

# On the Reproducibility of Bird and Mammal Transect Counts in Polar Seas

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**Submitted:** 05 Jan 2021; **Accepted:** 11 Jan 2021; **Published:** 27 Jan 2021

**Citation:** Claude Joiris (2021) On the Reproducibility of Bird and Mammal Transect Counts in Polar Seas. *J Mari Scie Res Ocean*, 4(1): 145-153.

**Abstract**

In order to make comparisons between seabird and marine mammal data collected at sea, a first step consists in evaluating their reproducibility. The same transects counted during years show huge variations up to one or two orders of magnitude. In this paper, I compare return transects followed in a short period. Out of important heterogeneities such as local hotspot concentrations, results obtained along the same return transect seem to vary by a factor of two to four. Within a same transect, data simultaneously collected by two observers on both sides of the bridge show ratios of mean values (numbers per 30 min counts) remaining below a factor two, with a mean variation by a factor 1.4.

**Keywords:** Seabirds & Marine Mammals, Polar Seas, Transect Counts, Reproducibility

**Introduction**

The main aims of the long-term study by this team concern on the one hand to identify the basic mechanism explaining their distribution at sea (hydrography), and on the other hand to detect possible temporal and spatial changes, with special attention to global climate changes. For this second aspect, a major question concerns the variability and reproducibility of transect counts.

**Materials and Methods**

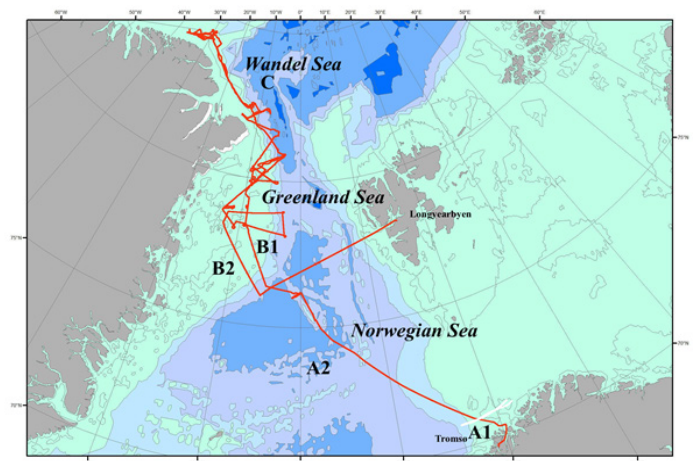
Our counting methodology is adapted to polar marine ecosystems with (very) low densities. Transect counts were conducted from the bridge of icebreaking RV *Polarstern* (18 m above sea level) without width limitation during 30 min periods, on a continuous basis when light and visibility conditions allowed and when speed was higher than seven knots. 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, covering an angle of 90° ahead, in four hour watches. Animals were detected with naked eye and observations confirmed with 10X40 binoculars when necessary.

**Results**

This paper concerns the comparison of data collected on the same return route during a short period.

In the Arctic, an expedition of RV *Polarstern* during August 2018

allowed to compare two return transects in the Greenland and Wandel seas respectively (Fig. 1) [3]. The abundance of seabird and mammal species was very different in both areas, but a quantitative comparison shows reproducibility factors between one and three within an area for the most numerous species (Table 1), variability being obviously much higher by low densities.

