

SEASONAL AND SPATIAL DISTRIBUTION OF SOME PROCELLARIIFORM SEABIRDS IN SOUTHERN AFRICAN WATERS

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1. INTRODUCTION

The occurrence and distribution of procellariiform seabirds in southern African waters have been discussed or reported by a number of authors (c.f. Grindley 1967, Lambert 1971, Liversidge 1959, Liversidge & Thomas 1972, Moreau 1938, Stanford 1953, Summerhayes 1976, Summerhayes *et al.* 1974, Van Oordt & Kruijt 1953). However, with the exception of Summerhayes *et al.* (1974), none presents a quantified account of the seasonal and spatial distribution of the birds considered. Further, data were not collected over a complete year in any one study.

This paper analyses the seasonal and spatial distribution of seven species of procellariiform seabirds in the Atlantic Ocean off the south-western Cape coast of South Africa between 30° and 34° S and up to 175 km offshore.

2. METHODS

Seasonal and spatial distribution of the Wandering Albatross *Diomedea exulans*, Shy Albatross *D. cauta*, Black-browed Albatross *D. melanophris*, White-chinned Petrel *Procellaria aequinoctialis*, Cape Pigeon *Daption capensis* and the giant petrels *Macronectes* spp. are analysed. Giant petrels were not identified specifically. Data are insufficient to separate age classes. Observations were made by 2nd Officer A. Thomas from the R.S. *Africana II*, a Government Sea Fisheries Branch research vessel, from October 1950 to June 1953. Thomas made observations at monthly intervals at routine stations off the south-western Cape coast of South Africa. The observation periods varied between one half and one hour. The horizon was scanned with binoculars and the greatest number of each identified species at one time was recorded. His observations have been previously analysed, but only published in abstract form (Liversidge & Thomas 1972). Positions of the stations are given by Marchand (1952). Observations made by P. Zoutendyk from research vessels of the University of Cape Town at stations in the same area during 1958 to 1968 have been included (Zoutendyk 1965). The area covered by the observers is shown in Figure 1.

The index of abundance of each species is expressed as the ratio of the total number of that

species for all the observations made at a station to the number of occasions the station was visited. Since some stations were visited more often than others this method allows for variation in the number of visits. Data for all years of observation have been combined. Changes in the index of abundance have been taken as indications of variation in the absolute density. The index for abundance for each month has been calculated to show seasonal distribution of each species. Stations have been grouped in units of 12,5 or 25 km distances offshore to show spatial variation in the index of abundance. The year has been divided into four seasons: summer (December-February), autumn (March-May), winter (June-August) and spring (September-November). Weather and sea conditions were not taken into account in the analysis.

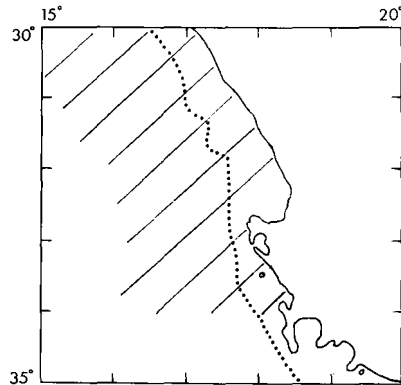


Fig. 1. Area of sea (hatched) off the South-western Cape covered by observations. The approximate position of the continental shelf edge (200 m isobath) is shown by a dotted line.

3. RESULTS

3.1. SEASONAL DISTRIBUTION

The seasonal distribution of each species is shown in Figure 2. The albatrosses show a broadly similar pattern with peaks in autumn-winter and late spring-summer. The White-chinned Petrel shows a single mid-winter peak. The Cape Pigeon and giant petrels occur most abundantly in winter and spring, being absent or rare during the rest of the year. The actual number of birds counted in each month is given in Appendix I.

3.2. SPATIAL DISTRIBUTION

The spatial distribution of each species is shown in Figure 3. Most species are most abundant 38-70 km offshore with the exception of the Wandering Albatross which is more abundant further offshore (>75 km). The giant petrels show no clear pattern but few observations were made. The Cape Pigeon is most abundant 101-125 km offshore. The actual number of birds counted per unit distance offshore is given in Appendix II.

4. DISCUSSION

4.1. SEASONAL DISTRIBUTION

The seasonal distribution of each species is discussed separately.

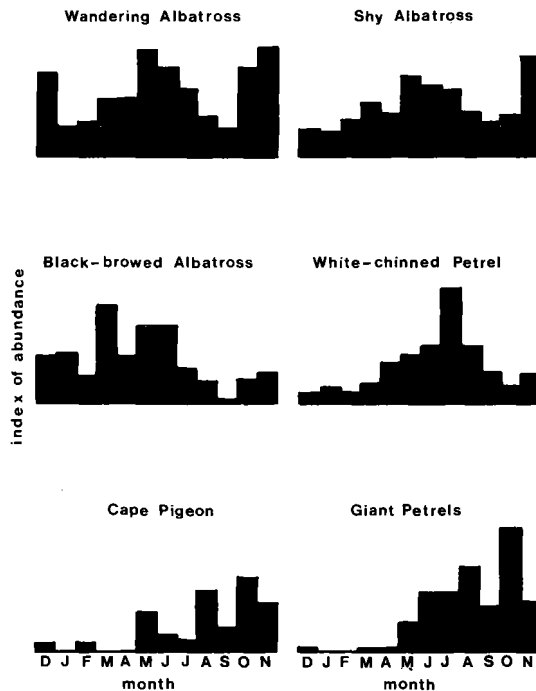


Fig. 2. Seasonal distribution of some procellariiform seabirds in southern African waters.

