VISUAL OBSERVATIONS OF THE ANTARCTIC SEA BIRDS DURING THE FIBEX CRUISE OF THE KAIYO MARU

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Abstract: The KAIYO MARU, a research vessel of the Fishery Agency, made the FIBEX survey in the Indian sector of the Antarctic Ocean during the austral summer of 1980–1981. At the same time, visual observations of sea birds were carried out along the cruise tracks of the survey. Sea birds were observed in the area from 30°E to 85°E longitudinally and on the south of 55°S, particularly from 61°S to the ice edge. Species and number of the sea birds recognized in a ten minutes observation were recorded in the sheets prepared for these observations. The ten-minute observations were usually made every four hours, six times a day. The bird species observed frequently were as follows: antarctic petrel, white-chinned petrel, cape pigeon, light-mantled sooty albatross, prions, and so on. These birds were evenly observed longitudinally and showed a circumpolar distribution. Latitudinally, however, they showed a different distribution, though they extended to the south with the retreat of the ice edge. The distribution of these birds was also considered with the records of acoustic estimation of krill.

1. Introduction

The international BIOMASS (Biological Investigations of Marine Antarctic Systems and Stocks) programme has been commenced in 1977 by the proposal of the Scientific Committees on Antarctic Research and for Oceanic Research. The programme aims at assessing the stocks of marine living resources of the Antarctic Ocean, and also at understanding the structure and function of the marine ecosystems for the future management of rational use of these living resourses. The first international BIOMASS experiment (FIBEX), participated by 17 ships from 11 countries, was carried out under the schedule of the BIOMASS programme in the austral summer of 1980–1981.

The KAIYO MARU (2539 gross tons), a research vessel of the Fishery Agency, made oceanographic and biological surveys including the acoustic estimations of krill in the Indian sector of the Antarctic Ocean. At the same time, visual observations of sea birds were carried out along the cruise tracks. Sea birds form an important part of the Antarctic marine ecosystems as consumers of crustaceans, molluscs, and fishes. It is, therefore, important for the BIOMASS programme to make clear the distribution and the abundance of these birds in the Antarctic Ocean. But in a vast ocean it is difficult to accomplish the task with the data of only one ship-board observation. Since it is necessary to accumulate much information about sea birds for a solution of this difficulty, this paper reports the results of the visual observations during the FIBEX cruise of the KAIYO MARU.

2. Observation

The observations of sea birds were carried out on the bridge of the KAIYO MARU about 13 m above sea level. It is essential to record the species and the number of birds that occurred in an observation for 10 minutes. Other items to be recorded were the ship's position, air and water temperatures, weather, direction and speed of wind, ship's activity, bird's state, and so on. These were put on the recording sheet which was prepared for these observations and slightly modified from the standard card of SCAR. The 10-min observations were made every four hours, six times a day from 0200 on many occasions of the present survey. All of the observations were made by the officers of the KAIYO MARU, Messrs. K. IIDA, T. TSUNEKAWA and K. TAKEZAWA. Since no bird specialist was on board the ship, the birds were identified by the aid of the booklet for field guide compiled by NAKAMURA and NAITO (1979).

The authors wish to express their thanks to the officers for their efforts in the continuous observations.

3. Area Observed

The KAIYO MARU was assigned to the Indian sector of the Antarctic Ocean for the FIBEX survey. The cruise tracks of the present survey consisting of two legs are indicated in Fig. 1. The all bird observations were made in the south of 55°S, particularly from 61°S to the ice edge. The observations were started on 9th December 1980 (55°01′S, 93°36′E), and ended on 28th December 1980 (55°32′S, 44°52′E) in the first leg. The observations in the second leg were started on 15th January 1981 (56°24′S, 28°24′E), and ended on 11th February 1981 (55°05′S, 86°37′E). As shown in Fig. 1, the surveys in both legs were made along the grid line. The first one was made in the area from 80°E to 60°E between 61°S and 64°S. The second one was from 30°E to 55°E between 63°S and 68°S, and along the ice

