THE DISPERSAL MOVEMENTS OF THE ROYAL ALBATROSS (Diomedea epomophora)

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ABSTRACT

An analysis of 122 recoveries of banded Royal Albatrosses of both subspecies, indicates a dispersal of non-breeding birds, with prevailing westerly winds from the breeding localities to winter feeding areas and then back to the breeding grounds. Evidence is given to show the progressive longitudinal movement of known age birds during the first twelve months of flight and the full circumpolar movement of this species in an easterly direction.

INTRODUCTION

The two subspecies of the Royal Albatross are known to breed only in the New Zealand region; *D. e. epomophora* at Campbell Island and the Auckland Islands (Enderby Island) and *D. e. sanfordi* at the Chatham Islands and Taiaroa Head, Otago Peninsula. Little credence is given to the presumed record by Dabbene in Murphy (1936) of breeding at Tierra del Fuego as it is based on the supposition that Royal Albatrosses found in the South Atlantic could not have come from the New Zealand breeding grounds and, therefore, must have originated from a local breeding population. The second-hand report of large white birds seen ashore, and nesting near Lake Cami in the interior of Tierra del Fuego has never been confirmed.

Because of difficulties in distinguishing between the Wandering Albatross *(Diomedea exulans)* and Royal Albatross at sea, Dixon (1933) combined all his sightings of the genus *Diomedea* and states that they are confined between 30°S and 60°S, being more common in northern latitudes in winter and in southern latitudes during summer. He noted the significance of the progressive shifting of the centre of abundance from West to East with each season as if the birds moved with the prevailing winds. Kuroda (1957) postulated that movements coincide with oceanic wind circulations and that there is no evidence to show any major movement against the wind in long distance movements. He further suggested a correlation between wind movements and deep oceanic currents producing major food sources at upwelling points.

Tickell & Gibson (1968) provided good evidence that Wanderers favour particular winter feeding grounds distant from their breeding colonies, but state that the theory of " eastward circumnavigation in the west wind zone " is still lacking factual support. They stated also that while there is little evidence to prove a westward migration,

a combination of the two may well prove to be the answer. They found that with Wanderers there was nothing to indicate any tendency to travel in one particular direction. However, Tickell (1968) suggested when referring to the New South Wales winter feeding area for the Wanderer and the similar South American area for Royals, that the difference in areas is probably a consequence of the positions of the banding stations and a similar predominantly easterly movement from each. This however, is based more on evidence provided from Royals than from Wanderers.

Though the Wandering Albatross is recognised as being circumpolar by Watson *et al.* (1971), they suggested that the Royal Albatross is probably also circumpolar although there are no confirmed reports for Africa or the Indian Ocean, and stated that there is no information to prove that *D. e. sanfordi* ranges as widely as *D. e. epomophora.* This latter statement is in conflict with evidence shown by Murphy (1936, 1950) as well as by Falla (1938) and Richdale (1939, 1965). Tickell (1970) stated that there is no reason, based on the speed of flight, why both Wanderers and Royals could not circumnavigate the Southern Hemisphere several times in a year.

Undoubtedly, the major problem in studying the dispersal movements of the Royal Albatross has been the hazard of identifying the species accurately at sea. Some 49 Royal Albatrosses of unknown subspecies have been banded in New Zealand coastal waters between 1956 and 1967. However, the extensive banding of the Royal Albatross at its breeding grounds and especially at Campbell Island during the 1960s has been designed, in part, to provide data on dispersal movements.

The total numbers banded in New Zealand since 1937 is shown in Table 1.