Wandering Albatross: This species has a breeding cycle extending over more than a year and therefore individuals do not breed every year (Tickell & Pinder 1967). Adults normally arrive at their breeding islands in November (Tickell 1968, van Zinderen Bakker Jr. 1971). However, Cooper (1974) has reported Wandering Albatrosses displaying sexually in South African waters in November and December. Lambert (1971) found that the species was most common in winter and early spring (August-October) off South West Africa when it is rare off the south-western Cape. Summerhayes *et al.* (1974) found it relatively common off the South West African coast between March and October but not common in November when a spring peak occurs off the south-western Cape. Movements within the south-eastern Atlantic Ocean may result in seasonal variations in numbers for different localities.

Shy Albatross: Breeding commences at the end of September or early October on Albatross Island, Bass Strait and chicks fledge in April (Johnstone *et al.* 1975, Le Souëf 1895). Lambert (1971) found the species commoner in the months August-October than in February. Summerhayes *et al.* (1974) found it commoner in May than November. There is no information on the breeding periodicity of the Shy Albatross (Johnstone *et al.* 1975). It is possible that most of the birds sighted in southern African

waters have not yet reached breeding age. Van Oordt & Kruijt (1953) found this species common off the Cape Peninsula in January and March, during the breeding season.

Black-browed Albatross: Sladen *et al.* (1968) have shown that the majority of banded Black-browed Albatrosses recovered in southern African waters comes from South Georgia. The species arrives on South Georgia to commence breeding in late September (Tickell & Pinder 1967). This arrival date corresponds with a decline in numbers in southern African waters (Fig. 2). However, Sladen *et al.* (1968) have shown that 98% of recoveries of ringed birds in southern African waters are first, second or third year birds. While the probability of higher mortality rates in young birds, resulting in higher recovery rates, vitiates the assumption that most of the birds are non-adults, it remains a possibility. For instance, Grindley (1967) saw mainly young birds on a cruise off the west coast of South Africa in winter. Lambert (1971) found this species commoner in winter than in summer, as did Summerhayes *et al.* (1974) who saw mainly young birds.

White-chinned Petrel: The seasonal distribution of this petrel is very different from that of the other species analysed. A single pronounced winter peak occurs outside the breeding season. A similar pattern is described by Lambert (1971) and Summerhayes *et al.* (1974). Birds arrive to commence breeding in early November on South Georgia and the Kerguelen Islands and leave in April-May (Serventy *et al.* (1971). Eggs were first found on Tristan da Cunha in November (Rowan *et al.* 1951).

It is possible that the birds occurring in southern African waters in summer months are non-breeding birds and that the increase in winter coincides with the end of breeding and the arrival of young and adult birds. Evidence from collected birds or banding recoveries is necessary to prove this.

Cape Pigeon: This species commences nesting at the end of August on Heard Island (Downes *et al.* 1959). Birds in southern African waters are therefore likely to be non-breeders, since they are most common from August onwards. The seasonal distribution of this bird is similar to that of the similarly-sized Antarctic Fulmar *Fulmarus glacialisoides*, which probably occurs only as an immature bird in southern African waters (Cooper & Elliott 1974).

Giant petrels: Both Lambert (1971) and Summerhayes *et al.* (1974) have ascribed all giant petrel sightings to the Southern Giant Petrel *Macronectes giganteus*. However, Johnstone (1974) has shown that from November to March *M. giganteus* occurs mainly to the south of the Antarctic Convergence and the Northern Giant Petrel *M. halli* occurs most frequently north of the Convergence. A sighting of *M. halli* has been made in South African waters (P.G.H. Frost, pers. comm.) but both species are known to occur since white phase individuals have been seen (P. D. Shaughnessy, pers. comm.). The Northern Giant Petrel has no white phase (Bourne & Warham 1966, Johnstone 1974). The southern species starts breeding in September-

October and the northern species in August (A. Burger, pers. comm. for Marion Island, Serventy *et al.* 1971).

All recoveries of banded giant petrels in southern African waters mentioned by Sladen *et al.* (1968) are of first or second year birds. The probability exists, therefore, that nearly all the birds sighted are non-adults, especially since they occur during the breeding seasons of the two species.

Lambert (1971) found the birds common from August to October and seldom saw them in February - a pattern somewhat similar to that shown in Figure 2.