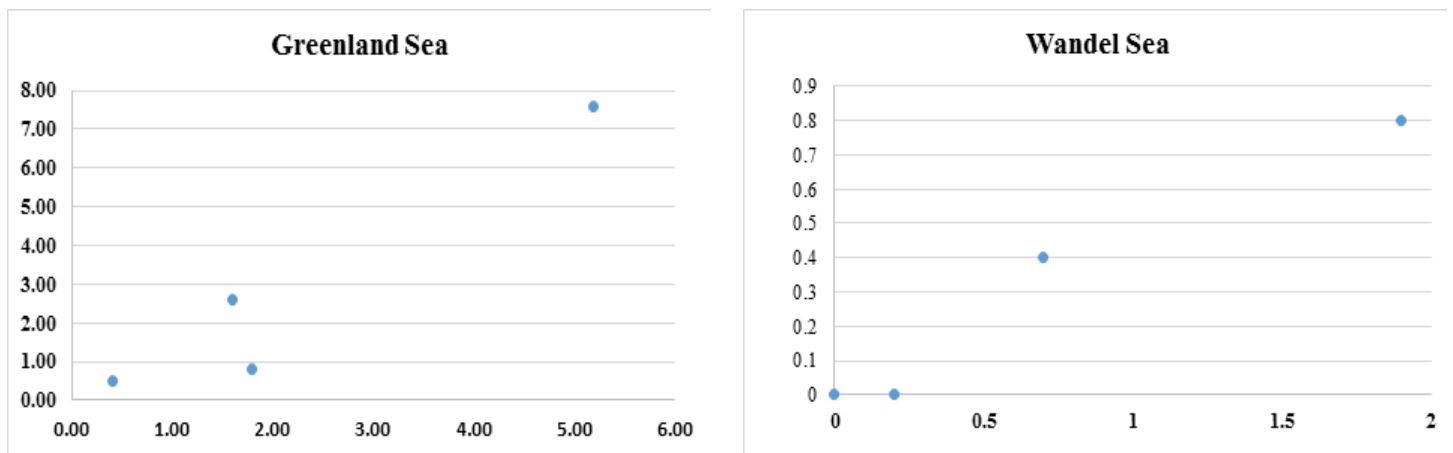


**Figure 1:** Seabird and mammal transect counts in August 2018: main geographical zones; return transects were B1 and B2 in the Greenland Sea and Fram Strait, and C in the Wandel Sea [3]

**Table 1: Reproducibility of results: data collected during a return route in the same zone, main species; n = number of 30min transect counts; N = total number of individuals, mean per count, ratio of means**

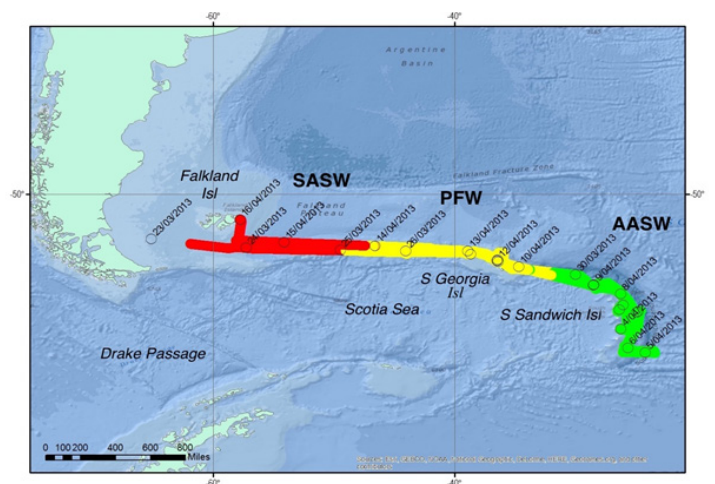
Zone*		B1		B2		ΣB	C1		C2		ΣC
Speed (knots)		6.9		7.9			6.7		6.9		
n		78		37			63		65		
		N	mean	N	mean	ratio	N	mean	N	mean	ratio
Fulmar all	<i>Fulmarus glacialis</i>	123	1.6	96	2.6	0.61	47	0.7	24	0.4	1.75
Ivory gull	<i>Pagophila eburnea</i>	142	1.8	28	0.8	2.25	121	1.9	50	0.8	2.38
Kittiwake	<i>Rissa tridactyla</i>	34	0.4	17	0.5	0.8	1	0	2	0	-
Little auk	<i>Alle alle</i>	403	5.2	281	7.6	0.68	15	0.2	2	0	-

\* B: Greenland Sea + Fram Strait, *partim* latitudinal transect; C: Wandel Sea;

