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BIRD LOG DATA

Atlantis Two - Cruise 8
International Indian Ocean Expedition

by

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Bostwick H. Ketchum, Acting Director

BIRD LOG DATA

Atlantis II

I. I. O. E.

1 August-11 November, 1963

being the combined field notes of Roger Pocklington,
Robert Risebrough and Michael Palmieri.

presented as

1. Oceanographic Background.

- a) Area covered
- b) Cruise course
- c) Zones of surface water
- d) Surface currents
- e) Weather conditions

2. Bird Log by Species.

3. Bird Log by Regions and Island Groups

4. Meteorological, Oceanographic and Biological Correlations of the
Data.

1. Oceanographic Background

a) Area covered

Following the "preliminary Guide to the Birds of the Indian Ocean" (Watson, Zusi & Stover, Smithsonian Institution, 1963) our Indian Ocean Bird Log begins at a position (20°N, 37°30'E) in the Red Sea off Port Sudan which we reached on the afternoon of 1 August, 1963. Thus the southern portion of the Red Sea and the Gulf of Aden are included in the area covered by our Indian Ocean records. The northern boundary line is the southern coast of Arabia, 20°N line to India and the west coast of India from Bombay to Ceylon. The furthest point East that we reached is Colombo (7°N 80°E) and the eastern boundary line runs from there through the Chagos Is. (6°S 71°E) to Mauritius (20°S 57°30'E) and the southern tip of Madagascar. The western boundary is the coast of Africa as far south as Cape Delgado (10°30'S 40°30'E) thence via the Comoros to Madagascar. We quit the region east of Lourenço Marques (26°S 37°E) around noon on the 11 November, 1963. About one third of the area of the Indian Ocean falls within these bounds.

b) Cruise course

Leaving the Red Sea and Gulf of Aden we went East on the 15°N line to the edge of the shelf on the Indian Coast then N. E. to Bombay. Out of Bombay we proceeded West along the 20°N line, striking S. W. to Socotra from 62°E. Reaching the Somali Coast we turned East along the 10°N line, passing through the Laccadives then S. E. to Ceylon. We left Colombo and took the Kahdiva Channel through the Maldives, moving West along the 5°N line. From the Somali coast we struck S. S. E. towards the Amirantes, turning West to Zanzibar 3° below the Equator. Out of Zanzibar we touched briefly at Dar-es-Salaam, turned away from the African continent at Cape Delgado and passed through the Comoros, N. E. from the northernmost tip of Madagascar by Providence Banks to the Seychelles. We reluctantly left the Seychelles and headed East to the Chagos Islands, S. and then W. along the 10°S line which took us over the Saha de Mahya Bank, past the Agalegas and back to Madagascar. Off Cape Anasiraka we struck East past Tromelin to the Cargados Carajos Group. Heading S. S. W. from here we put in to Mauritius then passed North of Reunion round the southern tip of Madagascar and due West to Lourenço Marques.

c) Zones of Surface Water Note: Because of the seasonal dependence of surface water conditions in the Indian Ocean, this division into zones applies only for the time of year that we were there.

1. Red Sea (St's 43-47)

Due to high evaporation and low run-off this arm of the Indian Ocean is hot and salty at all depths (average of stas. at 1 m T=30.9°C, S=37.4‰). It is also relatively rich in nutrients as compared with the Mediterranean (a similar high T-high S arm of an ocean), as the following table shows.

	Med #30	Red Sea #43
Surface Phosphate	0.02	0.12 $\mu\text{gA PO}_4\text{-P/L}$
400M Phosphate	0.06	1.05
Surface Nitrate	0.06	0.30 $\mu\text{gA NO}_3\text{-N/L}$
400M Nitrate	4.40	17.14

The reason for this great difference in nutrient values seems to be that the water entering the Red Sea from the Indian Ocean, to make good the loss by evaporation, is itself very rich in nutrients. This combination of conditions plus the presence of many small islands for breeding stations indicates a good area for tropical bird species

2. Gulf of Aden and Arabian Sea (#48-54, 67-78)

The surface water is cooler and less saline than in the Red Sea (av. of stas. at 1 m, $T=27.4^\circ\text{C}$, $S=36.4\text{‰}$). Both T and S are higher on the Indian coast than on the Arabian side. Nutrient levels are fairly high (e.g. #72, at 1 m, $0.26 \mu\text{gA PO}_4\text{P/L}$, $0.85 \mu\text{gA NO}_3\text{-N/L}$.) probably due to admixture of sub-surface water by the Monsoon winds.

