

The South African SIBEX I Cruise to the Prydz Bay region, 1984: XI. Distribution and abundance of birds at sea

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During SIBEX I the distribution and abundance of flying birds were studied. A preliminary analysis of the results from the survey area is presented. The results suggest that there is a positive correlation between the distribution of krill-eating birds and that of krill.

Die verspreiding en voorkoms van vlieënde voëls is bestudeer en 'n voorlopige analise van resultate uit die opname word voorgelê. Uit die gegewens lyk dit asof daar 'n positiewe korrelasie tussen die verspreiding van krilvretende voëls en dié van kril is.

Introduction

The distribution and abundance of flying birds within the SIBEX I grid were studied in order to obtain data towards answering the question: can seabirds be used as indicators of the presence of abundance of their prey, especially krill?

Methods

Observations were made both while steaming and while on station.

Steaming observations

The "300 m 90° quadrant to one side of bow" method (BIOMASS Working Party on Bird Ecology 1984) was used for all steaming observations in accordance with international agreement for all SIBEX vessels (BIOMASS Working Party on Bird Ecology 1983). Observations were made from the bridge.

On-station observations

During daylight stations, counts were made for 10 minutes at half hourly intervals up to a maximum of 10 times (over a five-hour period). The largest number of individuals of any one species seen at one time ("instantaneous scan") during a 10-minute period was recorded. Observations were made from the helicopter deck and scans were made to the horizon in an arc of approximately 270°. At some stations, onset of dusk or commencement of steaming resulted in fewer than ten 10-minute observations periods being made.

Data from both steaming and on-station observations were recorded in the field on 10-minute cards (BIOMASS Working Party on Bird Ecology 1984).

Results and Discussion

Steaming observations

A total of 59 hours of daylight observations was made over a period of 24 days. Maximum numbers of hours in any one day was eight (during the diagonal traverse from the northwest corner to the southeast corner of the grid). No observations at all were made on one day. Mean number of hours observation/day was $2,4 \pm 1,7$.

This disappointingly low total of steaming observations was due to two factors: lateness of the austral summer season which resulted in a short day length (which progressively shortened during the cruise) and a high on-station/steaming ratio, which was due to deep (and therefore time-consuming) stations and a finely space grid. The data collected have been coded along with abiotic information (primarily weather and sea surface factors) and are now being analysed.

On-station observations

Data were collected at 27 (58,7 %) of the 46 SIBEX stations, a reasonably high percentage considering the short day length. The mean numbers of birds/10-minute observation varied from 5 to 602 at different stations.

Table 1

Relative abundance of flying birds during on-station observations.

Species	Number recorded	% Relative abundance
Antarctic petrel		
<i>Thalassoica antarctica</i>	6 513	50,1
Sooty shearwater		
<i>Puffinus griseus</i>	1 166	9,0
Antarctic fulmar		
<i>Fulmarus glacialisoides</i>	1 131	8,7
Pintado petrel		
<i>Daption capense</i>	1 082	8,3
Blue petrel		
<i>Halobaena caerulea</i>	1 024	7,9
Snow petrel		
<i>Pagodroma nivea</i>	752	5,8
Prions		
<i>Pachyptila</i> spp.	514	4,0
Whitechinned petrel		
<i>Procellaria aequinoctialis</i>	422	3,2
Lightmantled sooty albatross		
<i>Phoebetria palpebrata</i>	252	1,9
Wilson's stormpetrel		
<i>Oceanites oceanicus</i>	69	0,5
Kerguelen petrel		
<i>Pterodroma brevirostris</i>	28	0,2
Giant petrel		
<i>Macronectes</i> spp.	28	0,2
Wandering albatross		
<i>Diomedea exulans</i>	8	<0,1
Greyheaded albatross		
<i>D. chrysostoma</i>	8	<0,1
Whiteheaded petrel		
<i>Pterodroma lessonii</i>	8	<0,1
Sooty albatross		
<i>Phoebetria fusca</i>	3	<0,1
McCormick's skua		
<i>Catharacta maccormicki</i>	1	<0,1
Total	13 009	

Relative abundance

A total of 13 009 sightings of 17 species of flying birds was made (Table 1). In addition, four sightings of juvenile emperor penguins *Aptenodytes forsteri*, representing probably two individuals, and one adult chinstrap penguin *Pygoscelis antarctica* were made. These records are not considered further. The most abundant species was the Antarctic petrel *Thalassoica antarctica* which formed 50,1 per cent of the total number of sightings made on-station. No other species accounted for more than 10 per cent (Table 1).