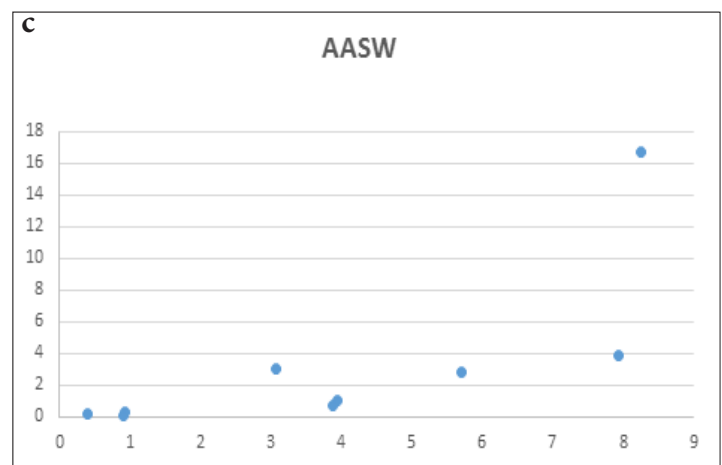
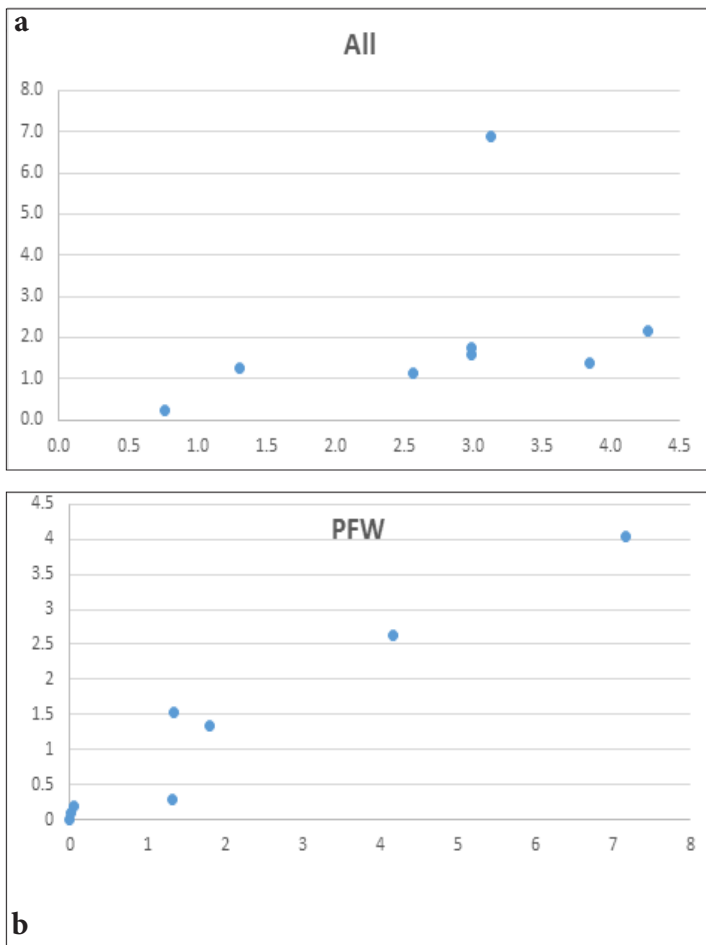


**Figure 2:** Main bird species recorded during return routes (mean number per 30min transect count). Greenland Sea and Fram Strait, section B; from left to right: kittiwake *Rissa tridactyla*, fulmar *Fulmarus glacialis*, ivory gull *Pagophila eburnea*, little auk *Alle alle* (a); Wandel Sea, section C: from left to right: kittiwake, little auk, ivory gull, fulmar (b); see Table 1 and Fig. 1; please note difference in scales

An Antarctic expedition allows a similar comparison: the Polarstern expedition along the Scotia Ridge, including South Georgia and South Sandwich Islands in March-April 2013 [4]. Three zones were recognised on the basis of hydrological data (mainly water temperature SST and salinity) (Fig 3). The first zone being very limited and showing differences in route was excluded from this discussion. Important heterogeneities (hotspots) were observed for some species in one area of the other, making calculation of mean and comparisons impossible: Antarctic prion *Pachyptila desolata* and prion sp., Antarctic fur seal *Arctocephalus gazella* and, to a lesser extend, southern right whale *Eubalaena australis* this is why they are not represented in the figure. A typical example of hotspot is the one of Antarctic prions: out of a total of 9800 individuals for the whole expedition, 9270 were tallied at eight successive counts close to the Antarctic Front, including 5000 in one count. Antarctic fur seal and humpback whale *Megaptera novaeangliae* were also present in the same area (Tables 2 & 3).



**Figure 3:** Polarstern expedition along the Scotia Ridge, Scotia Sea; main water masses defined on the basis of water temperature SST and salinity: sub-Antarctic Surface Water (SASW), Polar Front Water (PFW), Antarctic Surface water (AASW); see Table 4 [4].