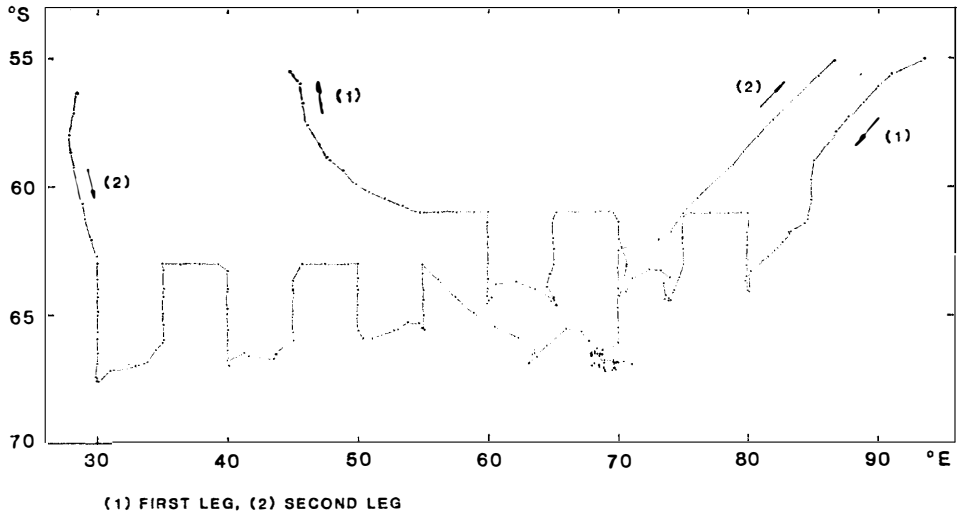

Fig. 1. The cruise tracks of the KAIYO MARU in the FIBEX survey.

edge off MacRobertson Land. The 70°E line was surveyed again after about one and half month. There was a time lag of about one month between the two legs. As the edge of flow ice retreated southward during this period, the southernmost area of survey reached 68°S in the second leg and 64°S in the first leg.

4. Results and Discussion

4.1. Bird species observed

A total of 19 species were observed in the present survey of the two legs together (Table 1). Both Latin and common names of birds were adopted from WATSON (1975). The number of species observed was not so small in comparison with the previous works made on board in one summer season. AOYANAGI (1973) listed 21 species of birds on board the icebreaker FUJI, though the survey was made in the south of 35°S. NAITO *et al.* (1979) and OHYAMA *et al.* (1981) listed 12 and 17 species respectively in the outer margin of flow ice in the Indian and Australian sectors of the Antarctic Ocean. OZAWA (1967) listed 23 species except the penguin, based on the surveys on board the UMITAKA MARU in several summers between 1961 and 1967 in the Indian and Atlantic sectors of the Antarctic Ocean.

The number of species is also related to a matter of specific identification of birds. The prions are difficult to identify on board even for bird specialists. As for the terns in the present survey, there were the cases assigned to the arctic tern and the antarctic tern even in the close areas on the same day. Although these terns are more likely the migratory flock of the arctic tern, they were dealt with as the terns in this paper. In addition, there was a large flock of unidentified birds on 24th December 1980.

No regular patterns were observed in the species or the number of the birds

Table 1. List of species observed in the present survey.

Spheniscidae	1.	*Pygoscelis adeliae* (Adélie penguin)
Diomedeidae	2.	*Diomedea exulans* (Wandering albatross)
	3.	*Diomedea chrysostoma* (Gray-headed albatross)
	4.	*Phoebetria palpebrata* (Light-mantled sooty albatross)
Procellariidae	5.	*Macronectes giganteus* (Southern giant fulmar)
	6.	*Fulmarus glacialoides* (Southern fulmar)
	7.	*Thalassoica antarctica* (Antarctic petrel)
	8.	*Daption capense* (Cape pigeon)
	9.	*Pagodroma nivea* (Snow petrel)
	10.	*Halobaena caerulea* (Blue petrel)
	11.	*Pterodroma lessoni* (White-headed petrel)
	12.	*Pterodroma brevirostris* (Kerguelen petrel)
	13.	*Procellaria aequinoctialis* (White-chinned petrel)
	14.	*Puffinus griseus* (Sooty shearwater)
	15.	Prions
Oceanitidae	16.	*Oceanites oceanicus* (Wilson's storm petrel)
Pelecanoididae	17.	Diving petrels
Stercorariidae	18.	*Catharacta maccormicki* (South polar skua)
Laridae	19.	Terns

throughout the observations six times a day. As the ice edge retreated southward in the second leg after about one month, the sea birds extended their range to the south. The wandering albatross was observed only two times at the end of the first leg, whereas in the second leg it was observed more frequently though not so much as other birds.