TABLE 1

ROYAL ALBATROSSES BANDED AT VARIOUS LOCALITIES

Locality and Period	Adults of Unknown Age	Non Flying Chicks
Taiaroa Head (1937-72)	42	85
Campbell Island (1943-70)	8012	12176
Enderby Island (1963-66)	53	-
New Zealand Coastal Waters (1956-67) subspecies unknown	49	-
	8156	12261
TOTAL	20417	

RESULTS

Up to 1972 some 2400 band recoveries of Royal Albatrosses were received (Robertson 1972*a*) with 123 of these being recovered away from the immediate banding locality. Sorenson (1954) recorded the details of a fledgling, banded on Campbell Island in 1943 and recovered at El Tabo in Chile during March 1944. This was the first proof that birds of the New Zealand population reached South America. In 1957 an adult bird of unknown age and subspecies banded in New Zealand coastal waters during 1956 was recovered at Huoicolla, Chile, and reported by Kinsky (1960). Because its breeding locality is unknown this record is not included in the analyses reported here. Since then, a further 121 recoveries from the three breeding localities have been reported to us, and these are of considerable importance in assessing the dispersal of both adult and immature Royal Albatrosses. Though the details of each recovery are not reported in this paper all records are held by the New Zealand National Banding Scheme.

Szijj (1967) suggested that an important factor in the lack of data on the Royal Albatross might be the scarcity of ship tracks crossing the South Pacific in winter. Although this is probably true, large parts of the range of the *Diomedea* species lie outside major shipping lanes. A large proportion of recoveries discussed here come from fishermen in the S.W. Atlantic which confirms this area as a major feeding ground for the Royal Albatross where for some parts of the year, especially the winter, they seem to be the major representative of the *Diomedea* species (Dabbene *in* Murphy 1936). However, returns from the Japanese tuna fisheries from the Indian Ocean have contributed substantially to the interpretation of the data given below. A recent increase of recoveries and sightings of the Royal Albatross in the Australian region where occurrences are still considered rare (Gibson & Sefton 1962; Rogers 1970; Simpson 1971) may indicate a change in habits, but is probably also attributable to improvements in techniques of identification.

The distribution of recoveries is shown in Fig. 1 and Table 2, where, for ease of interpretation, recoveries are grouped into 6 geographical regions.

Data from studies at Campbell Island and Taiaroa Head have shown that breeding adults successfully rearing a chick are as a rule absent from their breeding places for about 12 months before returning to breed again. Fledglings, following departure, are not seen at the breeding grounds for at least 4 years and more generally 5-7 years. Observations on Taiaroa Head (A. Wright *in litt.*) suggest that immature birds returning to the breeding area for the first time, following their departure as fledglings, have not been on land for the entire period of their absence. This is shown mainly by the unsteadiness and apparent weakness of their legs on landing for the first time, and throughout the first 2-3 days following their return, a feature not shown by adults after their one year absence.