**Figure 4:** Main bird species recorded during return routes (mean number of individuals per 30min transect count) along the Scotia Ridge. Whole expedition (a): from left to right, Wilson’s storm-petrel *Oceanites oceanicus*, Cape petrel *Daption capense*, southern giant petrel *Macronectes giganteus*, southern fulmar *Fulmarus glaucooides*, black-bellied storm-petrel *Fregetta tropica*, chinstrap penguin *Pygoscelis antarctica*, black-browed albatross *Diomedea melanophri*, white-chinned petrel *Procellaria aequinoctialis*. Polar Front Water PFW (b), from left to right: Cape petrel, chinstrap penguin, southern fulmar, Wilson’s storm-petrel, southern giant petrel, black-bellied storm-petrel, black-browed albatross, white-chinned petrel. Antarctic Surface Water AASW (c): Wilson’s storm-petrel, southern giant petrel, black-browed albatross, southern fulmar, southern giant petrel, black-bellied storm-petrel, Cape petrel, chinstrap penguin; see Table 2 and Fig. 3.

**Table 2: Main water masses and fronts detected along the North Scotia Ridge and South Sandwich Trench; water temperature (SST) and salinity values: mean (min-max)**

	Position	SST °C	Salinity
		Mean (min- max)	Mean (min- max)
Sub-Antarctic Surface Water (SASW)		6.45 (4.96-7.15)	33.98 (33.87-34.02)
Antarctic front (AF)	53.6°S, 49°W		
Polar Front Water (PFW)		3.06 (1.76-4.79)	33.76 (33.15-33.89)
Polar Front (PF)	55°S, 32°W		
Antarctic Surface Water (AASW)		0.47 (-0.17-1.70)	33.81 (33.70-33.93)

**Table 3: Reproducibility of results: data collected during a return route in the same zone, main species; n = number of 30min transect counts; mean per count; ratio of means**

	Zone*	All 1	All 2	∑All	PFW 1	PFW 2	∑PFW	AASW 1	AASW 2	∑AASW
				Ratio			Ratio			Ratio
	n	202	145	343	94	69	263	76	59	
Chinstrap penguin	<i>Pygoscelis antarctica</i>	3.13	6.90	0.45	0.05	0.2	0.25	8.25	16.7	0.49
Black-browed albatross	<i>Diomedea melanophris</i>	3.85	1.38	2.79	4.17	2.62	1.59	0.93	0.29	3.21
Southern giant petrel	<i>Macronectes giganteus</i>	2.57	1.14	2.26	1.35	1.52	0.89	3.95	0.97	4.07
Cape petrel	<i>Daption capense</i>	2.99	1.57	1.91	0	0.01	0.00	7.93	3.83	2.07
Southern fulmar	<i>Fulmarus glacialis</i>	1.31	1.27	1.03	0.02	0.1	0.20	3.08	2.98	1.03
∑ prions	<i>Pachyptila sp.</i>	37.45	3.64	10.28	77.12	4.77	16.17	3.88	0.66	5.88
White-chinned petrel	<i>Procellaria aequinoctialis</i>	4.27	2.14	1.99	7.17	4.04	1.77	0.9	0.1	9.00
Wilson's storm-petrel	<i>Oceanites oceanicus</i>	0.77	0.22	3.48	1.33	0.3	4.43	0.39	0.17	2.29
Black-bellied storm-petrel	<i>Fregatta tropica</i>	2.99	1.76	1.70	1.81	1.33	1.36	5.7	2.76	2.07
<b>All birds</b>		67.58	27.28	2.48						
Antarctic fur seal	<i>Arctocephalus gazella</i>	9.79	9.79	1.00	19.9	5.74	3.47	0.73	0.36	2.03

\* All: Scotia Ridge expedition; PFW: Polar Front Water; AASW: Antarctic Surface Water; see Table 2 and Fig. 2

**Table 4: Hotspot concentration of selected species close to South Georgia; number per count from the bridge (left)**

Count	Date	Time	Latitude °S	Longitude °W	Water temperature	Depth	Antarctic prion <i>Pachyptila desolata</i>	Antarctic fur seal <i>Arctocephalus gazella</i>	southern right whale <i>Eubalaena australis</i>	hump-back whale <i>Megaptera novaeangliae</i>
130	29/03/13	13:30	54,33	36,04	2,93	5696	11	7	0	0
131	29/03/13	14:00	54,40	35,93	2,70	5514	60	9	0	0
132	29/03/13	14:30	54,46	35,82	2,71	5263	220	11	0	0
133	29/03/13	15:00	54,53	35,72	2,72	5311	600	23	0	0
134	29/03/13	15:30	54,59	35,61	2,74	5251	1700	9	0	0
135	29/03/13	16:00	54,66	35,50	2,79	6186	1500	55	0	0
136	29/03/13	16:30	54,71	35,39	2,73	6243	5000	750	0	14
137	29/03/13	17:00	54,77	35,26	2,72	6276	180	4	0	0
138	30/03/13	05:30	55,01	31,93	2,07	6474	0	16	0	8
	(Antarctic Front)									
139	30/03/13	06:00	55,02	31,77	1,70	5482	0	2	0	0

