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## NOTES ON THE ZOO-GEOGRAPHICAL DISTRIBUTION OF ANTARCTIC BIRDS BASED ON THE SIGHTING OF ZSI SCIENTISTS DURING 15<sup>TH</sup> AND 22<sup>ND</sup> INDIAN ANTARCTIC EXPEDITIONS

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### INTRODUCTION

The Southern Ocean is oceanographically defined as an ocean productive connected with the Antarctic Circumpolar Current, which circulates around Antarctica. This is the aquatic zone in the face of earth where marine birds come in the austral spring and summer to incubate their eggs and to care for their young. During these few months there are sufficient nutrients in the surface of ocean waters to support tremendous blooms of marine plants and the birds spend much of their time in this nutrient rich ocean.

The chapter of Indian Antarctic Programme opened way back in 1981, when the first Indian Scientific Expedition to Antarctica was flagged off from Goa, India. The first scientist from Zoological Survey of India joined 9<sup>th</sup> expedition during 1989-1990. Since then a continuing monitoring programme was taken up specially on birds and mammals of Antarctic Ocean and moss-inhabiting invertebrate fauna of Schirmacher Oasis, by the ZSI scientists. Daily watch by the scientists was recorded en-route from the ship on sighting of birds and mammals (Fig. 1).

Information on the occurrence and distribution of sea birds of the Indian Ocean sector is meager. Parulekar (1983) published first paper on the occurrence of sea birds in Indian Ocean. Afterwards, Mathew (1994), Chattopadhyay (1995), Sathyakumar (1998) and Bhatnagar and Sathyakumar (1999) published reports on the observation of Antarctic birds. This present communication reveals a comparative study on the zoo-

geographical distribution of Antarctic birds in two different routes of Indian Antarctic expedition (15<sup>th</sup> from Goa and 22<sup>nd</sup> from Cape Town, South Africa). Attempts have also been made to find out the variation of distributional ranges and occurrence of marine birds since the 11<sup>th</sup> Indian Antarctic Scientific Expedition.

This communication is dedicated in the memory of Late Srikumar Chattopadhyay, a great Ornithologist and a member of 11<sup>th</sup> Indian Antarctic Expedition, who deeply inspired us and left an everlasting influence on us.

### STUDY AREA

The 15<sup>th</sup> expedition route started from Goa (15° 24' N, 73° 48' E) to Indian Bay (69° 56' S, 11° 54' E) in Antarctica via Mauritius and almost 11,000 km stretch of the Indian Ocean was traversed during the onward journey and same during the return journey. The member of the 22<sup>nd</sup> expedition reached Cape Town from Goa by Air and landed at Indian Bay by ship through the Atlantic Ocean. While return to India the same route was followed. Observations of marine birds were carried out over a vast area from 36°S to 69°S and 30° E to 48° E and from 34°S to 70°S and 12° E to 39° E of Antarctic and sub-Antarctic region during 15<sup>th</sup> and 22<sup>nd</sup> expeditions respectively (Fig. 5). These areas were comprised of open sea, floating ice, pack ice, polynia, ice shaft and continental ice. We have considered here only latitude-wise distribution of birds on sightings in both the expeditions. For easy understandings the zoo-geographical distribution of the birds, the study areas

have been divided into three broad divisions i.e., Temperate zone (36°S to 49°S) where cool sub-Antarctic and the warmer sub-tropical surface water is mixing up. Sub-Antarctic or sub-polar zone (50°S to 59°S) where surface layer with slightly warmer Sub-antarctic water and deeper layer with cold denser Antarctic water and the last and third zone is Antarctic or polar zone (60°S to 69°S) which is cooled by ice and wind and more biologically rich.

#### MATERIALS AND METHODS

Birds were Observed from ship with the help of high power field binocular (One 8×40B Luminar and one 10×50 extra wide Bushnell). Besides recording of bird species, their abundance and distributional range were also recorded on voyage during both the onward and return journeys. Photographs were taken with a still 35 mm camera. The position of each sighting place was recorded by using the Magellan GPS 5000 NAV PRO equipment.

#### RESULTS

1. **Wandering Albatross** : *Diomedea exulans exulans* Linnaeus : This species is highly pelagic in Antarctic and Sub-Antarctic water but rarely occurs near pack ice (Watson, 1975). This species was sighted in both the voyages. Distributions of the bird in lower latitude are same in the two voyages (Temperate zone) but in 22<sup>nd</sup> expedition the bird has been found at much higher latitude (Sub-polar zone) than 15<sup>th</sup> expedition. Parulekar (1983) reported this bird during the 1st Antarctic expedition almost in the Antarctic or Polar region (in between 59°-69° S).