Biomass

Utilising published and unpublished information on the mean masses of each species it has been calculated that a total biomass of 9 038 kg of all species was recorded (Table 2). Antarctic petrels made up 50,4 per cent of the total avian biomass. The mean mass of species recorded ranged from less than 50 g for Wilson's stormpetrel *Oceanites oceanicus* to 8,6 kg for the wandering albatross *Diomedea exulans*.

Table 2
Biomass (kg) of flying birds during on-station observations.

Species	Mean mass*	Total mass	% Biomass
Antarctic petrel	0.7	4 559	50,4
Antarctic fulmar	1,0	1 131	12,5
Sooty shearwater	0,8	921	10,2
Lightmantled sooty albatross	2,7	680	7,5
Whitechinned petrel	1,2	506	5,6
Pintado petrel	0,5	487	5,4
Snow petrel	0,3	226	2,5
Blue petrel	0,2	215	2,4
Giant petrels	4,0	112	1,2
Prions	0,2	77	0,9
Seven rarely-recorded species	—	124	1,4
Total		9 038	

*FitzPatrick Institute (unpubl. data).

Diet classes

Based on published and unpublished information on the diets of seabirds, the seventeen species have been assigned, somewhat arbitrarily, to five diet-classes (Table 3). Krill-eaters formed 72,9 per cent of the total numbers and 70,8 per cent of the biomass. The second largest category by biomass was squid-eaters. Krill-eaters were the Antarctic petrel, Antarctic fulmar *Fulmarus glacialisoides*, pintado petrel *Daption capense* and the snow petrel *Pagodroma nivea*. Squid-eaters were primarily whitechinned petrels *Procellaria aequinoctialis* and lightmantled sooty albatrosses *Phoebetria palpebrata*. Fish-eaters were sooty shearwaters *Puffinus griseus*. Blue petrels *Halobaena caerulea* and prions *Pachyptila* spp. formed the bulk of the plankton-eaters.

Distribution

Seabirds were most abundant in terms of numbers and biomass at high latitudes (Table 4, Figs. 1 & 2) among loose pack-ice. No clear patterns existed in geographical variation in the number of species recorded at different stations (Fig. 3). No clear longitudinal patterns in relative abundance or biomass were discernible (Figs. 1 & 2). Krill-eaters (in terms of numbers and biomass) were most abundant at high latitudes (Figs. 6 & 7). Plankton-eaters, as exemplified by the

blue petrel, and fish-eaters (sooty shearwater) were most abundant at low latitudes (Figs. 6 & 7). Squid-eaters and scavengers were more widely distributed.

Snow petrels occurred very rarely away from pack-ice and therefore were only recorded at high latitudes (+64°S). All sooty shearwaters recorded were travelling from west to east or roosting on the sea surface and were considered to have been migrating through the region. Foraging was not observed in this species.

Table 3
Relative abundance and biomass (kg) of different diet classes of flying birds during on-station observations.