In summarising, it seems probable that most of the species' populations visiting southern African waters comprise non-breeding birds in their first few years of life. Lack of information on plumage phases relative to onset of breeding and the small number of recoveries of known-age banded individuals make it difficult to test this proposal. It must also be realised that little is known of the feeding ranges of breeding birds, but they may be large (Rowan 1965) and breeding birds may occur in southern African waters. Clearly, future studies of procellariiform seabirds in southern African waters require more than specific identification.

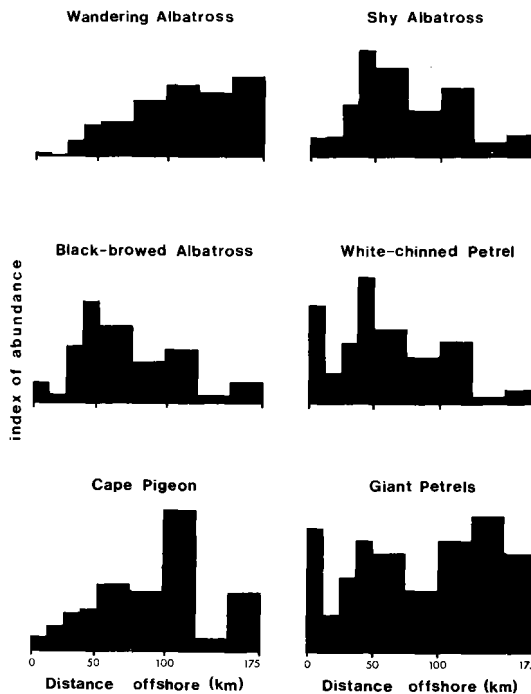


Fig. 3. Spatial distribution of some procellariiform seabirds in southern African waters.

4.2. SPATIAL DISTRIBUTION

Seabirds tend to aggregate in areas of high surface productivity which occur where there is upwelling of cold nutrient-rich water (Bourne 1963, Emery *et al.* 1973, Summerhayes *et al.* 1974). Upwelling occurs along the southern African coast and over the edge of the continental shelf (Bang 1971, Emery *et al.* 1973, Shannon 1966). Summerhayes (1976) and Summerhayes *et al.* (1974) found relatively few birds between these two areas of upwelling. In the area studied the continental shelf is approximately 20-70 km offshore and no marked decline in numbers of seabirds was found between the two productive areas, with the exception of the White-chinned and the giant petrels. (Fig. 3). The data do show that birds are more abundant over the shelf edge where upwelling occurs, with the most noticeable exception of the Wandering Albatross which is most abundant farther offshore.

Little is known about the diets of procellariiform seabirds away from their breeding grounds but differences in distribution of the species may be related to their food habits. Tickell (1964) showed that the diet of the Grey-headed Albatross *D. chrysostoma* differed from that of the Black-browed Albatross and related this to the more oceanic distribution of the former species.

Future studies of the distribution of procellariiform seabirds at sea should include their food habits (Imber & Russ, 1975).

5. ACKNOWLEDGEMENTS

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6. SUMMARY

Seasonal and spatial distribution of the Wandering Albatross *Diomedea exulans*, Shy Albatross *D. cauta*, Black-browed Albatross *D. melanophris*, White-chinned Petrel *Procellaria aequinoctialis*, Cape Pigeon *Daption capensis* and the giant petrels *Macronectes* spp. in the waters off the south-western Cape, South Africa, are analysed. The occurrence of each species is expressed as an index of abundance at monthly intervals and 12,5 or 25 km distances offshore. Most species are abundant in winter months and, with the most noticeable exception of the Wandering Albatross, most abundant in the region of the continental shelf edge. The distribution pattern of each species is discussed in relation to breeding season and regions of upwelling of water of high productivity.

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8. Appendix I. Distribution of some procellariiform seabirds in southern African waters,
Number of birds observed per month

Season Month	Summer		Autumn				Winter			Spring		Nov
	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	
Wandering Albatross	192	20	80	89	98	207	134	59	47	42	166	328
Shy Albatross	114	37	168	163	148	311	214	117	105	104	154	435
Black-browed Albatross	327	100	201	461	240	457	342	92	83	23	135	404
White-chinned Petrel	536	224	558	654	1422	1925	1763	1999	1403	935	664	1355
Cape Pigeon	2	0	1	0	0	8	27	12	74	39	140	113
Giant petrels	1	0	1	1	1	6	9	5	10	7	23	11
No. visits to station	112	33	112	77	83	96	75	43	59	74	92	108

9. Appendix II. Distribution of some procellariiform seabirds in southern African waters,
Number of birds observed per unit distance offshore

Distance offshore (km)	0-12,5	13-25	26-37,5	38-50	51-75	76-100	100-125	126-150	151-175
Wandering Albatross	32	6	78	115	245	245	322	47	282
Shy Albatross	167	65	246	381	607	201	311	11	81
Black-browed Albatross	259	46	430	552	807	277	366	10	120
White-chinned Petrel	4032	473	1433	2246	2542	1022	1399	31	261
Cape Pigeon	24	16	36	30	91	52	124	2	41
Giant petrels	20	2	7	8	14	5	10	2	7
No. visits to stations	201	75	115	87	167	106	109	18	86