Sea-bird Transects between Europe and Rio Plate, South America, in Autumn 1973

By
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(Med et dansk resumé: Iagttagelser af havfugle i Atlanterhavet mellem Europa og Sydamerika, efterår 1973)

INTRODUCTION

This paper describes the birds seen on three crossings of the tropical Atlantic between September and November 1973 and compares the observations with those of the few similar transects.

The routes of our three transects followed more or less the same path (Fig. 1), from the approaches to the English Channel to near Madeira and the Canary Islands, through or near the Cape Verde Islands and across the Atlantic at its narrowest point to near the island of Fernando de Noronha and then down the Brazilian coast to the Rio Plate. More accurate paths can be plotted from the noon positions given in the Appendix. Two crossings were made by Hansen on the vessel *Nippon Reefer* which averaged 21 knots for the 12,900 mile round trip. (Throughout measurements are given in nautical miles; 1 nautical mile = 1.9 km.). His sailings were from Zeebrügge (Belgium) on 31 August 1973 to Montevideo (Uruguay) on 13 September, and Buenos Aires (Argentina) on 28 September to Le Havre (France) on 11 October. Normally watches were kept from outside the wheelhouse, eye-height about 13 m above sea level, which allowed a wide view of most, but not all, of the horizon. In particularly good conditions observations were made from the roof of the wheelhouse which gave a complete 360° view. Apart from breaks for meals, a look-out was kept every day from a little before sunrise to sunset – an average of 10.5 hours per day. All birds seen were recorded.

Harris made a single crossing from Barry (Wales) on 13 October 1973 to Montevideo on 8 November on the Oceanographic research vessel RRS Shackleton, which averaged 9.5 knots for the 6052 mile voyage. Minor delays and work at sea are included in this average and sea-speed was sometimes 2 knots faster. This slow speed allowed far more detailed observations to be made than is normally possible from the much faster commercial vessels. In addition he also had some say in the route (hence the close approach to Fernando de Noronha) and was also able to collect information on sea-temperatures. Observations were made from the bridge, with an eye height of 10 m above the sea through a field of view of 180-200°. Only birds spotted with the naked eye were counted though identifications and observations were made with 10 x 40 binoculars. Notes were dictated onto a tape recorder and the time added every ten minutes. Observations were halted when the observer noticed that his concentration was wavering. Weather, positions and surface water temperatures were available from the ship's log. Flying fish and cetaceans were also counted.

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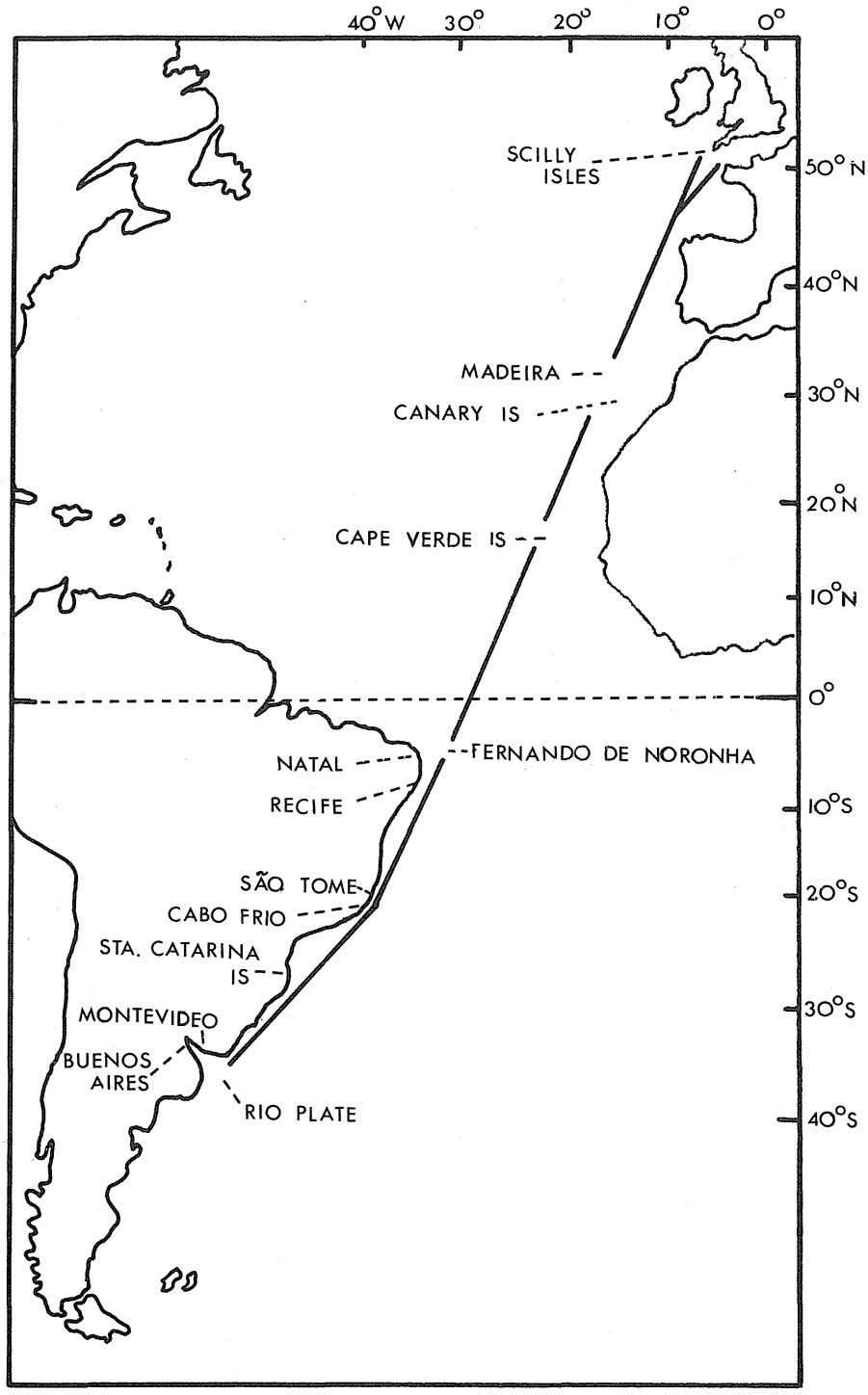


Fig. 1. Approximate route of the three transects. Actual noon positions are given in the appendix.
Omtrentlig rute af de tre rejser. Middagspositioner ses i appendix.

SPECIES ACCOUNTS

Comparisons are made with two similar transects undertaken by TICKELL & WOODS (1972) in October 1954 and 1962 respectively, a voyage by MURPHY (1914) in October-November 1912 who landed at Fernando de Noronha but then proceeded south some 5° to the east of our courses, and one in December 1951 by VAN OORDT & KRUIJT (1954) who went from Aruba (Dutch Antilles) to Cape Town (South Africa) and passed to the east of Fernando de Noronha.

Our original data are presented as an appendix.

Magellan Penguin *Spheniscus magellanicus* (Magellanpingvin).

Only seen near the Rio Plate. As this species is difficult to see, the counts are probably meaningless.

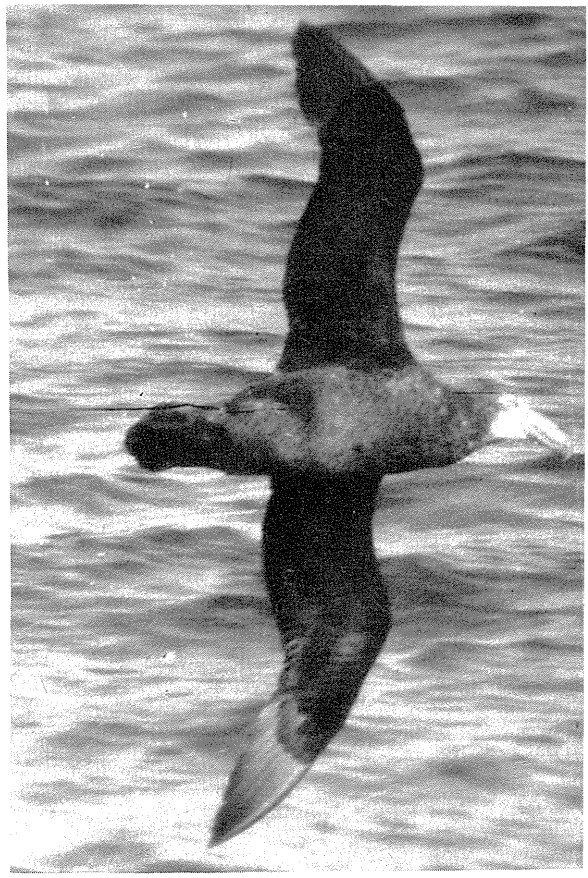
Wandering Albatross *Diomedea exulans* (Vandrealbatros).

The most northern records in the three voyages (and dates) were 20° 35'S, 38° 35'W (11 September), 22° 20'S, 40° 24'W (1 October) and 27° 45'S, 46° 20'W (6 October). In all 30 birds were recorded including a single individual which followed the Nippon Reefer for 135 miles. Some of these birds could have been mis-identified Royal Albatrosses, *D. epomophora,* as adults are indistinguishable in the field, but all those seen closely were immature Wanderers. Both MURPHY and TICKELL & WOODS had their most northern October records at 23° S.