No. individuals	% Relative abundance	Total mass	% Biomass
Krill-eaters			
9 478	72,9	6 403	70,8
Plankton-eaters			
1 607	12,4	295	3,3
Fish-eaters			
1 166	9,0	921	10,2
Squid-eaters			
729	5,6	1 307	14,5
Scavengers			
29	0,2	113	1,3

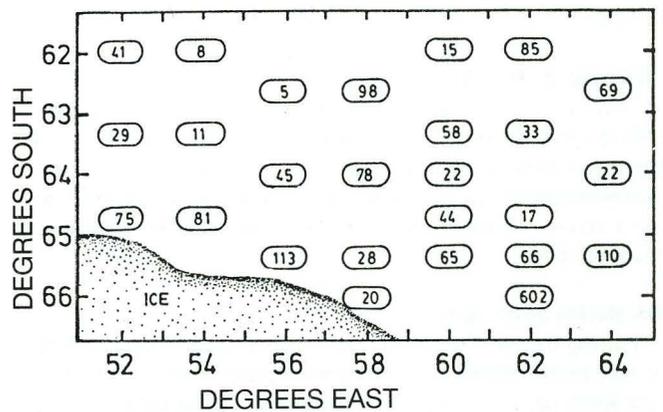


Fig. 1. Mean no. individuals/10-minute count during daylight stations. All species.

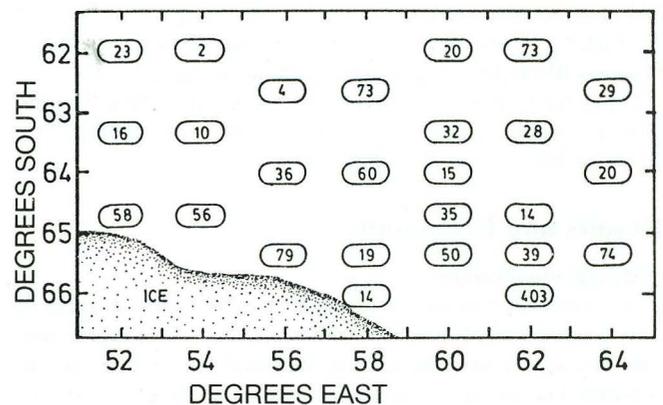


Fig. 2. Mean biomass/10-minute count during daylight stations. All species.

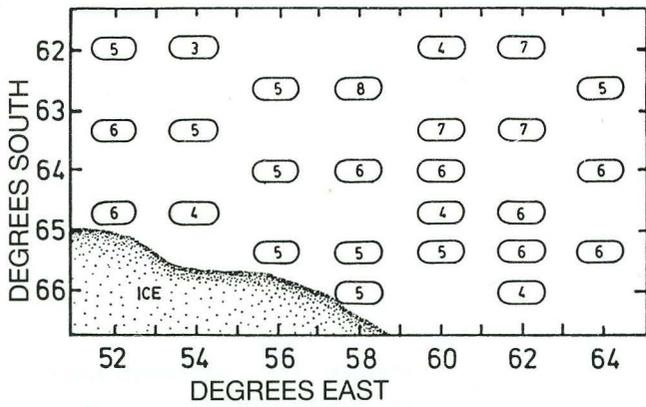


Fig. 3. Mean no. species/10-minute count during daylight stations.

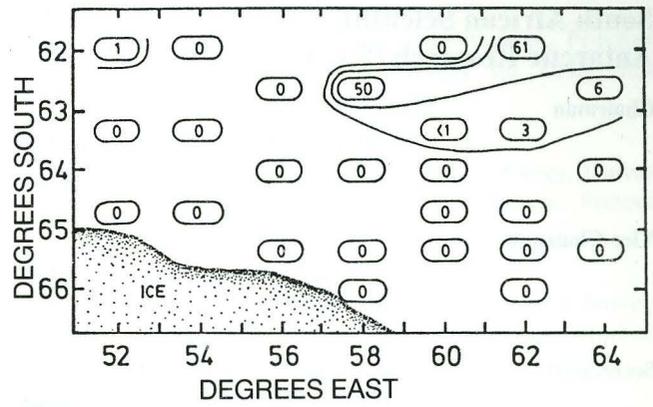


Fig. 7. Mean no. individuals/10-minute count during daylight stations. Sooty shearwater *Puffinus griseus*.