3. Arabian Coast(#55-66, 79-82)

The indications are that colder sub-surface water reaches the surface by upwelling close into the Arabian coast then moves away from shore under the influence of the Monsoon winds giving lower T and S at the surface (av. of stas, at 1 m, $T=25.7^\circ\text{C}$, $S=35.9\text{‰}$) than in the Gulf of Aden and Arabian Sea. This also accounts for the presence of record-high nutrients at the surface (e.g. #62, at 1 m, $1.03 \mu\text{gA PO}_4\text{-P/L}$, $8.17 \mu\text{gA NO}_3\text{-N/L}$).

4. Socotra (#83-91)

This is the only region in the northern part of the Indian Ocean in which we encountered surface water of less than 23°C , i.e. sub-tropical water rather than the tropical water (T average 22.0°C) of the rest of the area covered. Salinity is relatively homogeneous throughout the upper water column ($S=35.35 \pm 0.1\text{‰}$, 0-1000m). Nutrient levels are incredibly high (e.g. #85 at 1 m, $1.07 \mu\text{gA PO}_4\text{-P/L}$, $19.21 \mu\text{gA NO}_3\text{-N/L}$). This is Somali Current Water originating South of the Equator and this productive region is likely to attract many bird species.

5. Somali Coast (#92-96, 127-135)

The coastal current spreads colder water (av. of stas at 1 m, $T=25.3^\circ\text{C}$, $S=35.5\text{‰}$) eastwards. Comparable with the Socotra water but with lower nutrient levels ($0.28 \mu\text{gA PO}_4\text{-P/L}$, $0.91 \mu\text{gA NO}_3\text{-N/L}$, #133 at 1 m)

6. Arabian Basin (#97-126, 136-142, 167-173)

Compared with the Arabian Sea to the North, we find higher T and lower S in this region (av. of stas 97-126, at 1 m, T=28.2°C, S=35.4‰). In the West, over the Somali Basin, temperatures are lower (av. of stas. 136-142 at 1 m, T=26.5°C, S=35.3‰), and in the South over the Seychelles Bank, salinity is lower (av. of stas. 169-173, at 1 m, T=28.2°C, S=35.1‰). Nutrients as in Arabian Sea.

7. East Africa and Madagascar Water (#143-168, 198-227)

This region is the southern part of the Somali Current Water. In the North, temperatures are higher than along the Somali coast (av of stas 143-151 at 1 m, T=25.3°C, S=35.3‰) and nutrients are lower (e.g. #159, at 1 m, 0.18 µgA PO₄P/L, 0.23 µgA NO₃N/L). Further South the temperature and Salinity drops (av. of stas. 152-161 at 1 m, T=25.4°C, S=35.1‰) and in the region of Providence Bank and the Amirantes there is no homogeneous water mass but a region where the surface water, though remaining constant in Salinity, is cool off Cap d' Ambre increasing in Temperature along N. N. E. line (#162-168, at 1 m, T=24.4 to 26.6°C, av. =25.63, S = 35.2‰) to the south, Mascarene water is slightly warmer (av. of stas 148-212 at 1 m, T=25.7°C, S=35.2‰), the Reunion Basin water cooler (av. of stas 213-220 at 1 m, T=23.8°C, S=35.2‰) and the water of the South Mozambique Channel intermediate (av. of stas. 221-227 at 1 m, T=24.1°C, S=35.3‰). Nutrients generally low, highest off Mauritius (#215 0.38 µgA NO₃-N/L) at 1 m.

8. Saha de Mahya Water (#174-197)

This region is similar to the Arabian Basin in temperature, but considerably less saline (av. of stas. 174-197 at 1 m, T=27.9°C, S=34.6‰). It is noticeably warmer and less saline than the East African Water. Nutrients generally low (e.g. #184 at 1 m, 0.18 µgA PO₄-P/L, 0.07 µgA NO₃-N/L)

d) Surface Currents

The most notable movement of surface water is in the vicinity of Socotra. Here the water of the Somali Current, which is well-marked to 1000 m, turns East to move with us along the 10°N line to India. In the region of the Arabian Coast, surface water is blown away from the shore and its place taken by up-welling of sub-surface water, creating a rich feeding area for many species and individual birds.

e) Weather conditions

Though both the S. W. and N. E. Monsoon rains are drawn from this region, there was very little rain over the water, and except for one or two occasions on the most northerly sections there was no cause for birds to seek shelter aboard our vessel from the weather. No birds noticeably wind-blown beyond their normal ranges were recorded.

