. 2 & 3, Table 1).



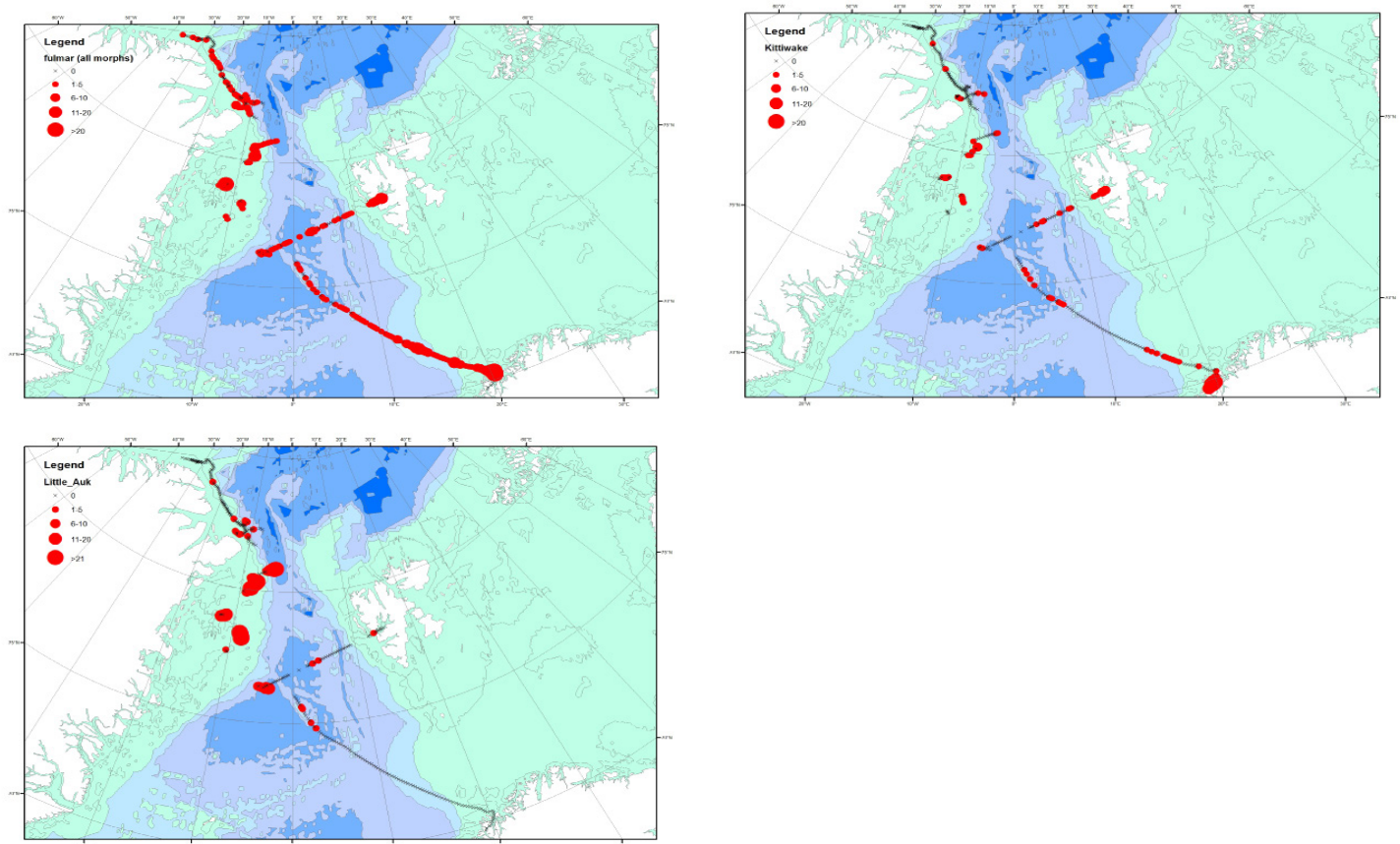


Figure 3: Distribution maps for the main seabird species in numbers per 30 min transect count: all birds (a); fulmar all (b); ivory gull (c); kittiwake (d); little auk (e). See text and Table 1

A similar situation was registered for cetaceans: 0.4 per count, belonging to six species in the Norwegian Sea; 0.1 belonging to four species in the Greenland Sea and Fram Strait, none in the Wandel Sea. In contrast, pinnipeds were absent in the Norwegian Sea and present in low numbers in the Greenland Sea (0.4 per count, 3 species) and the Wandel Sea (0.3 per count, 3 species). Numbers of polar bears *Ursus maritimus* were low as well (0.03

and 0.02 per count respectively).