2. **Grey Headed Albatross** : *Diomedea chrysostoma* Forster : Usually this bird is found in Antarctic and Sub-Antarctic waters but its tendency is to occur in higher latitudes where land masses are absent (Watson, 1975). During the 15<sup>th</sup> expedition this species was recorded only from the Sub-Antarctic or Sub-Polar region, but in 22<sup>nd</sup> expedition this species was sighted in both temperate and Sub-Antarctic zones.

3. **Yellow-Nosed Albatross** : *Diomedea chlorohynchos* Gmelin : This species is pelagic in nature and is found largely in sub-tropical and warmer Sub-Antarctic waters (Watson, 1975). This bird was only

sighted in 22<sup>nd</sup> expedition and from sub-Antarctic zone. Parulekar (1983) also reported this bird in between temperate and sub-Antarctic zones.

4. **Sooty Albatross** : *Phoebetria fusca* Hilsenberg : This species is mostly found in temperate and sub-Antarctic waters and highly pelagic in nature (Watson, 1975). This species was sighted only during the 15<sup>th</sup> expedition. It was observed that this species is distributed in all the three zones of Southern Ocean i.e., Temperate, sub-Antarctic and Antarctic.

5. **Laysan Albatross** : *Diomedea immutabilis* Rothschild : This bird is very rare and only sighted during the 15<sup>th</sup> expedition. The distributional range of this species was found upto sub-Antarctic zone from temperate zone.

6. **Black-Browed Albatross** : *Diomedea melanophris* Temminck : Generally this bird is found in Antarctic and sub-Antarctic waters. It occurs both offshore and far out to sea but tends to favour the seas near the continental landmasses (Watson, 1975). Like the Laysan Albatross this bird was also found in both the temperate and sub-Antarctic zones and sighted only in 15<sup>th</sup> expedition.

7. **Royal Albatross** : *Diomedea epomophora* Lesson : This bird is very common in Antarctic water. This bird was sighted in the temperate zone only during the 15<sup>th</sup> expedition.

8. **Light mantled Sooty Albatross** : *Phoebetria palpebrata* Forster : This bird is highly pelagic and distributed all along the Antarctic waters; its southern limit seems to be heavy pack ice at the edge of the Antarctic continent (Watson, 1975). During the 15<sup>th</sup> expedition this bird was recorded from both the temperate and sub-Antarctic zones. But it was never sighted in 22<sup>nd</sup> expedition.

9. **White Chinned Petrel** : *Procellaria aequinoctialis aequinoctialis* Linnaeus : Widespread in pelagic and offshore waters of the Sub-Antarctic and uncommon in south of the Antarctic convergence (Watson, 1975). This species was recorded in both the expeditions. In both the voyages the bird was recorded from the temperate zone but in the 15<sup>th</sup> expedition the distributional range extended up to the sub-Antarctic zone.

10. **Southern Giant Fulmer/Southern Giant Petrel** : *Macronectes giganteus* (Gmelin) : They are pelagic in Antarctic and sub Antarctic waters throughout the year (Watson, 1975). The distributional range of this bird was recorded in all the three zones by the 22<sup>nd</sup> expedition member whereas it was only reported from temperate zone during 15<sup>th</sup> expedition.

11. **Fairy Prion** : *Pachyptila turtur turtur* (Kuhl) : According to Watson (1975) this bird is very common in sub-tropical and sub-Antarctic waters. This bird was sighted in the temperate zone in both the expeditions.

12. **Blue Petrel** : *Holobaena caerulea* (Gmelin) : This species was reported from the cold sub-Antarctic and Antarctic waters (Watson, 1975). But during the 15<sup>th</sup> expedition this species was reported from both temperate and sub-Antarctic zones, whereas in 22<sup>nd</sup> expedition this bird was only sighted in sub-Antarctic zone.

13. **Cape Pegion/Cape Petrel** : *Daption capensis capensis* Linnaeus (Figs.3&4). This bird is generally pelagic in sub-Antarctic and Antarctic waters but it avoids the pack ice. Sometimes they are found in cooler tropical waters (Watson, 1975). This bird was sighted in the sub-Antarctic zone (15<sup>th</sup> expedition) but is observed much higher latitudinal distribution (in between 59°S to 69°S) in 22<sup>nd</sup> expedition. Parulekar (1983) also reported its wide distributional range during 1<sup>st</sup> Indian expedition.

14. **Antarctic Petrel** : *Thalassoica antarctica* (Gmelin) : This bird is most frequent in open water with scattered ice bergs and ice floes, also found in open pack ice (Watson, 1975). This bird was sighted in both the expeditions and almost from the same zone (Antarctic zone).