BIRD LOG BY SPECIES

The following is a list of the birds seen at sea. It does not include those observed ashore on Mahé or on Mauritius.

Puffinus pacificus. WEDGE-TAILED SHEARWATER

Oct. 16: 4°S 56°E Abundant in large, mixed flocks west of Praslin Island, Seychelles.

Oct. 22: 6°15'S 71°11'E Several in mixed flock west of the Chagos Archipelago.

Puffinus l'herminieri. AUDUBON'S SHEARWATER

Aug. 27: 13°N 54°E One came aboard ship at night near Socotra. Although apparently within the range of the Persian Gulf race, P.l. persicus, the white ring about the eye, a diagnostic feature of that race, was not present.

Oct. 16: 4°S 56°E Large numbers observed west of Praslin Island, Seychelles.

Oct. 22: 6°15'S 71°11'E Several in mixed flock west of the Chagos Archipelago.

Pterodroma sp. and Bulweria sp.

Black petrels were observed frequently in the Indian Ocean. According to the Birds of the Indian Ocean, five species occur in the area. They are very difficult to distinguish in the field and no unquestionable records can be contributed here.

Oceanites oceanicus. WILSON'S PETREL

Aug. 7: 12°20'N 47°46'E Two came aboard and were examined in the hand.

Oct. 22: 06°15'S 71°10.5'E In mixed group W. of Chagos Archipelago.

Nov. 7: 23°32'S 50°13'E Adult aboard

Phaethon aethereus. RED-BILLED TROPICBIRD

Aug. 21: 20°N 66°E One adult
Aug. 29: 10°50'N 52°20'E Two adults

Phaethon lepturus. WHITE-TAILED TROPICBIRD

Aug. 9: 14°51'N 51°50'E One adult
Sept. 13: 4°50'N 72°50'E One adult, Kahdiva Channel,
Maldiva Islands.
Oct. 16: 4°S 56°E Several in mixed company.

Sula dactylatra. MASKED or BLUE-FACED BOOBY

Sept 19: 5°N 55°E Two immatures (360 miles from
land).
Oct. 30: 15°39.5'S 53°58'E 4 adults and 1 imm. flying and
fishing about ship. Probably
from Tromelin Islands.

Sula sula. RED-FOOTED BOOBY

Oct. 21: 6°20'S 71°E Light and dark phases and im-
matures, ca 20 in all, feeding
in one small spot.

Sula leucogaster. BROWN BOOBY

Aug. 3: 14°30'N 42°40'E In mixed flock.
Sept 24: 1°30'S 52°E One following ship (180 nautical
miles from Seychelles)

Fregata sp.

Sept 18: 04°53'N 57°20'E Two frigate birds (465 miles
from land!) with terns.
Sept 29: 5°S 42°50'E 3 with ca. 40 Sooty Terns.
Oct. 30: 16°S 55°E Individuals among large flock
of Sterna sp. off Tromelin
Island.

Fregata minor. GREAT FRIGATEBIRD

Oct. 24: 9°30'S 62°E

3 males preying upon a flock of ca. 30 Sterna fuscata feeding on Saha de Mahya Bank (300 miles out).

Fregata ariel. LESSER FRIGATEBIRD

Nov. 1: 16°49'S 59°30'E

On November 1, a small party from the Atlantis II spent three hours ashore on a small island at the southern tip of the Cargados Carajos Shoals. 200 pairs of lesser frigate birds were nesting there on low bushes, one-two feet from the ground in the company of greater and lesser noddies and fairy terns. Although none of the males was in courtship plumage, all other stages of the nesting cycle were observed. It is therefore likely that breeding is continuous throughout the year. Several of the males which were incubating eggs showed remnants of the courtship plumage—some green iridescence on the nape feathers and a very small shrunken throat pouch. Plumage of the adult nesting females was surprisingly variable. Some had a complete white neck collar, on others the back of the neck was brownish black. The eye ring was red or blackish and the amount of rufous on the chest showed significant variations. This species unlike F. minor, was not observed at sea. It is therefore possible that Fregata ariel feeds only close to shore, contributing to the ecological separation between the two species.