As we followed the same transect the return route in the Greenland Sea (B1 and partim North-South transect) and in the Wandel Sea (C1 and C2), a reproducibility test was applied. Reproducibility can be considered as very good, most of the data for the main species differing within a factor two (Table 2).

Table 1: Observations of seabirds and marine mammals registered during the PS115-1 expedition of RV Polarstern in the Norwegian, Greenland and Wandel seas, August 2018; n = number of 30 min transect counts; N = total number; mean number per count

	Zone	All		A*		B*		C*		
	Speed (knots)			11.3		7.5		6.8		
	n	381		88		166		128		
Species	Species	N	mean	N	mean	N	mean	N	mean	Remark
Arctic diver	<i>Gavia stellata</i>	1		1		0		0		
Fulmar L	<i>Fulmarus glacialis</i>	645	1.7	390	4.4	232	1.4	23	0.2	
Fulmar D	<i>Fulmarus glacialis</i>	207	0.5	13	0.15	146	0.9	48	0.4	
Fulmar all	<i>Fulmarus glacialis</i>	840	2.2	403	4.6	366	2.2	71	0.6	
Gannet	<i>Sula bassana</i>	6		6		0		0		
Pomarine skua	<i>Stercorarius pomarinus</i>	0		0		0		0		1 out of effort
Arctic skua	<i>Stercorarius parasiticus</i>	25	0.1	17	0.2	7	0.04	1		off Norway
Long-tailed skua	<i>Stercorarius longicaudus</i>	11	0.03	4	0.05	6	0.04	1		
Skua sp	<i>Stercorarius sp</i>	11	0.03	1		8	0.05	2		
Herring gull	<i>Larus argentatus</i>	1204	3.2	1204	13.7	0		0		off Norway
Lesser black-backed gull	<i>Larus fuscus</i>	2		2		0		0		off Norway
Great black-backed gull	<i>Larus marinus</i>	643	1.7	643	7.3	0		0		off Norway
Common gull	<i>Larus canus</i>	61	0.2	61	0.7	0		0		off Norway
Sabine's gull	<i>Xema sabini</i>	1		0		0		1		+ 1 out of effort
Glaucous gull	<i>Larus glaucooides</i>	9	0.02	0		9	0.05	0		
Ivory gull	<i>Pagophila eburnea</i>	342	0.9	0		171	1.0	171	1.3	
Kittiwake	<i>Rissa tridactyla</i>	228	0.6	141	1.6	84	0.5	3		
Common tern	<i>Sterna hirundo</i>	18	0.05	18	0.2	0		0		off Norway
Arctic tern	<i>Sterna paradisaea</i>	44	0.1	27	0.3	17		0		
Black guillemot	<i>Cephus grylle</i>	2		0		2		0		
Atlantic puffin	<i>Fratercula arctica</i>	3120	8.3	3043	34.6	0		0		off Norway
Little auk	<i>Alle alle</i>	713	1.9	3		693	4.2	17	0.1	
Brünnich's guillemot	<i>Uria lomvia</i>	15	0.04	0		15	0.1	0		
Common guillemot	<i>Uria aalge</i>	48	0.13	44	0.5	4	0.02	0		
Razorbill	<i>Alca torda</i>	3		3		0		0		
Common eider	<i>Somateria mollissima</i>	5		5		0		0		
∑ birds		7351	19.3	5625	64.0	1382	8.3	267	2.1	
Number of species		25		18		14		7		
Harbour porpoise	<i>Phocoena phocoena</i>	5		5		0		0		
Humpback whale	<i>Megaptera novaeangliae</i>	3		0		3		0		
Bowhead	<i>Balaena mysticetus</i>	0		0		0		0		1 out of effort, E Greenland
Fin whale	<i>Balaenoptera physalus</i>	3		2		1		0		+ 5 out of effort, Fram Strait
Blue whale	<i>Balaenoptera musculus</i>	0		0		0		0		2 out of effort
Minke whale	<i>Balaenoptera acurostrata</i>	7		5		2		0		
Sperm whale	<i>Physeter macrocephalus</i>	5		5		0		0		
Killer whale	<i>Orcinus orca</i>	9		9		0		0		
Dolphin sp	<i>Lagenorhynchus</i>	6		6		0		0		White-beaked or white-sided
Large whale sp		7		3		5		0		
∑ cetaceans		46	0.12	35	0.4	11	0.07	0		