4.2. Distribution of birds

As already mentioned, the present survey covered latitudinally the area between 55°S and 64°S in the first leg, and between 55°S and 68°S in the second leg. The latitudinal distribution of birds that occurred frequently in the present survey is shown in Fig. 2 as an average number of birds counted in the 10-min observations within a two degrees section. The thickness of the black band represents the average number of birds. Since the observation times were much different among the sections, especially less in the northern sections, these values could not be compared directly for the regional distribution and the abundance of the birds that occurred.

The wandering albatross occurred more in the northern sections, and decreased in number in the southern sections. The light-mantled sooty albatross extended its distribution southward. OZAWA *et al.* (1964) reported that this species was frequently observed in the area within 100 miles from the edge of the pack ice zone.

The antarctic petrel and the snow petrel were apparently distributed in the southernmost part of the area surveyed. The snow petrel was observed in the south of 62°S in December, but most of it occurred in the south of 66°S in the second leg. Both of the species breed in the ice free areas of the Antarctic Continent or adjacent islands, and even in winter the antarctic petrel can be observed on Cape Denison of the Adélie Land as far as the open water exists (FALLA, 1937). Figures 3 and 4 show the distribution of the snow petrel and the antarctic petrel along the cruise tracks of the present survey. The size of circles indicates as average number of birds

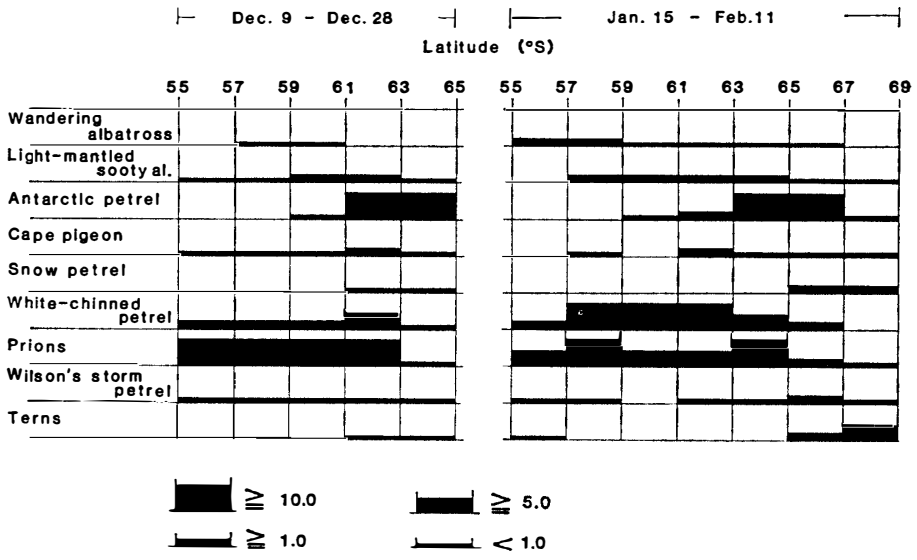

Fig. 2. The latitudinal distribution of sea birds.

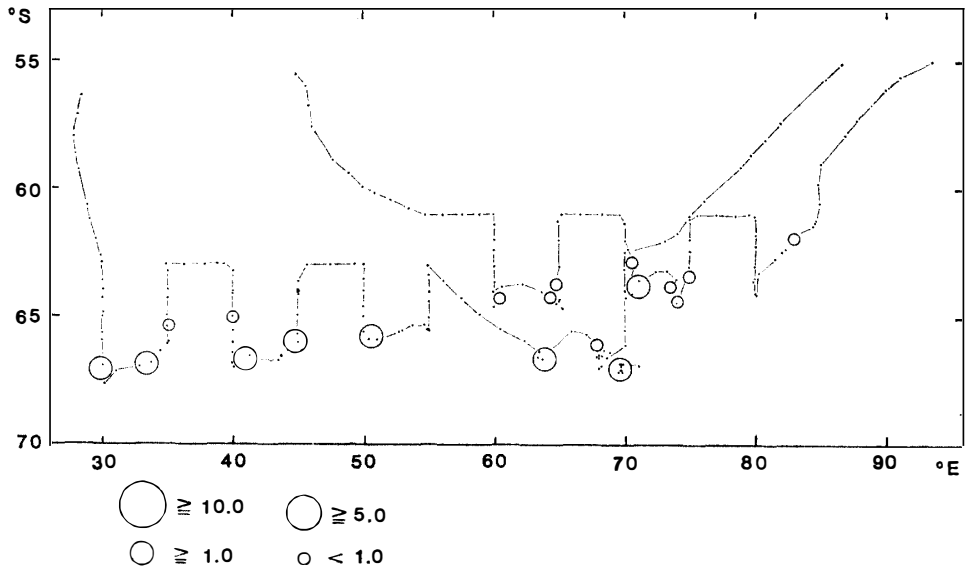

Fig. 3. The distribution of snow petrel along the cruise tracks.