Black-browed Albatross *Diomedea melanophris* (Sortbrynet Albatros)

On 4 November, Harris recorded 21 in the cold waters between Cabo Sao Tomé and Cabo Frio, Brazil, the most northern being at 21° 58'S. From there south the species was common, the majority of birds being immatures. Surprisingly in two October transects down this coast, TICKELL & WOODS recorded only a single Black-browed Albatross (at 33°S). The most northern record by MURPHY was at 33°28'S.

Hansen first encountered this species at 21° 38'S, 39° 40'W on 11 September; none were seen the next day but from then the species was plentiful in the entrance to the Rio Plate, including a flock of 70 birds sitting on the water. Less numerous on the northward voyage, last seen 24° 07'S, 42° 46'W on 1 October.



Giant Petrel *Macronectes giganteus.* Photo: L. FERDINAND *Kæmpestormfugl.*

Yellow-nosed Albatross *Diomedea chlororhynchos* (Gulnæset Albatros)

Not recorded by Harris but Hansen found it not uncommon south of 21° 38'S, 39° 43'W in early September and of 23° 21'S, 41° 29'W on 1 October. As this species was only identifiable when the colour of the bill was seen, there is some chance of confusion between this species and Black-browed Albatrosses. TICKELL & WOODS had a single record at 24° S, 41° W on 28 October.

Giant Petrel *Macronectes giganteus* (Kæmpestormfugl)

A total of 63 individuals seen in the entrance to the Rio Plate on 13 and 29 September. Only one there on 7 November which suggests that most birds had moved south to the breeding areas.

Fulmar *Fulmarus glacialis* (Mallemuk)

The only records were in the approaches to the English Channel (five birds) and well out from north-west Iberia (three).

Cape Pigeon *Daption capense.* Photo: LH. *Kapdue* Daption capense. *Foto: LH.*

Cape Pigeon *Daption capense* (Kapdue)

This species was common south of 20° 35'S in mid-September but by the end of the month it was not seen north of 29° 07'S. In November only three individuals were seen, all in the green Rio Plate water.

White-chinned Petrel *Procellaria aequinoctialis* (Skomager)

One of the commonest birds south of 28° S in both of Hansen's transects. First recorded by Harris at 22° 10'S and then it became common. The white chin of the species cannot be relied on as a species recognition mark for it was lacking in over 100 of the 131 birds seen closely. However, some of the most nothern birds had substantial amounts of white on the sides of the head. Most birds were in heavy wing moult (Harris). TICKELL & WOODS recorded far fewer with the northernmost records at 23°S and 30°S in two Octobers; MURPHY'S first sightings were at 24°42'S, 37°10'W.

Cory's Shearwater *Calonectris diomedea* (Kuhls Skråpe)

Although it is known that the winter range of this species includes waters off eastern South America (VAN OORDT & KRUIJT, COOKE & MILLS 1972), the bulk of our records were near the known breeding islands of Madeira and the Cape Verdes. Most of the Madeiran and some of the Cape Verde birds were in heavy wing moult (Harris). As the populations leave these seas from October/November until the first birds return during the last few days in February (at least in 1973), the adults must moult immediately after nesting and before migrating. This is in contrast to most migratory species in the genus, e.g., British Manx Shearwaters *P. puffinus puffinus,* Sooty and Great Shearwaters which migrate first and then moult. The only records away from the breeding areas were five near 15° N, 23° W on 6 October. Some Cape Verde birds were puzzling for, although their flight was typical of the species with much soaring and high banking, they showed much white at the base of the tail and had dark beaks. First thoughts were of Great Shearwaters, even though the cap was less obvious than in most birds of that species. Closer views of the birds' dark bill showed that they were the Cape Verde race *edwardsi.*

Great Shearwater *Puffinus gravis* (Storskråpe)

Between 2-4 September Hansen saw 186 between 43° N, 09° W and 26° N, 17° W. These were feeding with other shearwaters, but 209 between 20° N, 20° W and 01° N, 28° W on 5-7 September were all migrating SSE. On 8 and 9 September about 200 individuals seen between 01° N, 31° W and 06° S, 34° W had no very obvious migratory pattern though some birds had a tendency to move westerly. However, later on that day and on 10 and 11 September a total of 315 birds were all flying SSW. No further Great Shearwaters were seen on the outward voyage but by the time the boat was returning north there were 71 just north of Rio Plate. Between 30 September and 2 October 34 birds were noted off the Brazilian coast north to 16° S. In the estern Atlantic there were only eight records; one of these was going north, the rest south.

The species was again abundant on 14 October south of the Scilly Isles when Harris saw 1228 in 410 minutes but the only lager records in the North Atlantic were two at 37° 50'N, 14° 53'W. Further south, eight birds were seen off Brazil and Uruguay.

The northern records were part of a large influx of birds into European waters in the

autumn of 1973. All birds seen closely were in immaculate, freshly moulted plumage.

Sooty Shearwater *Puffinus griseus* (Sodfarvet Skråpe)

Hansen noted a total of 22 individuals scattered between Brittany and Uruguay whereas later Harris saw only one, south of the Scilly Isles on 14 October.

Manx Shearwater *Puffinus puffinus* (Alm. Skråpe)

During the first week of September numbers of Manx Shearwaters were present from the

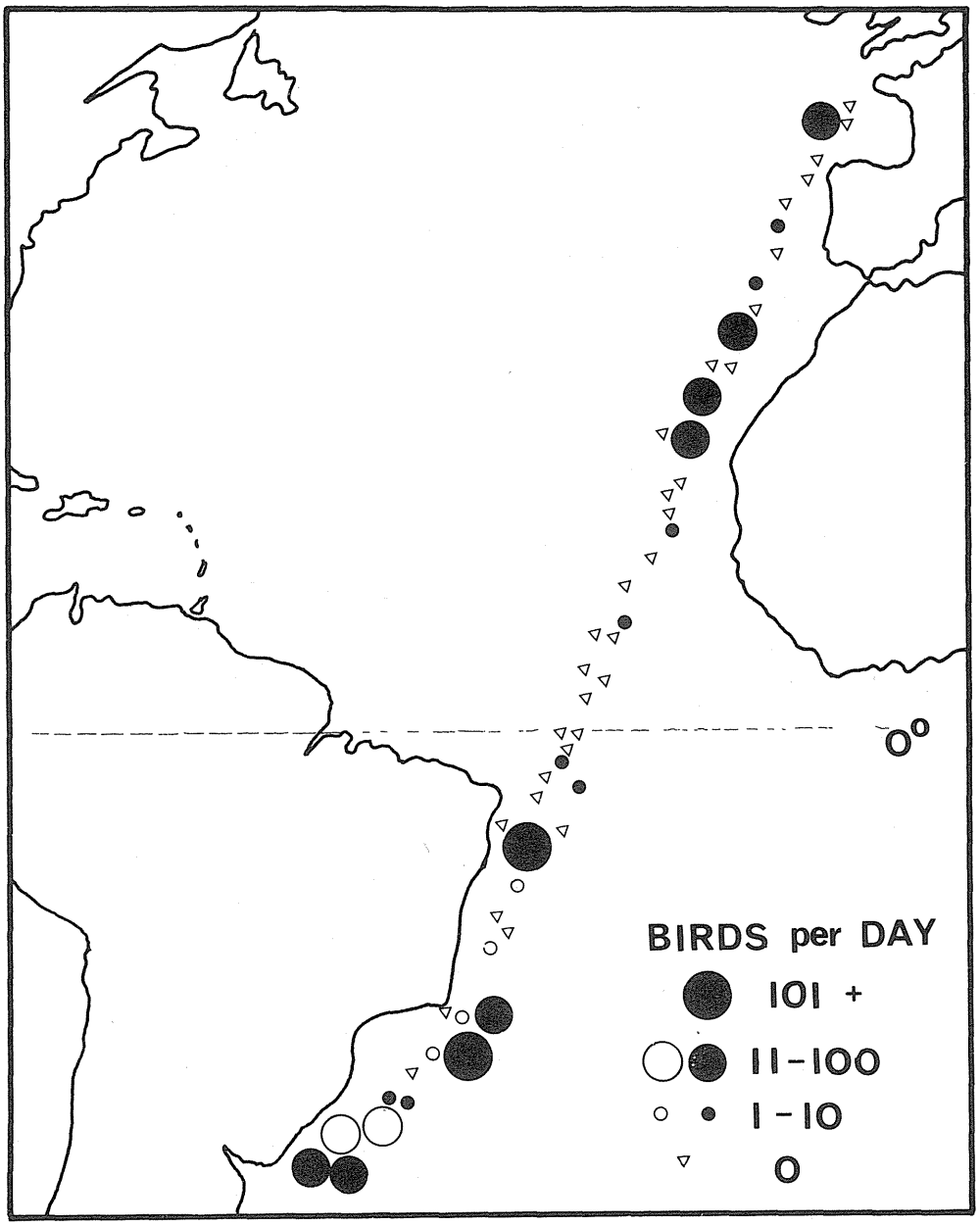
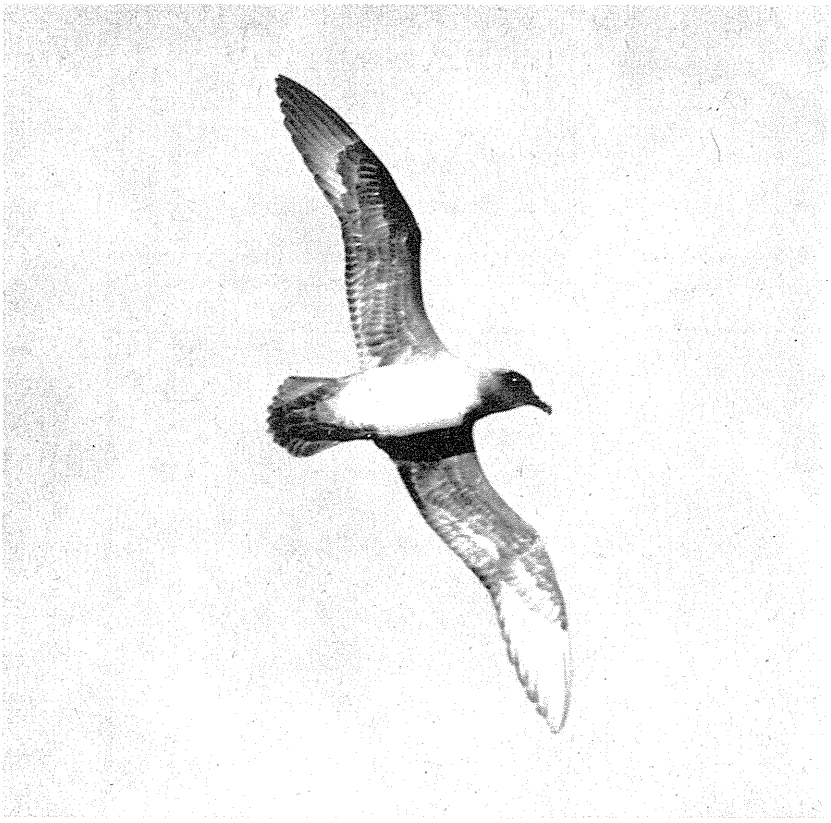