15. **Antarctic Prion** : *Pachyptila desolata desolata* (Gmelin) : This species is highly pelagic in Antarctic and sub-Antarctic waters (Watson, 1975). The bird was sighted in temperate as well as in sub-Antarctic zones during 15<sup>th</sup> expedition. The bird was recorded at much lower latitude during 22<sup>nd</sup> expedition (Temperate zone).

16. **Kerguelen Petrel** : *Pterodroma brevirostris* (Lesson) : This species is highly pelagic in sub-Antarctic and Antarctic waters north of the pack ice (Watson, 1975). This species was sighted from

temperate zone and recorded only during 15<sup>th</sup> expedition.

17. **Great Winged Petrel** : *Pterodroma macroptera macroptera* (A. Smith) : Generally occurs well out to sea, where it is largely confined to the sub-tropical surface water zone. Occasionally, the Great Winged Petrel stays into the sub-Antarctic and Antarctic zones during summer (Watson, 1975). This species was sighted from temperate zone and recorded only during 15<sup>th</sup> expedition.

18. **Northern Giant Fulmer** : *Macronectes giganteus halli* Mathews : This bird occurs almost exclusively north of the convergence, and pelagic in Antarctic and sub-Antarctic waters (Watson, 1975). This species was sighted from temperate zone and recorded only during 15<sup>th</sup> expedition.

19. **Soft Plumaged Petrel** : *Pterodroma mollis mollis* (Gould) : This petrel is reported from mostly sub-tropical and sub-Antarctic waters but occasionally entering the Antarctic zone during the summer (Watson, 1975). This species was sighted from temperate zone and recorded only during 15<sup>th</sup> expedition.

20. **Short Tailed Shear Water** : *Puffinus tenuirostris tenuirostris* (Temminck) : This species was sighted from temperate zone and recorded only during 15<sup>th</sup> expedition.

21. **Wilson's Storm Petrel** : *Oceanites oceanicus oceanicus* (Kuhl) : Although this species is confined to colder pelagic and offshore Antarctic and sub-Antarctic waters during the breeding seasons but migrate to climatically similar northern hemisphere waters in the off season (Watson, 1975). During both the expeditions, this bird was sighted in temperate zone.

22. **Grey Backed Storm Petrel** : *Garrodia nereis* (Gould) : This bird is highly pelagic, and found largely in the sub-Antarctic zone (Watson, 1975). This bird was sighted by the 15<sup>th</sup> expedition member from temperate zone.

23. **Snow Petrel** : *Pagodroma nivea* (Forster) : This species is almost entirely restricted to the colder Antarctic waters with pack ice or icebergs and ice floes (Watson, 1975). During both the expeditions, this bird was sighted near the shelf in Antarctic zone.

24. **Antarctic Tern** : *Sterna vittata Gmelina* : This bird was sighted only in 22<sup>nd</sup> expedition and recorded its wide zoo-geographical distribution from 48°S to 61°S latitude. But during the 1<sup>st</sup> expedition, the bird was reported only from temperate zone (Parulekar, 1983).

25. **South Polar Skua** : *Catharacta skua macormicki* (Saunders) : (Fig. 2). Adults stay near breeding colonies in the Antarctic zone during the summer, but during the off-season it may range north to sub-tropical waters (Watson, 1975). This bird was sighted only in Antarctic zone during both the expeditions.

26. **Adelie Penguin** : *Pygoscelis adelia* (Hombron and Jacquinot) : These are the most common penguin species in the East Antarctica. In both the expeditions a good number of birds were sighted from 60° to 70° S latitude and 10° – 40° E longitude.

27. **King Penguin** : *Aptenodytes patagonicus patagonicus* Miller : The bird was sighted in the 15<sup>th</sup> expedition near the Prince Edward Island (45°S and 69° E). The bird is known to breed in South Georgia.

28. **Emperor Penguin** : *Aptenodytes forsteri* Gray : Earlier report says that Emperor penguins breed regularly during winter in more than 30 colonies around the shores of the Continent and adjacent islands. Mostly the birds were sighted in between 66°S to 71°S latitude during 15<sup>th</sup> and 22<sup>nd</sup> expeditions.

### DISCUSSION

The studies made separately on occurrence and distribution of different bird species sighted in 15<sup>th</sup> and 22<sup>nd</sup> Indian Antarctic expeditions during voyage through Indian and Atlantic Oceans Recorded 28 species including 14 species as common in occurrence in both the expeditions. Among different bird groups Petrels were dominant in number of species followed by Albatrosses. Record of Lesser number (14 spp.) of bird species during 22<sup>nd</sup> expedition than the 15<sup>th</sup> expedition (23 spp.) may be due to shorter travel time and for shorter route and also for lower temperature in Atlantic Ocean. These may have some impact on species make-up and distribution. This was evident by

absence of some birds species in the 22<sup>nd</sup> expedition (Table-1).