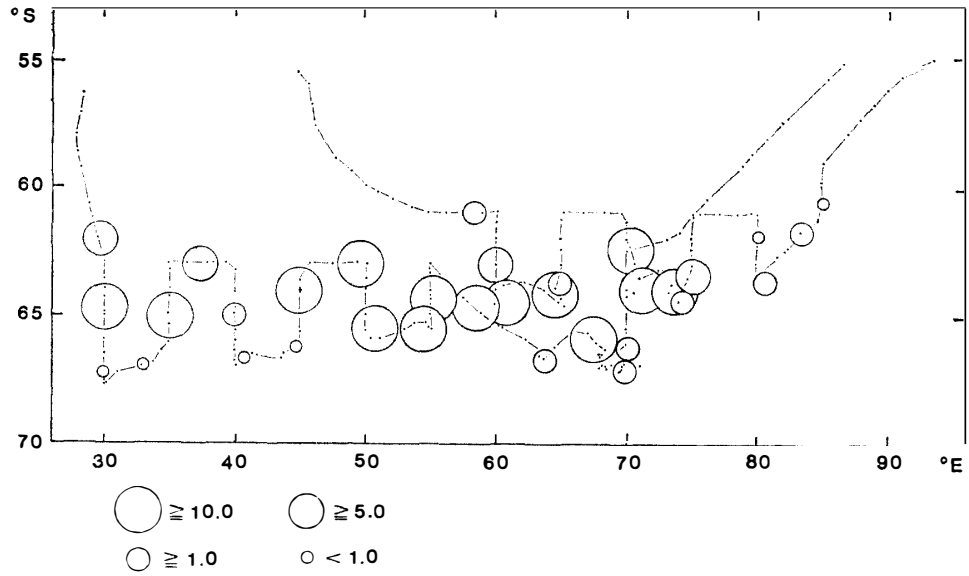

Fig. 4. The distribution of antarctic petrel along the cruise tracks.

counted in daily 10-min observations. As seen in Figs. 3 and 4, the snow petrel has a more southern distribution than the antarctic petrel.

The white-chinned petrel and the prions were dominant in a wide range, and the antarctic petrel took place of them in the southern areas. Figure 5 shows the average number of the prions along the cruise tracks. The prions were dominant in the northern areas surveyed in the first leg. As the distribution area of the prions extended southward in accordance with the retreat of ice edge in the second leg, two peaks of the average number of the prions were observed (Fig. 2).

The main object of the FIBEX cruise of the KAIYO MARU was the grid survey at intervals of five degrees longitudinally in the area from 30°E to 85°E. Figure 6 indi-

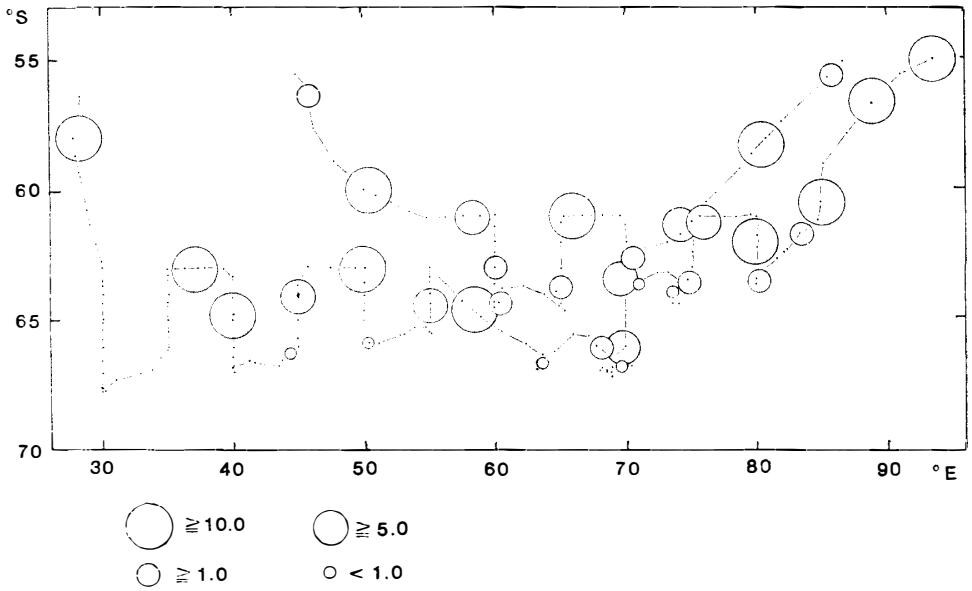

Fig. 5. The distribution of prions along the cruise tracks.