Fig. 2. Daily totals of Manx Shearwaters *Puffinus puffinus* plotted against local noon position. A few positions are slightly off set for clarification.
Daglige antal Alm. Skråpe afmærket ved dagens middagsposition. Nogle tegn er flyttet en anelse af hensyn til tydeligheden.



Schlegel's Petrel *Pterodroma incerta* off the coast of Brazil. Note the dark throat and undertail coverts contrasting with white belly and breast. Photo: MPH.
Schlegels Skråpe Pterodroma incerta *udfor Brasiliens kyst. Bemærk mørk strube og underhaledækfjer i kontrast til hvidt bryst og bug.*

English Channel to the Canary Islands. Then, apart from a single bird at 17° 40'N, 21° 50'W on 5 September, there were no records until nine at 02° 30'S, 32° 22'W on 8 September. The next day at least 800 birds were congregated close to the Brazilian coast between Natal and Recife at 07° S, 34° 30'W. Only odd groups, totalling 42 birds, were encountered between there and the Rio Plate. On the return passage birds were slightly commoner north to 23° S (total 129) but the only concentration was 90 at 24° 07'S, 42° 26'W on 1 October. In the eastern Atlantic small numbers of birds were still present north to 34° N, 14° W (northeast of Madeira). By the time of the third transect which left Wales on 13 October the bulk, if not all, of the Manx Shearwaters must have moved to Brazil as none were seen until a single at 11° 50'S, 35° 29'W– 70 miles off the Brazilian coast – on 1 November and the first significant numbers not until 90 miles west of Sta. Catarina Is. Numbers increased between here and Montevideo but this could have been due to the fact that the Shackleton was then closer to land. Ringing recoveries show that many Manx Shearwaters die in the large bay between Cabo Frio and Sta. Catarina Is. (HARRIS 1966) – an area we passed well to the west. This concentration of recoveries is probably due to a combination of high human population (for it includes Rio de Janeiro and Sâo Paulo) and relatively cold waters at the northern end of the north flowing Falkland Current.

Although we crossed the Atlantic at the time when most Manx Shearwaters are leaving European waters we saw very few birds in the tropics (Fig. 2). This suggests that they spend little time in these warm waters, and supports the view of PERRINS, HARRIS & BRITTON (1973) that young birds may be able to cross the Atlantic without having to stop to feed.

Of the 123 Manx Shearwaters seen only two were obviously in moult though many had worn and bleached plumage (Harris). Either the birds were gathering elsewhere to moult or these birds were still recovering from the migration and building up reserves before starting to moult.

Little Shearwater *Puffinus assimilis* (Lille Skråpe)

Small black-and-white shearwaters were seen near to Madeira (two) and the Cape Verdes (nine) and off Brazil between 23° S and 31° S (5). These were probably all Little Shearwaters but the flight of one of the Brazilian birds was more typical of Audubon's Shearwater *P. lherminieri.* Some may have been overlooked in flocks of Manx Shearwaters.

Schlegel's Petrel *Pterodroma incerta* (Schlegels Skråpe)

This species nests only on Tristan da Cunha but is common in the South Atlantic. We saw a total of 134 between 24° S and 32° S but none in the cold water near Cabo Frio nor in the area

influenced by the Rio Plate. Only a single bird (at 29°S) was noted by TICKELL & WOODS but MURPHY recorded 'large flocks' south from 33°S but far further from land. Of the 24 birds seen closely, six were in fresh plumage and 18 were moulting the inner primaries.

Trinidad Petrel *Pterodroma arminjoniana*

Two birds were 30 and 90 miles respectively south-west of Fernando de Noronha on 30 October and another the next day was at 08° 25'S, 34° 20'W (Harris).

Great-winged Petrel *Pterodroma macroptera* (Langvinget Skråpe)

Three birds between 20° S, 39° W and 24° S, 42° W on 11 September and three more at 30° S, 49° W on 30 September were the only records (Hansen).

Soft-plumaged Petrel *Pterodroma mollis* (Madeiraskråpe)

Three singles – 21° 30'N, 20° 07'W (5 September), 03° 58'N, 28° 10'W (5 October) and 33° 50'N, 17° 00'W (19 October).

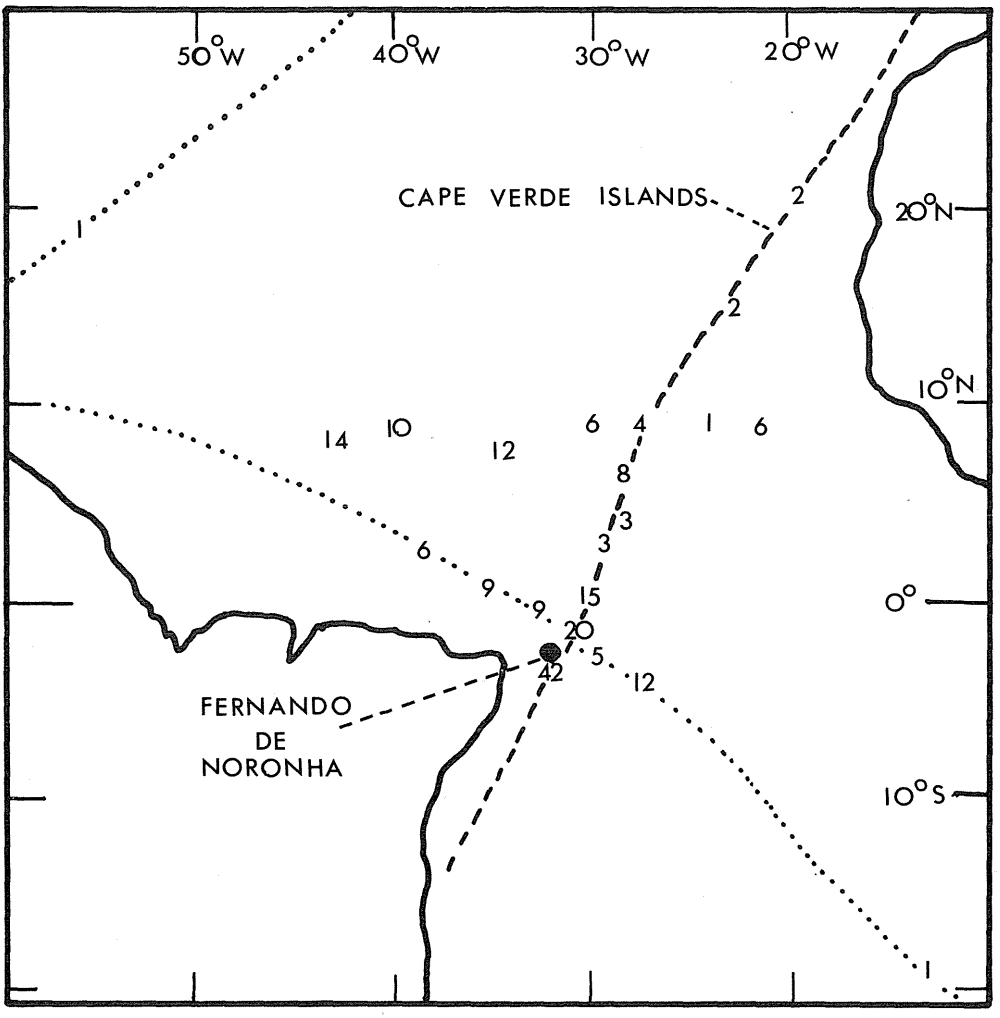


Fig. 3. October and November records of Bulwer's Petrel *Bulweria bulweri*. Sources are present transects (figures joined by dashed lines), VAN OORDT & KRUIJT (1954) (records joined by dotted line) and scattered records in BOURNE (1960-70). Figures refer to daily counts of birds.
Oktober og november iagttagelser af Bulwers Skråpe. Tallene fra vore rejser er afsat langs stiplet linie; iagttagelser af van Oordt & Kruijt (1954) er afsat langs prikket linie. Spredte optegnelser hos Bourne (1960-70) er afsat som fritstående tal. Alle tal angiver fugle pr. dag.