140	30/03/13	06:30	55,04	31,60	1,44	4306	0	0	0	0
141	30/03/13	07:00	55,05	31,44	1,37	4203	2	0	0	0
142	30/03/13	07:30	55,06	31,28	1,23	1189	0	0	0	2
143	30/03/13	08:00	55,07	31,12	1,20	1157	2	4	0	0
144	30/03/13	09:10	55,10	30,74	1,04	1345	5	0	2	4
145	30/03/13	09:40	55,12	30,58	1,05	3663	2	0	1	1
146	30/03/13	10:10	55,13	30,42	1,04	3721	7	0	0	0
147	30/03/13	10:40	55,14	30,25	1,02	4014	4	0	0	0
148	30/03/13	11:10	55,15	30,09	1,03	3925	2	0	1	0
Total							9295	890	4	29

Variability of counting data was compared between simultaneous counts from both sides of the bridge of *Polarstern*, two observers being separated by 25m, counting following an angle of 90° ahead. Reproducibility was as expected much better, the mean ratio between mean values per count being always less than a factor two (Table 5).

**Table 5: Main species tallied from both sides of the bridge of RV Polarstern during the Scotia Ridge expedition *n* = number of 30min transect counts; *N*: total number of individuals; mean per count; ratio of means**

		left		right		
	<i>n</i>	365		352		
		<i>N</i>	mean	<i>N</i>	mean	ratio
Chinstrap penguin	<i>Pygoscelis antarctica</i>	2852	7.81	1632	5.79	0.74
Black-browed albatross	<i>Diomedea melanophris</i>	732	2.01	977	3.46	1.72
Southern giant petrel	<i>Macronectes giganteus</i>	567	1.55	685	2.43	1.57
Cape petrel	<i>Daption capense</i>	360	0.99	450	1.6	1.62
Southern fulmar	<i>Fulmarus glacialisoides</i>	709	1.94	831	2.95	1.52
∑ prions	<i>Pachyptila sp.</i>	1359	3.72	884	3.13	0.84
White-chinned petrel	<i>Procellaria aequinoctialis</i>	936	2.56	1189	4.22	1.65
Wilson's storm-petrel	<i>Oceanites oceanicus</i>	340	0.93	503	1.78	1.91
Black-bellied storm-petrel	<i>Fregatta tropica</i>	787	2.16	859	3.05	1.41
<b>All birds</b>		<b>20740</b>	<b>56.8</b>	<b>17852</b>	<b>48.9</b>	<b>1.16</b>
Hourglass dolphin	<i>Lagenorhynchus cruciger</i>	76	0.21	60	0.21	1.00
Humpback whale	<i>Megaptera novaeangliae</i>	41	0.11	41	0.15	1.40
Antarctic fur seal	<i>Arctocephalus gazella</i>	1634	4.48	2317	8.22	1.83
Mean						1.41

## Discussion and Conclusion

Drastic changes in population abundance and/ or geographical distribution can be detected by comparing data collected during different expeditions, for instance the decrease of Arctic gulls in northern Canada and northern Greenland [5-8], or the increase of cetacean density in the North Atlantic Ocean probably due to decrease of ice coverage in the North-East and North-West Passages from 2005 and 2007 on [9]. More limited changes however can be much difficult to detect. This is why in this article I tried to compare data collected by the same team and methodology, especially their reproducibility. This study concerns the most abundance species, since variability obviously increase by low densities.

When the same transect is followed in different years and seasons, the general trends are confirmed, mainly the importance of hydrological features. Reproducibility however can be very weak, mainly due to seasonal changes in distribution both for seabirds and marine mammals the variability might reached one order of magnitude or more [10-12]. So that quantitative comparisons should concern only return routes followed during a short period. Out of very large heterogeneities such as hotspots, variability seems to remain within a factor of two to four. By simultaneous comparisons this factor is reduced to a mean value of 1.4, reaching a maximum value of two.