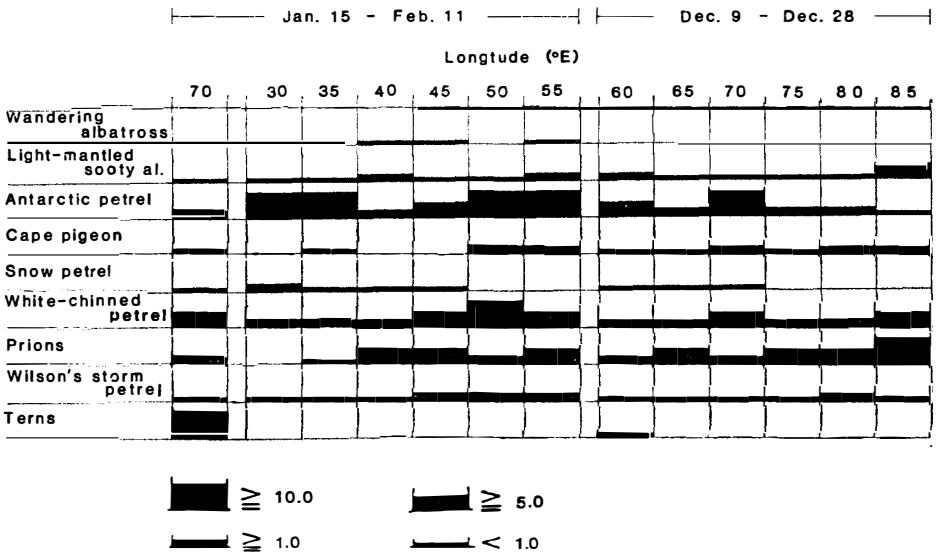

Fig. 6. The longitudinal distribution of sea birds.

cates an average number of birds that occurred in the 10-min observations along the line at every 5 degrees in the area from about 60°S to the ice edge latitudinally. Most of the birds were evenly observed longitudinally, and showed the circumpolar distribution. But the terns observed as a large flock only in the 70°E line were restricted in the southern area. The prions did not occur in the 30°E line in Fig. 6 as the area was confined in the south of 60°S. A few of the sooty shearwater were observed throughout the present survey. NAITO *et al.* (1979) and OHYAMA *et al.* (1981) reported large flocks of this bird in the area a little to the east.

Most of the sea birds listed in Table 1 seem to be dependent more or less on krill for their food except the wandering albatross. Even the light-mantled sooty alba-

tross depends about 50 per cent of its food on krill (CROXALL and PRINCE, 1980). The acoustic estimation of krill was one of the important subjects of the FIBEX survey by the KAIYO MARU. Average values of back scattering strength of the acoustic survey were recorded along the cruise tracks in the sections of every one degree longitudinally and every 20 min latitudinally. Since the values of back scattering strength of the acoustic survey are correlated to the abundance of krill, it was attempted to use the values to verify the number of birds occurring in each section of acoustic survey. There was no clear correlation between them throughout the area surveyed.

However, when the average values of the back scattering strength were inspected throughout the whole areas surveyed, the difference in the average values was recognized between the north and the south areas. The values were low in the north and high in the south, bounded by about 62°S in the first leg and about 64°S in the second leg. When these values were converted to the krill abundance, the difference between the north and the south areas was about ten times in the first leg and about four times in the second leg. The krill abundant areas based on the acoustic survey are in accordance with the two southern sections of the first leg and the three southern ones of the second leg in Fig. 2. It is an interesting fact that these sections have rather abundant species and number of birds than others. Moreover, the acoustic surveys along the latitudinal lines revealed that the maximum values of the back scattering strength occurred in the area at 20 to 100 miles from the ice edge in the first leg and at 80 to 140 miles in the second leg. It seems to be reasonable that the distribution of sea birds was observed in relation to that of the pack ice zone as already noticed by OZAWA (1964).

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