Bulwer's Petrel *Bulweria bulwerii* (Bulwers Skråpe)

During the first voyage only recorded near to Madeira and the Cape Verdes in the first week of September. By the second voyage (October) 13 were seen at 01° S; there were still a few near Cape Verdes but none north of 20° N.

On 18-25 October the species was not encountered near the African islands but was fairly common from 09° 04'N, 26° 17'W to 04° S, 33° 06'W, and abundant near Fernando de Noronha. Of the 77 birds seen, two were moulting the inner primaries (Harris). A bird which came aboard at night had wing length 196 mm and wing-span 640 mm. In general appearance, and with a wedge-shaped tail, the species is not unlike a Brown Noddy though it flies with more-bent wings and normally lacks the typical tern-like flight of the Noddy. In calm conditions the flight is low over the sea and resembles both the bounding flight of an *Oceanodroma* storm petrel and the twisting flight of a Manx Shearwater. Less commonly there is an extremely erratic flight with the bird sometimes almost turning back on itself. In rough conditions it glides and banks like a miniature *Pterodroma* petrel.

Birds appear to leave the north-east Atlantic outside the breeding season and winter off the north-east coast of Brazil – though not further south than 5° S near to the coast (Fig. 3). WINTERBOTTOM (1940) remarks that whereas the species was common south of Madeira in August, he saw none there in January; neither did Bierman in a November transect through the area (BIERMAN & VOOUS 1950).

Storm Petrels

The two authors had very different experiences with this group of birds. Whereas Harris had just under a thousand sightings, Hansen saw only 92 individuals in double the mileage. This was probably due to the latter travelling at 21 knots, the former at only 9-11. The identification of these birds is notoriously difficult and depends on many variables, not the least of which are the weather, experience and self-confidence of the observer. Therefore the two authors' records are clearly separated below.

British Storm Petrel *Hydrobates pelagicus* (Lille Stormsvale)

Harris – Two storm petrels seen south of the Scilly Isles on 14 October were identified as this species but there must be some doubt due to the later abundance of the next species, and the fact that the diagnostic whitish underwings coverts were not noted.

Wilson's Storm Petrel *Oceanites oceanicus* (Havløber)

The commonest storm petrel.

Hansen – Most records were south of 20° S but there were also nine birds between 04° N and 28° N. The only storm petrel to follow the ship.

Harris – This wake-feeder *par excellence* was first seen at 41° 30'N, 13° 20'W and from then was the most consistently seen bird despite a noticeable drop in density in mid-Atlantic. None of the many hundreds of individuals seen closely showed any signs of moult and in none did we see the oft-quoted diagnostic yellow webs on the feet.

Leach's Storm Petrel *Oceanodroma leucorrhoa* (Stor Stormsvale)

Hansen – Not recorded (but see next species).

Harris – Birds were identified if the dark area running longitudinally through the white rump patch or the deeply forked tail were seen, or by size comparison if any one bird in the occasional small flock could be identified. All definite records were between the Canary Islands and Fernando de Noronha where 73 were identified, along with nine Madeiran and 72 unidentified *Oceanodroma,* in 67 hours of observations. No *Oceanodroma* was seen west of 37° W, approximately where Wilson's Storm Petrel started to become abundant. Van Oordt & Kruijt found it common (up to 37 in seven hours) from the Caribbean to 08°S on a course passing east of Fernando de Noronha whereas neither Murphy nor Tickell & Woods reported it. The sea between Cape Verdes, Fernando de Noronha and the Caribbean must be an important wintering area. Fourteen of the birds were in heavy wing moult. The species does not occur close inshore to South America south of the equator.

Madeiran Storm Petrel *Oceanodroma castro* (Madeirastormsvale)

Hansen – One definite record near Tenerife on 8 October. Originally a further 25 *Oceanodroma* were assigned to this species as most were near known breeding areas (but seven birds at 06° 30'N, 27° 07'W on 5 October), but it is now realized that these identifications are open to doubt.

Harris – Despite the great difficulty of separating the present species from Leach's, there were nine almost certain records between 24° 03'N, 20° 31'W and 12° 47'N, 25° 00'W, i.e., close to known breeding grounds. The wintering grounds of this species are unknown. WALLACE (1973) suggested that birds which occur in the Gulf of Guinea were likely to be migrants from the Cape Verdes but there are three specimens from the Gulf which are clearly separable from Cape Verde birds and probably belong to a local breeding population (HARRIS 1969).

Grey-backed Storm Petrel *Garrodia nereis*

Three identified at 34° 40'S, 57° 30'W on 29

September. Tickell & Woods' most northern records were at 42°S.

White-faced Storm Petrel *Pelagodroma marina* (Fregatstormsvale)

Hansen – Five records between 02° S, 30° W and 03° S, 31° W on 4 October.

Harris – Singles in the Cape Verdes on 24 October, and at 09° 34'N, 26° 09'W on 26 October.

White-bellied Storm Petrel *Fregetta grallaria*

A single Fregetta sp. at 07° 36'S, 33° 58'W was probably this species though the possibility of Black-bellied Storm Petrel *F. tropica* cannot be ruled out as the latter's black line down centre of the belly is difficult to see. The flight was direct with rapid wing beats interspaced with glides when the white wing linings and belly were very attention-drawing. Both Murphy and Tickell & Woods recorded a few individuals north to this latitude.

Red-billed Tropicbird *Phaethon aethereus* (Rødnæbbet Tropikfugl)

Single in the Cape Verdes on 24 October. BANNERMAN (1968) gave no September or October record for the area.

Yellow-billed Tropicbird *Phaethon lepturus* (Gulnæbbet Tropikfugl)

Single seen at Fernando de Noronha. In addition unidentified tropicbirds near Fernando de Noronha and at 19° 05'S, 39° 17'W. Tropicbirds are so easily spotted and normally approach boats that these few records must indicate a very low density of birds.

Gannet *Sula bassana* (Sule)

Recorded in English Channel and Bay of Biscay. Of the birds seen clearly on 15 October, 340 showed no signs of immaturity, four were juveniles and 33 older immatures suggesting that the 1973 – young had already moved quickly south to the winter quarters. The later lack of birds may have been due to our course lying off the Continental Shelf but nine adults were seen in 620 minutes observation just east of Madeira in February – March 1973 (HARRIS & BOURNE pers.obs.) Two immature Gannets seen near to the Cape Verdes 6 October were also assumed to be this species.

White or Masked Booby *Sula dactylatra*

Six adults inshore at Fernando de Noronha on 30 October and an adult and an immature (probably this species) off Recife (Brazil) 9 October.

Red-footed Booby *Sula sula*

As well as many birds close to the colonies at Fernando de Noronha, there was a single brown phase of this species, the most pelagic of the boobies, on 29 October some 170 miles north-east of the island and two feeding flocks totalling 112 birds between 20 and 100 miles south-west of Noronha on 30 October. Of a sample seen closely 42 were white phase, seven brown phase and 12 juveniles.

Brown Booby *Sula leucogaster* (Brun Sule)

This species was seen close to Fernando de Noronha (eight birds on 30 October) and within 70 miles of the Brazilian coast (3-5 November). Although a tropical species it was commonest in the cold waters between Cabo São Tomé and Cabo Frio. It was the only sea-bird present in the brown outpourings of the Rio Docé.

Magnificent Frigatebird *Fregata magnificens* (Amerikansk Fregatfugl)

Two at Fernando de Noronha and another with a flock of terns and boobies 100 miles south-west on 30 October. Single with Brown Boobies off Cabo Frio on 4 November. Frigatebirds were visible long after the species they were with were lost to sight.

Cormorant *Phalacrocorax carbo* (Skarv)

Single off Cape Finistere on 10 October.

Phalaropes *Phalaropus fulicarius/lobatus* (Thorshane/Odinshane)

A single at 28°03'N, 17°02'N on 8 October, 12 on 9 October between 35°N, 13°W and 38° N, 12° W, and three flying south at 41° 20'N, 13° 14'W on 17 October could not be identified.