Number of species		7		6		4		0		
Harp seal	<i>Pagophilus groenlandicus</i>	3		0		3		0		+ 10 out of effort
Bearded seal	<i>Erignathus barbatus</i>	10	0.03	0		7	0.04	3		
Ringed seal	<i>Pusa hispida</i>	12	0.03	0		9	0.05	3		
Hooded seal	<i>Cystophora cristata</i>	13	0.03	0		9	0.05	4		
Piniped sp	<i>Pinipedia sp</i>	64	0.17	0		44	0.3	27	0.2	
Σ pinipeds		38	0.10	0		72	0.4	37	0.3	
Number of species		4		0		4		3		
Polar bear	<i>Ursus maritimus</i>	8	0.02			5	0.03	3	0.02	+ 2 out of effort

* A: Norwegian Sea; B: Greenland Sea + Fram Strait; C: Wandel Sea; A1: Coastal Norway only; A2: Off Norway .

Table 2: Reproducibility of results: data collected during return route in the same zone (see Fig. 1, Table 1); main species

	Zone*	B1		B2**		B1+B2**		B all		C1		C2		C all	
	Speed (knots)	6.9		7.9		7.5		7.7		6.7		6.9			
	n	78		37		115		166		63		65		128	
		N	mean	N	mean	N	mean	N	mean	N	mean	N	mean	N	mean
Fulmar all	<i>Fulmarus glacialis</i>	123	1.6	96	2.6	219	1.9	366	2.2	47	0.7	24	0.4	71	0.6
Ivory gull	<i>Pagophila eburnea</i>	142	1.8	28	0.8	170	1.5	171	1.0	121	1.9	50	0.8	171	1.3
Kittiwake	<i>Rissa tridactla</i>	34	0.4	17	0.5	51	0.4	84	0.5	1		2		3	
Little auk	<i>Alle alle</i>	403	5.2	281	7.6	684	5.9	693	4.2	15	0.2	2		17	0.1

* B: Greenland Sea + Fram Strait; C: Wandel Sea; ** partim N-S transect

Discussion

Biodiversity and bio-productivity are very low in the Arctic Ocean, and especially low in the Wandel Sea, very poor in numbers of seabird species (7) and of individuals (mean value of 2 per 30 min transect count, including possible undetected followers in an area without any other ship). Moreover few species were dominant in numbers: ivory gull, fulmar and little auk represented together 95% of the total (90% for the two first ones). Ivory gull was thus the most abundant species, but in very low numbers. This observation can be put in parallel with the presence of a few small ivory gull colonies in the area [5, 6]. This breeding population was declining for years in northern Canada, Svalbard and in the south-eastern part of Greenland [7-11]. Such a decline might reflect a movement towards more eastern areas, e.g. Russian Arctic where no decline was detected [12]. It thus does not necessarily reflect a real decline of the species [13]. Connections between the ivory gulls of both areas were already recorded: they are considered a genetically homogeneous metapopulation [14,15]. These local failures can be linked to declining ice conditions (global change) and/ or to unusual rainy conditions [16]. The absence of Ross' gull *Rhodostethia rosea* is striking, confirming previous studies: the species was regularly tallied in the area mainly in the North-East Water polynya till 2004 (28 individuals to be compared with 63 ivory gulls but strongly declined and left the area from 2005 on [3,10,17].

Comparable data were already obtained in other areas of the high Arctic Ocean by the same team and same methodology: along the

ice-covered part of the Lomonosov Ridge, the main species were (all mean numbers per count) ivory gull (0.4), fulmar (0.3) and kittiwake (0.3) (zone 2) in [10]. In the central part: ivory gull (0.3) (zone C in) [18]. Along the North-East Passage, off coastal Siberia, the main species were "wintering" short-tailed shearwater *Puffinus tenuirostris* (21), kittiwake (7) and Brünnich's guillemot (3) (East Siberian and Laptev seas, 12 and 9 species) [19]. Joiris submitted). Much higher numbers of species and individuals were detected in the Bering Strait (Bering and Chukchi seas) on the one hand, and Fram Strait (Barents and Greenland seas) on the other, both in species and as individuals. An intermediate situation was tallied at the ice-free end of Lomonosov Ridge off Wrangel Island (same references).

As a whole, these data fit the model of seabird species distribution in the high Arctic Ocean [20, 21].

Conclusion

Numbers of seabird, pinniped and cetacean species, as well as of individuals, are low in the high Arctic Ocean. Wandel Sea showed especially low values, reflecting extremely low biodiversity and bio-productivity. They probably represent the lowest values recorded in polar seas. These figures represent a maximal estimation of densities, probably even an over-estimation taking into account the possible presence of undetected, long-distance followers (mainly fulmar, kittiwake, ivory gull).

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