The result also showed that except Wandering Albatross which was recorded in Antarctic zone all other Albatross species were found to occur between temperate to Sub-Antarctic zones. Two species of Penguins, Adelie and Emperor were observed in all the three zones, being maximum in Sub-Antarctic and Antarctic zones. Only King Penguin sighted in 15<sup>th</sup> expedition were found to distribute in Sub-Antarctic Islands. Among the Petrels, Cape Petrel, Antarctic Petrel, Giant Winged Petrel and Snow Petrel were found to tolerate much lower temperature as they mostly live in Sub-Antarctic and Antarctic zones. Many of the other birds recorded in this study are known to occur in Antarctic zone but they are here observed to live in temperate and Sub-Antarctic zones.

But it is very early to say, whether these changes are occurred due to the climatic changes of Southern Ocean, or non-availability of food in the Southern Ocean or insufficient data of Avifauna of Southern Ocean.

Present day Polar Regions experience greater rates of climate change than elsewhere on the planet. The fauna of these regions is uniquely adapted to the extreme environments in which they exist, and may be vulnerable to shifts in climate. Climate change is having impacts on both marine, and terrestrial, and limnetic systems, and hence will influence future biological diversity.

In view to above, it has been clearly understood that the Antarctic research in future will not be the mere listing of species but also essential to develop the long-term monitoring programme to have a better understanding the causes of changes.

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**Table-1 :** List of bird species encountered during the voyages in both 15th and 22nd Indian Antarctic Expedition (Latitude wise).

Sl. No.	Common Name	Latitude	
		1995-1996	2002-2003
1	Wandering Albatross	36°S to 49°S	34°S to 58°S
2	Grey Headed Albatross	50°S to 59°S	46°S to 55°S
3	Yellow-Nosed Albatross	NOT SIGHTED	55° S
4	Sooty Albatross	36°S to 69°S	NOT SIGHTED
5	Laysan Albatross	36°S to 59°S	NOT SIGHTED
6	Black-Browed Albatross	36°S to 59°S	NOT SIGHTED
7	Royal Albatross	36°S to 49°S	NOT SIGHTED
8	Light Mantled Sooty Albatross	36°S to 69°S	NOT SIGHTED
9	White Chinned Petrel	35°S to 69°S	34°S to 51°S
10	Southern Giant Fulmer/ Southern Giant Petrel	60°S to 69°S	34°S to 70°S
11	Fairy Prion	36°S to 49°S	45°S to 50°S
12	Blue Petrel	36°S to 69°S	51°S
13	Cape Pegin/Cape Petrel	50°S to 59°S	59°S to 69°S
14	Antarctic Petrel	50°S to 69°S	68°S to 70°S
15	Antarctic Prion	39°S to 59°S	38°S
16	Kerguelen Petrel	36°S to 49°S	NOT SIGHTED
17	Great Winged Petrel	36°S to 49°S	NOT SIGHTED
18	Northern Giant Fulmer	36°S to 49°S	NOT SIGHTED
19	Soft Plumaged Petrel	36°S to 49°S	NOT SIGHTED
20	Short Tailed Shear Water	36°S to 49°S	NOT SIGHTED
21	Wilson's storm Petrel	36°S to 49°S	38°S
22	Grey Backed Strom Petrel	36°S to 49°S	NOT SIGHTED
23	Snow Petrel	60°S to 69°S	63°S to 69°S
24	Antarctic Tern	NOT SIGHTED	48°S to 61°S
25	South Polar Skua	59°S to 69°S	63°S to 69°S
26	Adelie Penguin	60° to 70° S	69° to 70° S
27	King Penguin	45°S to 69°S	NOT SIGHTED
28	Emperor Penguin	66°S to 69°S	69°S to 71°S

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**Fig. 1.** Monitoring of the birds from the Ship in Pack ice zone



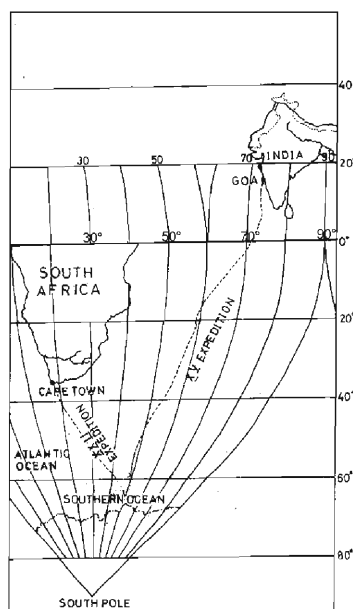
**Fig. 2.** Antarctic Skua in Schirmacher oasis



**Fig. 3.** Cape-Pigeon (Ventral view)



**Fig. 4.** Cape Pigeon (Dorsal view)



**Fig. 5.** Root map of Expedition