Great Skua *Catharacta skua* (Storkjove)

Common only south of the Scilly Isles, where at least 81 on 14 October, and off Cape Finistere where 23 on 10 October. Singles at 46° 06'N, 09° 38'W (15 October), ten miles south of Madeira (20 October) and two in mid-Atlantic at 06° 30'N, 27° 07'W (5 October). (The species is common near Madeira later in the winter for 11 were seen near that island in 620 mins. observations on 3 March 1973 (Harris & Bourne pers. observations)). Off the Brazilian coast three between 11° 50'S and 15° 40'S and three more between 30° S and 33° S were most likely southern hemisphere nesting birds at the northern edge of their range though a few British-ringed Great Skuas have also been recovered off Brazil.

Pomarine Skua *Stercorarius pomarinus* (Mellemkjove)

Whereas Hansen saw only two singles off north-west Spain, Harris had a total of 28 records between 41° N and 35° S with a concentration of 17 sightings (including eight birds together) in 520 minutes near Cape Verdes. BIERMAN & VOOUS (1950) also recorded a concentration of 100 birds in a day near these islands. There was no problem with identifications as birds usually came to inspect the

vessel. Similar behaviour by Great Skuas means that the identifications of skuas are highly biased towards these two species.

Arctic Skua *Stercorarius parasiticus* (Alm. Kjove)

On Hansen's southward voyage this species was seen on four instances between just north of Madeira and the Cape Verdes whereas on the return passage it was common all the way from 30° S to 42° N with a flock of 50 harrying terns at 08° 48'S, 33° 23'W on 3 October. Later Harris had 11 definite records and four small unidentified skuas from 17° N to the Rio Plate with a concentration of four near Cabo Frio.

Long-tailed Skua *Stercorarius longicaudus* (Lille Kjove)

Singles on 4 October at 01°04'S, 30°15'W and 00° 15'N, 29° 45'W and on 6 November at 28° 50'S, 47° 20'W.

Herring Gull *Larus argentatus* (Sølvmåge)
Lesser Black-backed Gull *L. fuscus* (Sildemåge)

No detailed records kept close to land. Otherwise there were seven first-winter individuals (probably Lesser Black-backed Gulls) between the Scilly Isles and Madeira. Large numbers of the resident yellow-legged, dark-backed Herring Gull *L. a. atlantis* with two adult British Lesser Black-backed Gulls *L.f. graellsii* at Funchal Harbour, Madeira on 19 October. Two Herring Gulls, two adult and one third-year British Lesser Black-backs (all in mid-primary moult) and two immature gulls followed the boat south for about 100 miles after leaving Madeira. Single adult and one immature Herring Gull seen well away from land at 34° 30'N, 14° 00'W on 3 October.

Dominican Gull *Larus dominicanus* (Dominikanermåge)
Brown-hooded Gull *Larus maculipennis* (Sydamerikansk Hættemåge)

Seen only close to land in the Rio Plate.

Great Black-backed Gull *Larus marinus* (Svartbag)

Single south of the Scilly Isles on 14 October.

Black-headed Gull *Larus ridibundus* (Hættemåge)

Single adult and two first-winter birds 100-150 miles east of the Iberian coast 16-17 October, and three immatures at Madeira, where the species winters in small numbers, on 19 October.

Little Gull *Larus minutus* (Dværgmåge)

Single first-winter and one just sub-adult 100 and 300 miles west of Iberia 17 and 18 October, respectively.

Kittiwake *Rissa tridactyla* (Ride)

Twenty-eight juveniles and a single adult south of the Scilly Isles (14 October), and three single juveniles well west of the Bay of Biscáy (15-16 October).

Sabine's Gull *Xema sabini* (Sabinemåge)

Single recorded at 22° 13'N, 18° 46'W on 21 October.

Sandwich Tern *Sterna sandvicensis* (Splitterne)

Four seen off Cape Finistere on 10 October and some in the Rio Plate on 8 November.

Little Tern *Sterna albifrons* (Dværgterne)

Single off Recife (Brazil) on 9 September.

Common/Arctic Terns *Sterna hirundo/paradisaea* (Fjord/Havterne)

On Hansen's southward transect 27 were seen in the eastern Atlantic between 48° N, 06° W and 09° N, 25° W. No more were noted until 12 near Recife. Returning north there were groups off Cabo Frio and Recife and scattered birds between 04° S, 28° W and 07° N, 26° W (15 birds) and 14° N, 24° W and 43° N, 09° W (9 birds). Harris had a single record at 41° 20'N, 13° 14'W.

Close to Uruguay terns were common but the great number of species which occur in the area, and the fact that most were in immature plumage or moult (indicating that they were probably migrants from the north) made specific identifications all but impossible. The flocks included at least the following species – Common/Arctic Tern, South American Tern *S. hirundinacea,* Royal Tern *Sterna maxima* and Sandwich Tern.

Sooty Tern *Sterna fuscata* (Sodfarvet Terne)

Seen from 30 October to 2 November between Fernando de Noronha (where it nests) and the Brazilian coast south to 17° S. Most of the birds were in three large feeding flocks of about 150, 250 and 350 birds.

A feeding flock of ca. 300 terns seen in very bad conditions on 3 October at 08° 48'S, 33° 23'W may have been this species on geographical grounds but no definite identifications were possible.

Brown Noddy *Anous stolidus*
Black Noddy *A.tenuirostris*

On 30 October two large mixed flocks totalling some 1,200 birds were feeding about three miles off Fernando de Noronha. Of the birds seen closely seven were Brown and 20 Black. Not seen more than five miles from the island.

Fairy Tern *Gygis alba*

Single close inshore to Fernando de Noronha (where it breeds) on 30 October.

LANDBIRDS

Many landbirds were seen well away from land. Some were so tired that they either fell into the sea when trying to gain enough height to land on the boat or could not even keep up with the Shackleton's rate of progress let alone the Nippon Reefer.

On 2 September, Common Redstart, *Phoenicurus phoenicurus* (1 bird), Willow Warbler, *Phylloscopus trochilus* (2) and Turtle Dove, *Streptopelia turtur* (2) were seen about 100 miles west of Portugal and on the next day, some 400 miles from Iberia and north-east of Madeira, there was another Turtle Dove, an unidentified Nightingale, *Luscinia sp.* and a Swift, *Apus apus.* No more birds appeared until the 5th between the Canary Islands and the Cape Verdes. Then there were Turtle Dove (1), Heron, *Ardea cinerea* (2), Willow Warbler (1), a pipit, probably *Anthus pratensis,* a lark or thrush, three exhausted Swallows *Hirundo rustica* and Whimbrel *Numenius phaeopus* (either two groups of eight or one group seen twice 65 miles apart). The only bird south of here was a Vermilion Flycatcher, *Pyrocephalus rubinus* 135 miles off Brazil on 12 September. The return passage was less eventful with only Turtle Doves (5), Meadow Pipit (one dead), Linnets *Carduelis cannabina* (3) and Skylark *Alauda arvensis.*

The third transect also produced a good selection of birds. South-west of the Scilly Isles on 14 October, nine species were recorded – Turtle Dove (3), Song Thrush *Turdus philomelos* (4), Redwing *T. iliacus* (8), Redstart (2), Goldcrest, *Regulus regulus* (1), Pipits (2) and Wood Sandpiper, *Tringa glareola* (1). Redwings (5) and Song Thrush (1) were aboard the next day, when 90 miles north-west of Finistere, and were joined by Skylark, (1), Snow Bunting, *Plectrophenax nivalis* (1), Dunlin, *Calidris alpina* (1) and a Sanderling, *Calidris alba* which circled the ship at a distance for half-hour before landing. Three-hundred miles west of Lisbon on 18 October singles of Woodlark, *Lullula arborea,* a *Phylloscopus* sp. and another unidentified warbler arrived with clear skies. Next day within sight of Madeira five Skylarks (a regular migrant to that island) circled the ship and a Red-breasted Flycatcher *Muscicapa parva* boarded. The latter was not recorded for Madeira by BANNERMAN (1965).

Between Madeira and the Cape Verdes the only landbirds encountered were Grey Wagtail *Motacilla cinerea* (single 100 miles south of Maderira), Song Thrushes (one far south at 20° 30'N, 22° 00'W), Blackcap, *Sylvia atricapilla* (1) and Swallow (1). Further Swallows appeared at 08° 40'N, 26° 30'W and at 06° 20'N, 27° 12'W – more than 500 miles from land having, presumably, overshot the Cape Verdes. The only species seen off the Brazilian coast were Turnstone *Arenaria interpres* (2) Kentish Plover *Charadrius alexandrinus,* two martins and a completely unidentifiable long-tailed brown bird being carried helplessly out to sea by a violent squall.

DISCUSSION

Observations of birds at sea are notoriously difficult to quantify being subject to many and varied biases. Even counts by a single observer are influenced to an unknown degree by the weather, speed of the boat and height of the waves. Inter-observer differences are also great and include sharpness of eyesight and experience in identification. Concentration is also important in obtaining accurate and comparable results. When birds are fairly numerous it is easy to concentrate for three or four hours at a stretch but when the density is lower than one or two sightings an hour, as often occurs in tropical oceans, it is usually unwise to continue quantitative watches for more than two hours at a time. Within the limits of accepted decency social contact with the crew on watch must also be avoided. Once an observer finds himself day-dreaming or involved in serious conversation it is time to terminate a watch. This sort of concentration is essential to the collection of accurate results or even if there is any desire to see the uncommon species.