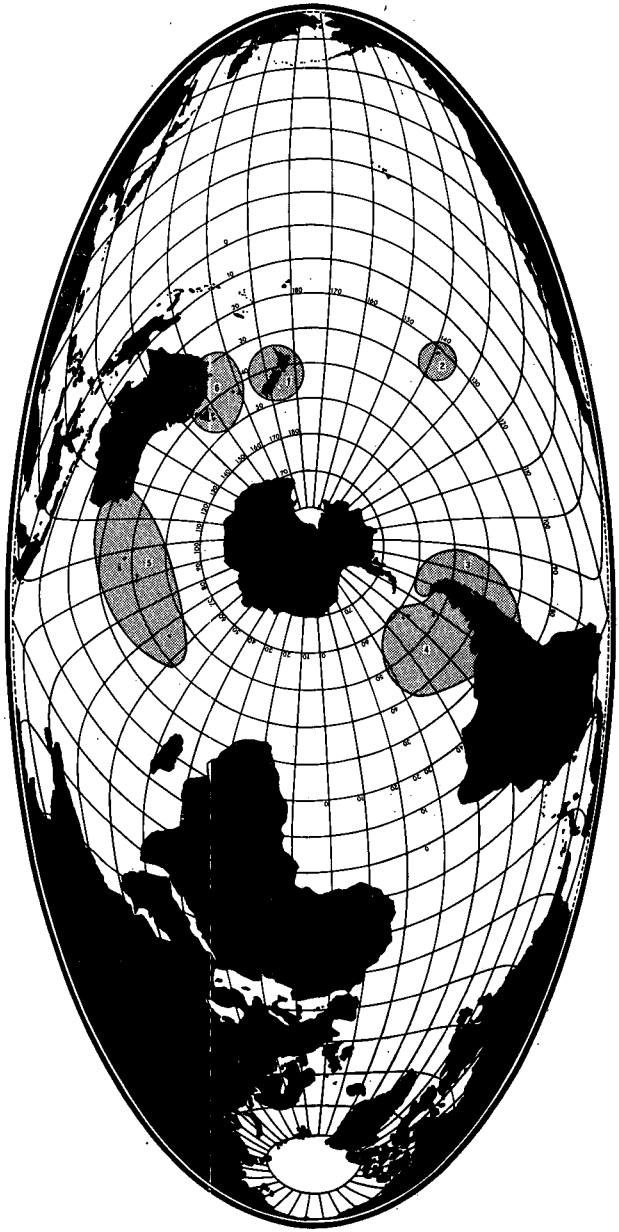

FIGURE 1: Geographical distribution of Royal Albatross band recoveries. (Numbers are shown in Table 2 and recoveries from Regions 2, 5 and 6 are shown).

TABLE 2

DISTRIBUTION OF RECOVERIES OF ROYAL ALBATROSSES
According to Geographical Regions shown in Figure 1

Region	Known Age Birds (Years Only)							Adults of Unknown Age	Total
	0-1	1-2	2-3	3-4	4-5	5-6	6-7		
1	8	1	1		1			20*	31
2	1							-	1
3	25	1	1					3	30
4	9	12	4	6			1	13**	45
5	1		1	1				3***	6
6				2		1	1	5	9
TOTALS	44	14	7	9	1	1	2	44	122

* Includes two sanfordi from Taiaroa Head
** Includes one sanfordi from Taiaroa Head
*** Includes one epomophora from Enderby Island

The most significant feature of Table 2 is the general relationship between the position of recovery and the age of known-age birds. the data assembled in Table 2 show a strong indication of a progressive increase in the age of birds recovered, starting from Regions 2 and 3 and progressing further east around the southern hemisphere to Region 6 (see also Fig. 1). Dixon's (1933) suggestion of movement with the prevailing winds is, therefore, supported by the progressive aging of known age Royal Albatrosses recovered along the route of the prevailing west winds. We suggest that most of the newly-fledged birds move from New Zealand to South America and thence to the S.W. Atlantic for a period before moving east with the prevailing westerlies back to the breeding grounds. The only major exception is one recovered dead near Perth, West Australia, during March or approximately 4 months after fledging.

The distribution, according to latitude and longitude, of recoveries of known age birds from Campbell Island less than one year after fledging is shown in Fig. 2. This gives further support to the hypothesis of movement with the prevailing wind, but also shows a marked northward movement during the summer across the Pacific which is in conflict with Dixon's observations for the *Diomedea* species. However, there is striking evidence to show a relatively brief stay in Chilean waters with a movement to the S.W. Atlantic by the winter. The recovery in Tahiti (Robertson 1972 *b*) possibly represents the extreme northward extent of the Pacific movement though the exact date of arrival is uncertain.