Arenaria interpres. TURNSTONE

Oct. 11: 06°27'S 53°09'E

Pair in flight about vessel off Amirantes.

Nov. 1: 16°49'S 59°30'E

Parties in winter plumage on Cargados Carajos.

Charadrius leschenaultii.

Nov. 1: 16°49'S 59°30'E Several on the Cargados Carajos.

Numenius sp.

Oct. 26: 10°10'S 56°E Two flew over ship off Agalegas. Not N. madagascarenensis, since the underwing was dark.

Erolia testacea. CURLEW SANDPIPER

Oct. 22: 06°15'S 71°10.5'E One flew over ship W. of Chagos Archipelago.

Catharacta skua. SKUA

Oct. 24: 9°30'S 62°E A skua approached three adult male Fregata minor which were preying upon ca. 30 Sterna fuscata feeding on the Saha de Mahya Bank. It repeatedly menaced one of the frigates in the air causing the latter to drop a fish which the skua caught.

Larus hemprichii. SOOTY GULL

Aug. 2: 18°30'N 39°30'E Individuals seen in Red Sea.

Sept 30: 6°S 39°20'E Many around Zanzibar.

Larus fuscus. LESSER BLACK-BACKED GULL

Aug. 4: 13°N 45°E Many about Aden.

Sterna dougallii. ROSEATE TERN

Nov. 1: 10°49'S 59°30'E Breeding on sand (coral) bank S. of Coco Islands, Cargados Carajos. Young in all stages but no eggs were found.

Sterna anaethetus. BRIDLED TERN

Aug. 3: 14°30'N 42°40'E Seen with Sterna fuscata in Red Sea.

Sterna anaethetus. BRIDLED TERN (Cont)

Sept 18: 04°53'N 57°20'E While passing through a long,
(465 naut. miles narrow strip of white water ca.
from Africa) 200 terns were seen. Ten were
identified as this species and
the remainder were probably also
bridled terns.

Oct. 16: 4°S 56°E Common in the large mixed flocks
W. of Praslin Island.

Sterna Fuscata. SOOTY TERN

Aug. 3: 14°30'N 42°40'E In company of Sterna anaethetus.

Sept 5: 10°N 72°E With Thalasseus bergii, Anous
stolidus and GAdfly Petrels off
the Laccadives.

Sept 16: 5°N 63°E Flock feeding on flying fish.
(570 naut. miles
from land)

Sept. 29: 5°S 42°50'E Ca. 40 with 3 Fregata sp.

Oct. 8: 12°S 48°30'E 20 near Gloriosa Island.

Oct. 10: 8°30'S 52°E One adult aboard disgorged a
small flying fish and two small
squid, one partially digested
the other virtually whole.

Oct. 11: 06°27'S 53°09'E Off Amirantes many about ship
(big colony on Isle des Noeufs).

Oct. 16: 4°S 56°E Abundant with other seabirds W.
of Praslin Island, Seychelles.

Oct. 22: 06°15'S 71°10.5'E Many in mixed flock W. of Chagos
Archipelago.

Oct. 24: 9°30'S 62°E On Saha de Mahya Bank a flock of
ca. 30 diving and feeding on the
water were preyed upon by three
adult male. Fregata minor.

Oct. 30: 16°S 55°E Distant view of large flock
working off Tromelin Island.
Sterna sp. present probably
Sootys.

Sterna fuscata. SOOTY TERN (Cont)

Nov. 1:	16°49'S	59°30'E	Sootys seen from the boat as we approached Cargados Carajos, but not seen ashore.
Nov. 6:	22°S	53°E	One adult on bridge deck disgorged pieces of small squid when handled.
Nov. 7:	22°40'S	52°E	Another aboard. Throughout night they were flying and calling about ship.

Sterna albifrons. LITTLE TERN

Sept 30:	6°S	39°20'E	With <u>Thalasseus bergii</u> and <u>Larus hemprichii</u> off Zanzibar.
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Thalasseus bergii. CRESTED TERN

Sept 5:	10°N	72°E	With Noddys and Sootys terns.
Sept 30:	6°S	39°20'E	Around Zanzibar.