Neither of us attempted to allow for birds which followed in the wake of the ship. The two main ship followers were Wandering Albatrosses (usually individually identifiable by plumage characters) and Wilson's Storm Petrels.

The latter were sometimes abundant and birds in the wake were excluded from the watches – a separate count of these birds being made from time to time. We find it impossible to allow for inter-specific differences in bird's behaviour to ships, e.g., Great and Pomarine Skuas are attracted whereas Arctic and Long-tailed are not, so interspecific comparisons must be treated with caution. SANGER, (1972) attempted to define an effective visual range for species or groups of species; e.g. ship-following albatrosses were given a ranking of 2 miles, species which did not 1 mile, shearwaters 0.5 miles, storm petrels 0.25 miles (which is certainly optimistic), Guillemots, *Uria* spp. 0.5 miles, Puffins *Fratercula* spp. 0.33 miles. Although as an attempt to quantify data it is commendable, in practice it is probably very misleading and we have not tried to correct our data. Therefore any comparison of bird densities in different areas assumes that all species are equally likely to be seen.

Due to these difficulties we have considered it unwise to combine our two sets of data which were collected under rather different conditions. Therefore the analysis is concerned mainly with the third (Shackleton) transect when a serious attempt was made to standardize record collection and to maintain a uniform standard of concentration by reducing observer fatigue. In addition the Nippon Reefer was probably too fast to allow a realistic assessment of the numbers of storm petrels. The other transects conform to the same general pattern. The daily densities of seabirds and (where taken) of flying fish and the surface sea temperatures are given in the appendix.

There was no correlation between the numbers of birds and sea temperature or incidence of flying fish despite the fact that many of the larger tropical species, especially boobies, tropicbirds and frigatebirds, include them in their diets. Perhaps these fish normally occur too deep to be caught by the birds and approach the surface only when scared by larger predatory fish, cetaceans or a boat. Certainly concentrations of feeding sea-birds are often seen with feeding tuna and Red-footed and Masked Boobies sometimes catch flying fish put to flight by boats (HARRIS in press). In the tropical Indian Ocean, BAILEY (1968)

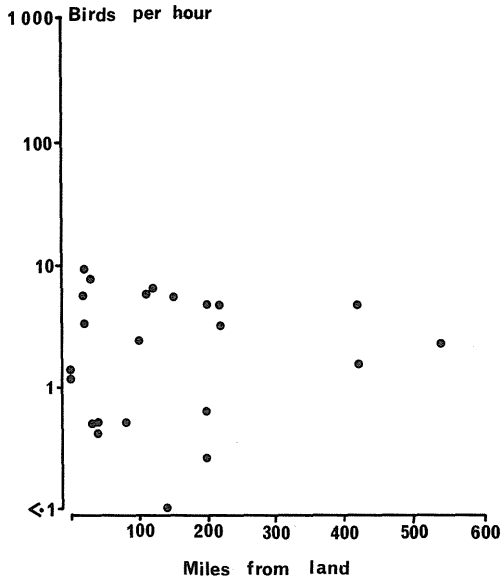


Fig. 4. Daily density of storm petrels *Oceanites/Oceanodroma spp.* and Bulwer's Petrels in relation to local noon distance (in nautical miles) from land.
Antallet af stormsvaler og Bulwers Skråper i forhold til afstanden fra land ved middag.

found that seabirds were most frequently seen when flying fish were common but there was no significant correlation for any one species. Neither could he find a correlation between the numbers of birds and zooplankton, remarking that 'may be ... the population of organisms on which sea-birds feed develop or concentrate a considerable time after upwelling of nutrient-rich waters occur'. However his observations were all made in a rather uniform water mass whereas JESPERSEN (1924, 1930) had found the expected correlation between low plankton yields and low bird numbers over a large and varied area of the North Atlantic.

Our data indicate that the highest bird densities occur near to land in both the temperate and tropical zones. North of the equator Harris found the highest densities near the Scilly Isles (230 birds/hour), Madeira (29/hour) and the Cape Verdes (45/hour) whereas in southern latitudes concentrations occured between Fernando de Noronha and Brazil (70 and 68/hour) and in the Rio Plate (38/hour). Hansen similarly had

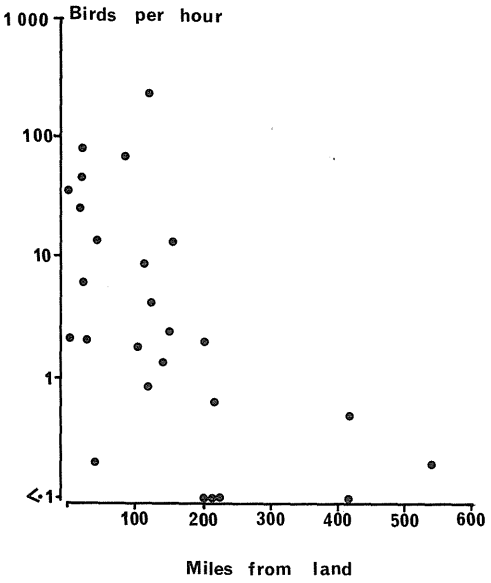


Fig. 5. Daily density of all sea-birds except storm petrels and Bulwer's Petrels in relation to local noon distance (in nautical miles) from land.
Daglig tæthed af alle havfugle bortset fra stormsvaler og Bulwer's Skråper, angivet som gennemsnit pr. time, i forhold til afstanden fra land ved middag.

concentrations east of Madeira (51/hour), within the Canary Islands (20/hour), south of Fernando de Noronha (97 and 34/hour) and in the Rio Plate (63 and 51/hour). Densities such as these are slightly misleading as the large and relatively obvious species, such as boobies and Cory's Shearwaters tend to be land-based whereas the smaller species are truely pelagic. The densities of storm petrels and Bulwer's Petrel are not correlated with distance from land (Fig. 4) which contrasts markedly with the very low incidence of other species more than 200 miles from coastlines (Fig. 5).

ALEXANDER (1928) and later workers noted that most birds which nest in the tropics do not range far from land. MURPHY (1936) stressed that 'from an ornithological point of view the central oceanic regions are the deserts of the sea'. Having looked for sea-birds on ocean passages between Europe and the West Indies, and in the western Indian Ocean we would agree, but were pleasantly surprised how many birds we both saw on these Atlantic crossings. Our records back up the surmise of Murphy, based on the data of Hentschel, that there is a concentration of birds in the 1530 mile narrows between the Cape Verdes and Brazil. The additional point brought out by our records is that most of the birds here are pelagic and not based on the islands sprinkled across the ocean.

The concentration of birds off the Brazilian coast south of Cabo Frio are due to the north-pushing of the Falkland Current and its mixing with the Brazil Current. These mixings are spectacularly shown both by the great fluctuations in the surface water temperatures (Fig. 6) and in the change from a tropical avifauna to a predominantly mixed temperate/subantarctic one. South of about 40° S the predominant winds are westerly which push the surface water offshore, resulting in upwellings of colder, richer water. In contrast, off Brazil the winds tend to be onshore, so preventing upwelling. Although the Falkland Current has only a weak influence north of the Rio Plate from November to April the situation is frequently confused and some cold water may penetrate north even in these months (South American Pilot 1959). Many Antarctic and Subantarctic species push northwards to Brazilian seas in the northern summer but even in mid-winter most species are still represented, though admittedly by rather few individuals.

ACKNOWLEDGEMENTS

We would like to thank the officers and crew of the Nippon Reefer and RRS Shackleton for their kindnesses and help during our voyages. Hansen's voyage was possible due to Knud Lauritzen – the owner of the Nippon Reefer. Drs. W.R.P. Bourne and D. Jenkins improved the manuscript by their criticisms.

1. This paper presents observations on birds seen on three crossings of the Atlantic from Europe to the Rio Plate, September – November 1973. Fifty-six species of seabirds were identified, including 24 Procellariiformes, 8 Pelecaniformes and 22 Charadriiformes.

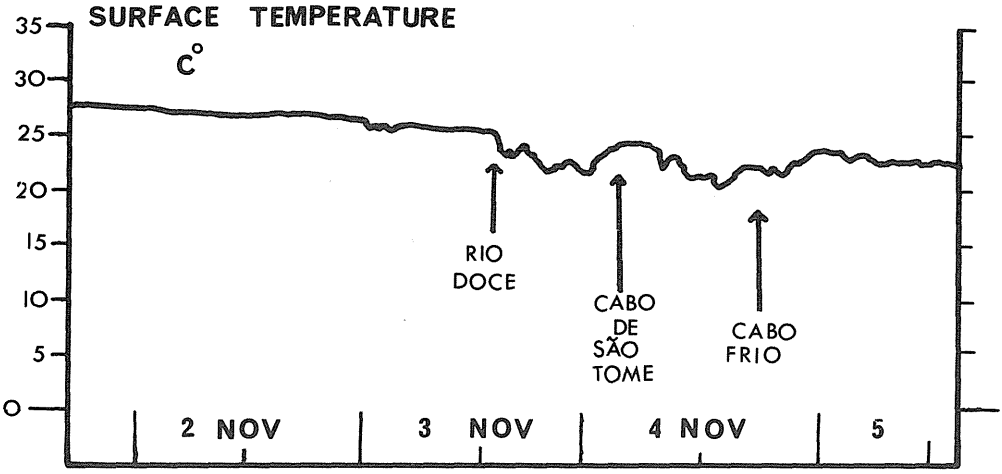


Fig. 6. Copy of automatically recorded surface sea temperature off Brazil Coast, November 1973.
Automatisk registreret temperatur af overfladevandet udfor den brasilianske kyst, november 1973.