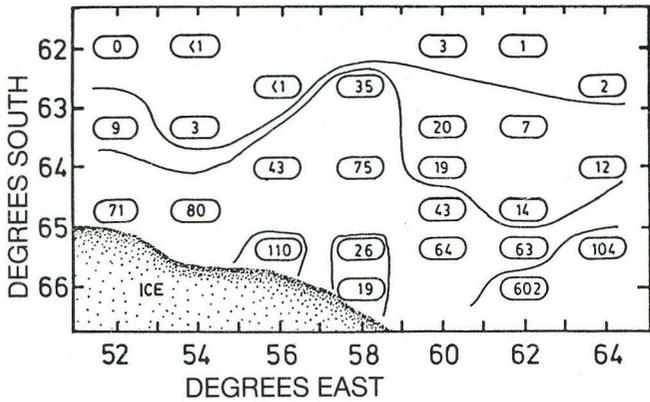


Fig. 4. Mean no. individuals/10-minute count during daylight stations. Krill-eating species.

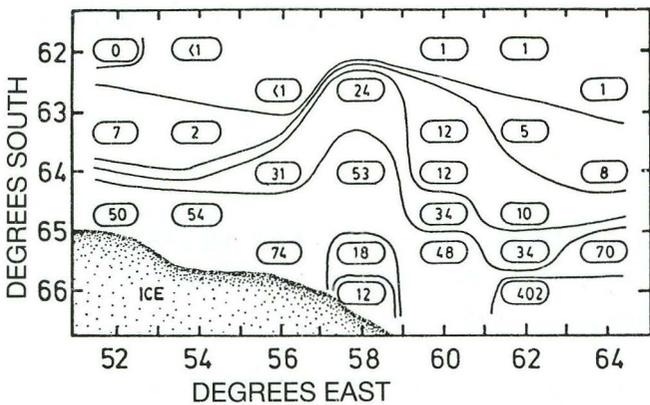


Fig. 5. Mean biomass/10-minute count during daylight stations. Krill-eating species.

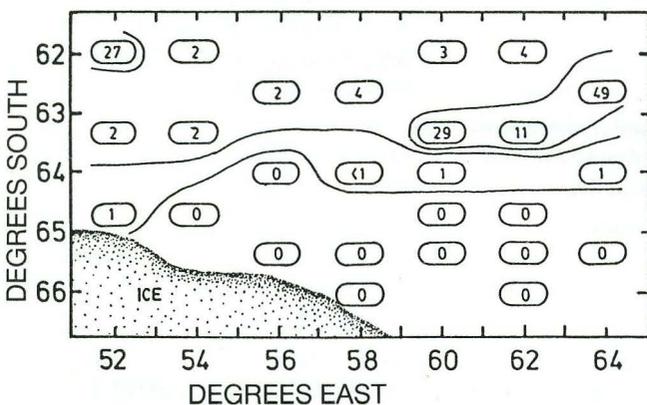


Fig. 6. Mean no. individuals/10-minute count during daylight stations. Blue petrel *Halobaena caerulea*.

Table 4

Variation in abundance of flying birds with latitude during on-station observations.

Latitude	Mean No. birds/10-minute observation
62 00S	37
62 40S	57
63 20S	33
64 00S	42
64 40S	54
65 20S	76
66 00S	309

Conclusions

The data set seems large and varied enough to warrant comparison with information collected during SIBEX I on phytoplankton and zooplankton relative abundance, especially that of Antarctic krill *Euphausia superba*. A preliminary comparison of the distribution of krill-eating seabirds (Figs. 4 & 5) and that of krill (Miller this volume, Figs. 1 & 2) suggests that statistically significant positive correlations will be obtained. Such comparisons are now underway.

References

- BIOMASS Working Party on Bird Ecology 1983. Meeting of BIOMASS Working Party on Bird Ecology. *BIOMASS Rpt. Ser.* 34: 1-33.
- BIOMASS Working Party on Bird Ecology 1984. Recording observations of birds at sea (Revised edition). *BIOMASS Handbook* 18: 1-20.