Anous stolidus. NODDY

Aug. 2:	18°30'N	39°30'E	First seen in Red Sea.
Aug. 27:	13°N	54°E	One aboard off Socotra and a number flying about ship.
Sept 5:	10°N	72°E	With <u>Thalasseus bergii</u> and <u>Sterna fuscata</u> , Laccadives.
Oct. 16:	4°S	56°E	Common in mixed flocks W. of Praslin Island, Seychelles.
Oct. 22:	06°15'S	71°10.5'E	In mixed groups W. of Chagos.
Nov. 1:	16°49'S	59°30'E	Commonly nesting on Cargados Carajos on the coral sand.

Anous tenuirostris. LESSER NODDY

Nov. 1:	16°49'S	59°30'E	Commonly nesting in small group in bushes on Cargados Carajos.
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Gygis alba. FAIRY TERN

Oct. 16: 4°S 56°E Common in mixed flocks W. of Praslin Island. (Observed breeding in trees of Mahé), Seychelles.

Nov. 1: 16°49'S 59°30'E Commonly nesting on the coral sand, on pieces of coral and in bushes on Cargados Carajos.

Hirundo rustica. SWALLOW

Aug. 22: 20°N 65°E Juv. aboard during day (270)naut. miles from India).

BIRD LOG BY REGIONS AND ISLAND GROUPS

Aug. 2 - 4: Red Sea, Southern part Larus hemprichii
Anous stolidus
Sterna fuscata
Sterna anaethetus
Sula leucogaster

Aug. 4 - 10: Gulf of Aden Larus fuscus
Oceanites oceanicus
Phaëthon lepturus
Pterodroma sp. or Bulweria sp.

Aug. 13 - 24: Arabian Sea Phaëthon aethereus
Pterodroma sp. or Bulweria sp.
Hirundo rustica

Few birds were seen in this region but observation time was reduced by bad weather. One palaeartic migrant, Hirundo rustica, came aboard.

Aug. 27 - 31: Socotra Anous stolidus
Puffinus l'herminieri
Phaëthon aethereus

In spite of high nutrient levels in this water mass, few sea birds were observed. Storm conditions, however, reduced observation time.

Sept. 5 - 7 Southern Island of Laccadives Thalasseus bergii
Anous stolidus
Sterna fuscata
Pterodroma sp. or Bulweria sp.

Congregation of species about the islands contrasted with the empty mid-ocean sections.

Sept. 13.	<u>Kahdiva Channel</u> <u>Maldives</u>	<u>Phaëthon lepturus</u>
Sept. 16 - 19	<u>Arabian Basin</u>	<u>Sterna fuscata</u> <u>Sterna anaethetus</u> <u>Fregata sp.</u> <u>Oceanodroma sp.</u> <u>Sula dactylatra</u>
Sept. 23 - 24	<u>Somali Coast</u>	<u>Fregata sp.</u> <u>Sula leucogaster</u>
Sept. 26	<u>Somali Basin</u>	<u>Fregata sp.</u>
Sept. 29 - 30	<u>E. African Water</u>	<u>Sterna fuscata</u> - 40 <u>Fregata sp.</u> - 3 <u>Thalasseus bergii</u> <u>Sterna albifrons</u> <u>Larus hemprichii</u>
Oct. 4 - 12	<u>Gloriosa Island</u> <u>Providence Banks</u> <u>Amirantes</u>	<u>Sterna fuscata</u> - 20 <u>Sterna fuscata</u> <u>Sterna fuscata</u> <u>Arenaria interpres</u>
Oct. 16	<u>Seychelles</u>	<u>Puffinus pacificus</u> - abundant <u>Puffinus l'hermineri</u> - common <u>Phaëthon lepturus</u> - several common <u>Sterna anaethetus</u> - common <u>Sterna fuscata</u> - abundant <u>Anous stolidus</u> - common <u>Gygis alba</u> - common
Oct. 21 - 22	<u>W. of Chagos</u> <u>Archipelago</u> 06°15'S 71°10.5'E	<u>Puffinus pacificus</u> <u>Puffinus l'herminieri</u> <u>Pterodroma sp.</u> , or <u>Bulweria sp.</u> <u>Oceanites oceanicus</u> <u>Sterna fuscata</u> <u>Anous stolidus</u> <u>Sula sula</u> <u>Erolia testacea</u>
Oct. 24	<u>Saha de Mahya</u> <u>Bank</u>	<u>Sterna fuscata</u> <u>Fregata minor</u> <u>Catharacta skua</u>
Oct. 26	<u>Agalegas</u>	<u>Numenius sp.</u> - 2
Oct. 30	<u>Tromelin</u>	<u>Sula dactylatra</u> <u>Sterna sp.</u> <u>Fregata sp.</u>