2. Many species were restricted to the cold waters between the Rio Plate and Brazil and the numbers of these species declined during the period covered.

3. The seas between the Cape Verde Islands and Fernando de Noronha are important wintering grounds for Bulwer's Petrels and Leach's Storm Petrels but Manx Shearwaters appear to move directly from Europe to Brazil and few were seen in the tropics.

4. Most Schlegel's and White-chinned Petrels and Cory's Shearwaters were in heavy wing moult as were some Leach's Storm Petrels; Great Shearwaters and Wilson's Storm Petrels were all in fresh plumage; Bulwer's Petrels and Manx Shearwaters were just commencing their moult in November.

5. The difficulties concerning the collection of quantitative observations are discussed. Many more storm petrels are seen from a slow-moving ship than from a fast one.

6. There were no correlations between the numbers of birds seen and the sea temperature or the incidence of flying fish. The highest densities of birds were encountered close to land but the incidence of storm and Bulwer's Petrels was not related to distance from land.

DANSK RESUME

Iagttagelser af havfugle i Atlanterhavet mellem Europa og Sydamerika, efterår 1973

Denne artikel beretter om iagttagelser af havfugle på tre rejser gennem omtrent samme område i løbet af efteråret 1973. Hansen sejlede fra Zeebrügge i Belgien den 31. august og ankom til Montevideo i Uruguay den 13. september. Tilbagerejse ad omtrent samme rute fra Buenos Aires i Argentina den 28. september, ankomst le Havre i Frankrig den 11. oktober. Harris rejste fra Barry i Wales den 13. oktober og ankom til Montevideo den 8. november.

Hansen rejste med rederiet J. Lauritzens moderne køleskib Nippon Reefer, et skib på 9.000 t som sejlede med en fart af 21 knob. Hansen havde ingen pligter ombord, så der holdtes udkig efter fugle gennemsnitlig 10 1/2 time daglig. Observationerne blev som oftest gjort fra brovingen i ca. 13 m's højde over vandoverfladen og med udsigt ca. 300°. Harris rejste med et oceanografisk undersøgelsesskib, Shackleton, ca. 1.000 t, som normalt sej-

lede 9-11 knob. Han havde i nogen grad indflydelse på fart og kurs, hvorfor man bl.a. kom til øen Fernando Noronha. Der observeredes fra broen i ca. 10 m's højde og en synsvinkel på 180-200°. Hansens rejser strakte sig over 12.900 sømil, og Harris' ca. 6.050 sømil.

Alle afstande er her givne i sømil; 1 sømil = 1,852 km. Knob = antal sømil i timen.

Lidt over 10.000 havfugle af 56 arter blev talt og artsbestemt.

Mange faktorer har haft indflydelse på de to iagttageres resultater – deriblandt en meget forskellig ornithologisk ballast – så disse er ikke helt umiddelbart sammenlignelige. Men tilsammen giver de dog et billede af fuglebestanden i det gennemsejlede område og af visse ændringer i løbet af efteråret. Bortset fra at Harris, når det var muligt, noterede sig fuglenes fældningstilstand, tilstræbtes udelukkende at bestemme arter og antal. Først efter rejsernes afslutning blev forfatterne bekendt med hinandens rejser.

En artsliste, nogle tabeller og figurer giver oplysning om havfuglenes forekomst og mængde. For adskillige arters vedkommende kunne konstateres trækbevægelser, bl.a. derved, at de nordligste iagttagelser ligger sydligere sent på efteråret. Dette er meget tydeligt for Bulwers Skråpe *Bulweria bulwerii,* som yngler på øerne i det østlige Atlanterhav, og som på den første rejse i begyndelsen af september kun sås der omkring; i begyndelsen af oktober var de flyttet sydover og sås til 01° S, mens der 18.-25. oktober slet ikke sås nogen nær ynglepladserne, men mange mellem 04° S og 09° N.

Af Storskråper var der i efteråret 1973 en usædvanlig stor invasion i europæiske farvande, hvilket bl.a. resulterede i, at Harris den 14. oktober i løbet af 7 timer talte 1.228 syd for Scilly Øerne. Men denne forekomst var meget pletvis, og senere så Harris kun enkelte. Under Hansens rejser konstateredes en tydelig trækbevægelse mod ynglepladsen Tristan da Cunha. Under første rejse sås mange i den østlige og mellemste del af Atlanten trække mod SSE, men længere vestpå trak de mod SW, dog sås de endnu ikke sydligere end til ca. 22° S. Under tilbagerejsen sås den 29. september – 1. oktober en hel del langs Sydamerikas østkyst mellem 35 og 23° S, senere kun enkelte. Det synes altså som om Storskråperne fra opholdet i Nordatlanten i den nordlige sommer dels trækker direkte mod ynglepladsen Tristan da Cunha og dels lader sig presse af de fremherskende østlige vinde over mod Sydamerikas østkyst, trækker videre langs denne til de kommer til ca. 40° S og derefter af de der fremherskende vestlige vinde føres til ynglepladsen.

Mange antarktiske og subantarktiske arter trækker mod nord til havet langs Brasiliens kyst. Eksempelvis kan nævnes, at Hansen i september så 63 Kæmpestormfugle *Macronectes giganteus,* 88 Kapduer *Daption capense* og 362 Skomagere *Procellaria aequinoctialis,* mens Harris i begyndelsen af november kun så henholdsvis 1, 3 og 131.

Et indtryk af fugletætheden får man ved at se, hvor mange fugle der er iagttaget pr. time. Nogle iagttagelser af store samlede, fiskende flokke forrykker dog i nogen grad de anførte tal, som er det daglige gennemsnit pr. observationstime. En anden fejlkilde er, at iagttagelser af især de mindste havfugle, stormsvalerne, var langt vanskeligere fra den hurtigtsejlende Nippon Reefer, hvorfra kun 91 sås, end fra den langsomme Shackleton, hvorfra der blev set 963. Størst var tætheden nær land, hvor både kystbundne og pelagiske fugle forekommer, men mere end 100 mil fra land er det næsten udelukkende pelagiske arter, og tallene viser, at disse er helt uafhængige af afstanden fra land. Mange af dem, f. eks. alle stormsvalerne, er så små, at de kun ses på kort afstand og altså forekommer i relativt større antal end de iagttagne større arter. Den antagelse, som har været gjort gældende, at »fra et ornithologisk synspunkt er de centrale havområder havenes ørkener«, gælder ikke for Atlantens 1.530 mil brede indsnævring mellem Kap Verde Øerne og Brasilien, hvor vi snarere fandt en vis koncentration af havfugle. Det interessante er, at de i dette havområde iagttagne havfugle så godt som alle var pelagiske arter. Koncentrationer er konstateret hvor koldt, næringsrigt bundvand kommer op til overfladen. Mange arter forekommer kun i det kolde vand mellem la Plata og Cabo Frio.

Havet mellem Kap Verde Øerne og Fernando Noronha er et vigtigt overvintringsområde for Bulwers Skråpe og Stor Stormsvale *Oceanodroma leucorrhoa,* hvorimod Alm. Skråpe *Puffinus puffinus* trækker direkte fra Europa til farvandet ved Brasilien.

De fleste Schlegels Skråper *Pterodroma incerta,* Skomagere og Kuhls Skråper *Calonectris diomedea* var i stærk svingfjersfældning, og det samme gjaldt nogle Store Stormsvaler. Storskråper *Puffinus gravis* og Havløbere *Oceanites oceanicus* var i frisk fjerdragt. Bulwers Skråpe og Alm. Skråpe begyndte fældningen i november.

Der kunne ikke påvises nogen forbindelse mellem antallet af fugle og vandets temperatur eller forekomst af flyvefisk.

Da rejserne foregik i de europæiske fugles efterårstræk, sås der som ventet en del landfugle på og ved skibene, men kun fra Europa til lidt syd for Kap Verde Øerne. De iagttagne spurvefugle var alle meget udmattede, hvorimod vadefuglene syntes ret upåvirkede. Langs Brasiliens kyst sås kun enkelte vadere og en sydamerikansk fluesnapper.