The practical consequence seems to be that at-sea counting might

allows detecting differences by one order of magnitude and more, after correction for heterogeneity (hotspots), seasonal movements and migrations, and changing ice conditions [2].

### Acknowledgements

Observers of the PoE team were often invited on board RV Polarstern (AWI, Bremerhaven), especially from 1988 till 2014.

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### Annexes

As a complement of information, more complete data for the main expeditions discussed in this article are presented as annexes.

#### Annex 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*		
	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		
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		
Lesser black-backed gull	<i>Larus fuscus</i>	2		2		0		0		
Great black-backed gull	<i>Larus marinus</i>	643	1.7	643	7.3	0		0		

Common gull	<i>Larus canus</i>	61	0.2	61		0		0		
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		
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>Sommateria mollissima</i>	5		5		0		0		
<b>∑ birds</b>		<b>7376</b>	<b>19.5</b>	<b>5630</b>	<b>64.0</b>	<b>1382</b>	<b>8.3</b>	<b>267</b>	<b>2.1</b>	
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>Orcinu 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		
<b>∑ cetaceans</b>		<b>46</b>	<b>0.12</b>	<b>35</b>	<b>0.4</b>	<b>11</b>	<b>0.07</b>	<b>0</b>		
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		
pinniped sp	<i>pinnipedia sp</i>	64	0.17	0		44	0.3	27	0.2	
<b>∑ Pinnipeds</b>		<b>38</b>	<b>0.10</b>	<b>0</b>		<b>72</b>	<b>0.4</b>	<b>37</b>	<b>0.3</b>	
Number of species		4				4		3		
Polar bear	<i>Ursus maritimus</i>	8	0.02	0		5	0.03	3	0.02	+ 2 out of effort

\* A: Norwegian Sea; B: Greenland Sea + Fram Strait; C: Wandel Sea

**Annex 2 : Seabirds and marine mammals tallied along the Scotia Ridge and South Sandwich Trench; N: total number recorded; mean per 30 min transect count; *partim* *Polarstern* [4]**

	<i>n</i> >	365		282		
		left (a)		right (a)		
		N	mean	N	mean	Remark
King penguin	<i>Aptenodytes patagonicus</i>	215	0.59	201	0.71	
Gentoo penguin	<i>Pygoscelis papua</i>	80	0.22	42	0.15	
Chinstrap penguin	<i>Pygoscelis antarctica</i>	2852	7.81	1632	5.79	
Rockhopper penguin	<i>Eudyptes chrysocome</i>	5		7		
Macaroni penguin	<i>Eudyptes chrysolophus</i>	66	0.18	42	0.15	
Penguin sp.		141	0.39	93	0.33	
Southern royal albatross	<i>Diomedea [epomorpha] epomorpha</i>	14	0.04	14	0.05	
Wandering albatross	<i>Diomedea [exulans] sp.</i>	184	0.5	175	0.62	
Wwand/royal albatross	<i>Diomedea [exulans]/ [epomorpha] sp.</i>	25	0.07			
Black-browed albatross	<i>Thalassarche [melanophrys] melanophrys</i>	732	2.01	977	3.46	
Grey-headed albatross	<i>Thalassarche chrysostoma</i>	52	0.14	46	0.16	
Sooty albatross	<i>Phoebetria fusca</i>	8		6		
Light-mantled sooty albatross	<i>Phoebetria palpebrata</i>	30	0.08	32	0.11	
Southern giant petrel	<i>Macronectes giganteus</i>	567	1.55	685	2.43	
Northern giant petrel	<i>Macronectes halli</i>	40	0.11	63	0.22	
Giant petrel sp.	<i>Macronectes sp.</i>	38	0.1	84	0.3	
Southern fulmar	<i>Fulmarus glacialoides</i>	709	1.94	831	2.95	
Cape petrel	<i>Daption capense</i>	360	0.99	450	1.6	
Snow petrel	<i>Pagodroma [nivea] sp.</i>	9		11	0.04	
White-chinned petrel	<i>Procellaria aequinoctialis</i>	936	2.56	1189	4.22	
Kerguelen petrel	<i>Pterodroma brevirostris</i>	123	0.34	136	0.48	
Great-winged petrel	<i>Pterodroma [macroptera] macroptera</i>	1		1		
Soft-plumaged petrel	<i>Pterodroma mollis</i>	345	0.95	379	1.34	
Atlantic petrel	<i>Pterodroma incerta</i>	2		2		
Grey petrel	<i>Procellaria cinerea</i>	6		4		
Blue petrel	<i>Halobaena caerulea</i>	278	0.76	325	1.15	
Antarctic prion	<i>Pachyptila desolata</i>	9769	26.76	7487	26.55	
Slender-billed prion	<i>Pachyptila belcheri</i>	9		2		
Fairy prion	<i>Pachyptila turtur</i>	106	0.29	42	0.15	
Prion sp.	<i>Pachyptila sp.</i>	1253	3.43	742	2.63	
Sooty shearwater	<i>Puffinus griseus</i>	67	0.18	142	0.5	
Great shearwater	<i>Puffinus gravis</i>	19	0.05	28	0.1	
Wilson storm-petrel	<i>Oceanites oceanicus</i>	340	0.93	503	1.78	
Grey-backed storm-petrel	<i>Oceanites nereis</i>	31	0.08	24	0.09	
Black-bellied storm-petrel	<i>Fregetta tropica</i>	787	2.16	859	3.05	
Storm-petrel sp.		24	0.07	2	0.01	
Common diving-petrel	<i>Pelecanoides urinatrix</i>			33	0.12	