Nov. 1	<u>Coco Island</u> <u>Cargados Carajos</u> <u>group</u>	<u>Fregata ariel</u> - commonly breeding <u>Arenaria interpres</u> - in winter plumage <u>Charadrius leschenaultii</u> <u>Sterna dougallii</u> - breeding <u>Sterna fuscata</u> <u>Anous stolidus</u> - commonly nesting <u>Anous tenuirostris</u> - commonly nesting <u>Gygis alba</u> - commonly nesting
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The island visited was most probably Coco. Sterna dougallii was confined to a sandy spit south of Coco Island; Fregata ariel was nesting one-two feet from the ground in the bushes; Anous tenuirostris also was confined to nesting sites above ground, occurring in groups of five to ten pairs, whereas Anous stolidus was a solitary nester on the ground; Gygis alba, usually a tree nester, was nesting either in the shrubbery on elevated pieces of coral, or on the ground.

Nov. 7	<u>Reunion Basin</u>	<u>Sterna fuscata</u> - numerous <u>Oceanites oceanicus</u>
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METEOROLOGICAL, OCEANOGRAPHIC AND BIOLOGICAL CORRELATION
OF BIRD LOG DATA

As the water throughout the region, with the exception of the small area about Socotra, was warmer than 23°C in the top metre, the whole area covered falls within the Tropical Zone having as breeding species in common with other tropical oceans; Puffinus l'herminieri; Phaethon aethereus and Phaethon lepturus (also the rare Phaethon rubricauda which we did not see); the three Sulidae- Sula dactylatra, Sula sula and Sula leucogaster; Fregata minor and Fregata ariel; Sterna anaethetus, Sterna fuscata, Anous stolidus, and Gygis alba.

The only Sub-Tropical or Temperate species encountered was Sterna dougallii, breeding on Coco Island, Cargados Carajos. Since it was past Northern Summer for most of the trip, Palearctic breeders were wintering on the islands and occasionally were seen at sea: Arenaria interpres, Charadrius sp., Numenius sp., Erolia testacea, Larus fuscus, Hirundo rustica Sub-Antarctic and Antarctic breeders were represented by the wide-ranging Oceanites oceanicus and Catharacta skua.

The colder water region off Socotra and about the Arabian coast did not have distinctive non-tropical bird fauna. This ties in with other oceanographic evidence to show that the existence of this cool surface-water region is seasonal, depending upon the Monsoon,

and not sufficiently well-established to have its own typical species. (Note however, that the Socotra Cormorant, Phalacrocorax nigrogularis, one of the least-known species of cormorants, which we did not see and Puffinus l'herminieri persicus may be associated with this seasonal sub-tropical region.

Our log indicates that large concentrations of sea birds occurred only near land and banks. This was true not only of land-based Sulidae, Fregatidae and Laridae, but also to the truly oceanic Procellariidae.

Tropic birds were occasionally seen singly far from shore, e.g. Phaethon aethereus at 20°N, 66°E, 240 miles from shore. Frigate birds, usually thought to remain near land, were seen at 04°53'N, 57°20'E, 465 miles from land. The most numerous and the most widely ranging species was the Sooty Tern observed on one occasion at 570 nautical miles from shore.

No species was recorded beyond the range given in the Preliminary Field Guide to the Birds of the Indian Ocean.

One interesting feature was the virtually complete absence of "overlap" in ranges of related species among the Phaethontidae and Sulidae. On no occasion were individuals of different species seen together or even in the same surface water region e.g. Sula leucogaster - Red Sea, Somali Coast; Sula dactylatra - Arabian Basin, Mascarene Water; Sula sula - Saha de Mahya water; Phaethon lepturus - Gulf of Aden, Arabian Basin, Seychelles; Phaethon aethereus - Arabian Sea, Socotra.