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Appendix 1. Observations by Hansen north of the equator on first transect

SEPTEMBER 1973

	1	2	3	4	5	6	7	8
LOCAL NOON LAT °N	49°25'	42°13'	34°59'	26°38'	18°55'	10°49'	03°12'	00°26'
LONG °W	03°33'	10°06'	14°11'	17°42'	21°17'	24°32'	27°40'	31°34'
Fulmar	5							
Great Shearwater		8	134	44	115	25	69	2
Sooty Shearwater	3		8				1	
Manx Shearwater	20	3	21	11	1			
Cory's Shearwater			387	155				
Shearwater sp.		4			1			
Soft-plumaged Petrel					1			
Bulwer's Petrel			3	1				
Wilson's Storm Petrel							7	
Madeiran/Leach's Storm Petrel					4			
Storm Petrel sp.						1		
Gannet	57	3						
Great Skua		1						
Pomarine Skua		1						
Arctic Skua			2	1	1			
Gulls spp.	13	2	3					
Terns spp.	1	3	2	2	2	17		
Observation (mins)	670	595	665	640	645	590	615	310
Birds/hour	9	3	51	20	12	4	8	<1

Appendix 2 Observations by Hansen north of the equator on second transect

OCTOBER 1973

	4	5	6	7	8	9	10	11
LOCAL NOON LAT °N	01°04'S	06°30'	14°16'	21°52'	29°12'	37°08'	44°54'	49°30'
LONG °W	30°15'	27°07'	23°17'	19°49'	16°37'	12°41'	08°08'	00°10'
Great Shearwater		1	1	4	2			
Sooty Shearwater		1					1	
Manx Shearwater			4		11	1		
Cory's Shearwater			5		85	2		
Shearwater sp.			5	1	1	1		
Soft-plumaged Petrel		1						
Bulwer's Petrel	2	3	2	2				
Wilson's Storm Petrel			1					
Madeiran/Leach's Storm Petrel		7	4	1	10			
Storm Petrel spp.						1		
Gannet			2				52	22
Phalarope sp.					1	12		
Great Skua		2					23	2
Pomarine Skua							1	
Arctic Skua	1	3	1		5	2	1	
Gulls spp.						1	33	34
Terns spp.		15	4		3	1	5	
Observations (mins)	100	670	640	615	620	590	610	240
Birds/hour	2	3	3	<1	12	2	12	15

Appendix 3. Observations by Harris north of 30°N north of the equator

OCTOBER 1973

LOCAL NOON		14	15	16	17	18	19	20
	LAT °N	49°04'	46°06'	44°42'	40°55'	37°06'	33°05'	31°40'
	LONG °W	07°23'	09°39'	11°18'	13°29'	15°31'	17°15'	17°22'
Fulmar			2	1				
Great Shearwater		1228				2		
Sooty Shearwater		1						
Cory's Shearwater							9	158
Little Shearwater								2
Soft-plumaged Petrel							1	
Wilson's Storm Petrel (+ Wake)					1 (2)			
British/Wilson's Storm Petrel		2				2	2	8
Madeiran/Leach's Storm Petrel						1	5	9
'Bk & White' Storm Petrel						1	1	5
Gannet		1	403					
Phalarope					3			
Great Skua		81	1					1
Pomarine Skua					1	1		1
Gulls sp.		8	1	2	3	1		7
Kittiwake		29	1	2				
Tern sp.					1			
No. of flying fish/hour		0	0	0	0	<1	<1	0
Sea temp. at 1200 hrs °C		15.0	16.6	16.7	19.2	20.5	22.5	22.6
Observations (mins)		410	230	320	240	390	400	390
Birds/hour		230	13	1	2	1	3	29

Appendix 4 Observations by Harris from 30°N to the equator

OCTOBER 1973

	21	22	23	24	25	26	27	28
LOCAL NOON Lat °N	27°40'	23°40'	22°34'	16°37'	12°47'	08°59'	05°47'	02°20'
Long °W	18°59'	20°40'	21°55'	23°31'	24°59'	26°21'	27°29'	28°57'
Cory's Shearwater				325				
Little Shearwater				8	1			
Bulwer's Petrel						4	8	3
Wilson's Storm Petrel		1	9	6				
(+ in wake)			(7)	(11)	(4)	(2)		
British/Wilson's Storm Petrel			1	4	1	1		
Madeiran Storm Petrel		1		6	2			
Leach's Storm Petrel	1		18	10	22	14	1	
Madeiran/Leach's Storm Petrel		8	1	5	16	21	5	9
'Bk & White' Storm Petrel	3		1	1	1	3		
White-faced Storm Petrel				1		1		
Red-billed Tropicbird				1				
Pomarine Skua				17		1	1	
Arctic Skua				1	1	1		
Small Skua sp.				2				
Gull sp.	1							
No. of flying fish/hour	2	28	47	245	1469	251	60	59
Sea temp. at 1200 hrs °C	23.5	23.8	24.3	24.9	26.6	28.1	28.4	28.2
Observations (mins)	350	200	380	520	390	510	380*	470*
Birds/hour	1	3	5	45	10	5	2	2

* rough

Appendix 5. Observations by Hansen on first transect south of the equator

SEPTEMBER 1973

	8	9	10	11	12	13
LOCAL NOON LAT °S	00°48'	08°05'	15°31'	22°38'	28°57'	34°47'
LONG °W	31°58'	34°50'	36°37'	40°44'	47°18'	54°10'
Penguins						21
Wandering Albatross				2		2
Black-browed Albatross				2		108
Yellow-nosed Albatross				7	13	
Albatross sp.				2		
Giant Petrel						14
Cape Pigeon				15	24	3
White-chinned Petrel					29	66
Great Shearwater	4	213	283	23		
Sooty Shearwater		6				
Manx Shearwater	9	805		16		21
Schlegel's Petrel					21	
Great-winged Petrel				3		
Wilson's Storm Petrel				29	7	
Storm Petrel sp.		2				
Masked Booby		2				
Great Skua						1
Gulls spp.						68
Terns spp.		13				370
Observations (mins)	230	645	610	610	575	635
Birds/hour	3	97	28	10	10	63

Appendix 6 Observations by Hansen on second transect south of the equator

		SEPTEMBER			OCTOBER		1973
		29	30	1	2	3	4
LOCAL NOON	LAT °S	35°25'	29°07'	23°21'	16°39'	08°48'	01°04'
	LONG °W	54°25'	47°44'	41°29'	36°29'	33°23'	30°15'
Penguins		4					
Wandering Albatross		5	7	3			
Black-browed Albatross		19	1	1			
Yellow-nosed Albatross			8	3			
Albatross sp.			1	3			
Giant Petrel		49					
Cape Pigeon		39	7				
White-chinned Petrel		245	22				
Great Shearwater		71	15	18	1		
Sooty Shearwater		1		1			
Manx Shearwater		12	4	113			6
Little Shearwater			2	2			
Shearwater sp.		2	1	7			1
Schlegel's Petrel			46	2			
Great-winged Petrel			3				
Bulwer's Petrel							13
Wilson's Storm Petrel		1	2	3		1	
Grey-backed Storm Petrel		3					
White-faced Storm Petrel							5
Storm Petrel			1				
Great Skua			2				
Arctic Skua			4	8	6	55	3
Long-tailed Skua							4
Gulls spp.		94					
Terns spp.		35		24	1	300	
Observations (mins)		680	645	640	630	625	580
Birds/hour		51	12	17	<1	34	3

Appendix 7. Observations by Harris south of the equator

	OCTOBER 1973						NOVEMBER				
	29	30	31	1	2	3	4	5	6	7	8
LOCAL NOON Lat °S	01°02'	04°29'	08°05'	12°02'	16°00'	19°39'	22°25'	25°31'	28°40'	31°36'	34°14'
Long °W	30°56'	32°48'	34°11'	35°24'	37°22'	39°40'	41°08'	44°03'	47°06'	50°18'	53°18'
SPECIES											
Wandering Albatross									7		4
Black-browed Albatross							21	4	10	49	26
Giant Petrel										1	
Cape Pigeon											3
White-chinned Petrel							1	3	9	68	50
Great Shearwater				1					2		5
Manx Shearwater				1	5		3	2	10	23	79
Little Shearwater									1?		
Schlegel's Petrel								17	45	3	
Trinidad Petrel		2	1								
Bulwer's Petrel	20	42									
Wilson's Storm Petrel (+ Wake)	1 (4)		3 (4)	(12)	19 (25)	2 (1)	92 (87)	44 (60)	50 (150)	4 (56)	12 (100)
Leach's Storm Petrel	5	2									
Leach's/Madeira Storm Petrel	8										
White-bellied Storm Petrel			1								
Tropicbird sp.						1					
Red-footed Booby	1	112									
Brown Booby						13	34	10			
Magnificent Frigatebird		1					1				
Great Skua				1	2						
Pomarine Skua			1		1		1				3
Arctic Skua			1	1			4		2		
Long-tailed Skua									1		
Skua sp.											2
Dominican Gull											40
Tern spp.		260	550	7	7						101
Flying fish/hr	192	1	16	101	94	1	0	1	2	0	0
Sea temp. at 1200 hrs °C	27.6	27.5	27.8	28.0	27.0	25.0	21.3	22.7	22.0	20.7	16.6
Observations (mins)	450	360	490	480	490	380	630	510	570	550	510
Birds/hour	5	70	68	1	4	3	15	9	14	16	38

Note - excludes birds on 30 October inshore at FERNANDO de NORONHA