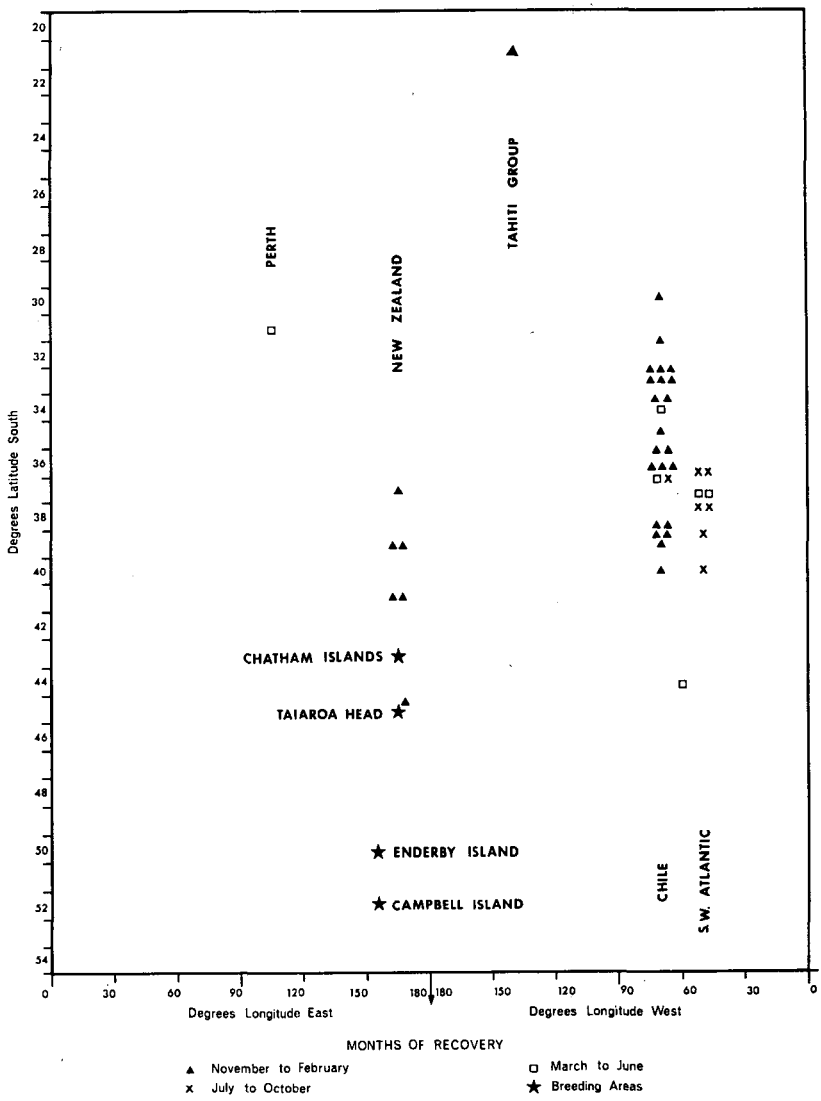

FIGURE 2: Distribution of Royal Albatrosses aged 0-1 years according to time and locality of recovery. (Refers to Campbell Island birds only).

Tickell (1968, 1970) produced evidence to support movements of 100-200 miles per day in adult Wandering Albatrosses and we have one record of an adult Royal which moved at an average rate of 91 miles per day from the time of banding on Campbell Island to live-recovery in Chile. As the departure date is unknown this obviously represents a minimum average speed. Six recoveries of fledglings from Chile during December indicate speeds at least equivalent to those already proposed. Hence, it is possible in the time period recorded, for the bird recovered near Perth to have arrived there by the full circumpolar route with the prevailing winds, although the possibility that it could have moved against the prevailing wind to West Australia as an exception cannot be discarded.

In the latitudinal and longitudinal distributions of birds according to time of year shown in Figs. 3 and 4 some general trends are suggested.

(1) The main range of distribution for adults and immatures is shown as between 30° and 45°S.

(2) In contrast to Dixon's (1933) observations for the *Diomedea* species there is some indication that the distribution is concentrated in lower latitudes during the winter, but this may be caused by movement around the southern tip of South America from the Pacific to S.W. Atlantic, and a possible bias in Dixon's observations caused by the generally more southerly breeding range of the Wanderer in summer.

(3) The concentration of immature birds between one and seven years in the S.W. Atlantic may be a reflection of human fishing intensity, but can also reflect a seasonal dependence on this feeding area.