South Georgian diving-petrel	<i>Pelecanoides georgicus</i>					One wrecked on board
Diving-petrel sp.	<i>Pelecanoides sp.</i>	369	1.01	376	1.33	
South Georgia shag	<i>Phalacrocorax [atriceps] georgianus</i>	19	0.05	13	0.05	
Snowy sheathbill	<i>Chionis alba</i>	1		1		
Antarctic tern	<i>Sterna vittata</i>	111	0.3	117	0.41	
South polar skua	<i>Catharacta [skua] maccormicki</i>	1		1		
Brown skua	<i>Catharacta [skua] antarctica</i>	15	33	11	0.04	
Arctic skua	<i>Stercorarius parasiticus</i>			1		
Phalarope sp.	<i>Phalaropus sp.</i>	1				Off S America
<b>Total all birds</b>		<b>20740</b>	<b>56.82</b>	<b>17811</b>	<b>63.16</b>	
<b>Total selected birds (c)</b>		<b>18870</b>	<b>51.7</b>	<b>16501</b>	<b>45.21</b>	
Commerson's dolphin	<i>Cephalorhynchus commersonii</i>					One Strait of Magellan
Hourglass dolphin	<i>Lagenorhynchus cruciger</i>	76	0.21	60	0.21	
dolphin sp.		20	0.05	16	0.06	
Long-finned pilot whale	<i>Globicephala melas</i>			30	0.11	
Killer whale	<i>Orcinus orca</i>			3	0.01	
sperm whale	<i>Physeter macrocephalus</i>			1	0	
Southern bottlenosed whale	<i>Hyperoodon australis</i>					
Southern right whale	<i>Eubalaena australis</i>	6	0.02	3	0.01	
Humpback whale	<i>Megaptera novaeangliae</i>	41	0.11	41	0.15	
Fin whale	<i>Balaenoptera physalus</i>	6	0.02	11	0.04	
large whale sp.		35	0.1	37	0.13	
<b>Total all cetaceans</b>		<b>184</b>	<b>0.5</b>	<b>152</b>	<b>0.54</b>	
<b>Total selected cetaceans (c)</b>		<b>129</b>	<b>0.35</b>	<b>149</b>	<b>0.53</b>	
South American fur seal	<i>Arctocephalus australis</i>	14	0.04	52	0.18	Off S America
Antarctic fur seal	<i>Arctocephalus gazella</i>	1634	4.48	2317	8.22	South Georgia
Seal sp.		511	1.4			
Southern elephant seal	<i>Mirounga leonina</i>	2	0.01	6	0.02	
<b>Total all pinnipeds</b>		<b>2281</b>	<b>6.25</b>	<b>2402</b>	<b>8.08</b>	
<b>Total selected pinnipeds (c)</b>		<b>1650</b>	<b>4.52</b>	<b>2375</b>	<b>8.42</b>	

(a): counting from backboard and portside of the bridge respectively; (b): not included in calculations; (c): after exclusion of unidentified and strictly coastal species

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