(4) The contrasting latitudinal range of adults and fledglings in December and January must be balanced with their longitudinal position. These two months reflect an adult mortality in the New Zealand region during the early breeding period, while early fledgling mortality seems to be indicated by recoveries at the start in the New Zealand region and at the completion of the first Pacific crossing in Chilean waters.

(5) The longitudinal distribution of adults during autumn and winter shows a concentration in the New Zealand region and the S.W. Atlantic. This probably indicates differences in location between breeding and non-breeding birds.

(6) Immature birds returning for the first time to the breeding area generally do so from December to March, according to age, with subsequent arrivals earlier in the season. The longitudinal distribution in Fig. 4 indicates a movement pattern of adult and immature birds towards the New Zealand region from August to March which would further support the hypothesis of easterly movement in the westerly wind belt.

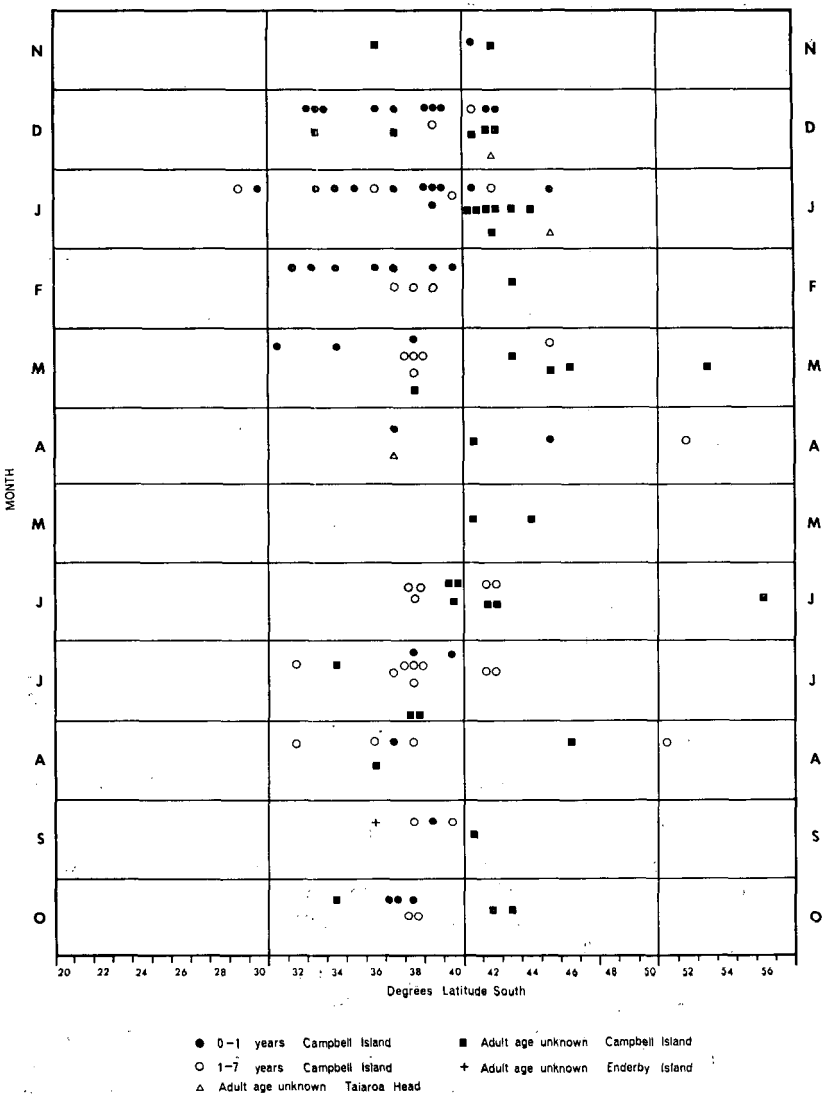

FIGURE 3: Latitudinal distribution of Royal Albatross band recoveries according to month and age when recovered. (N.B.: Tahitian recovery not shown).

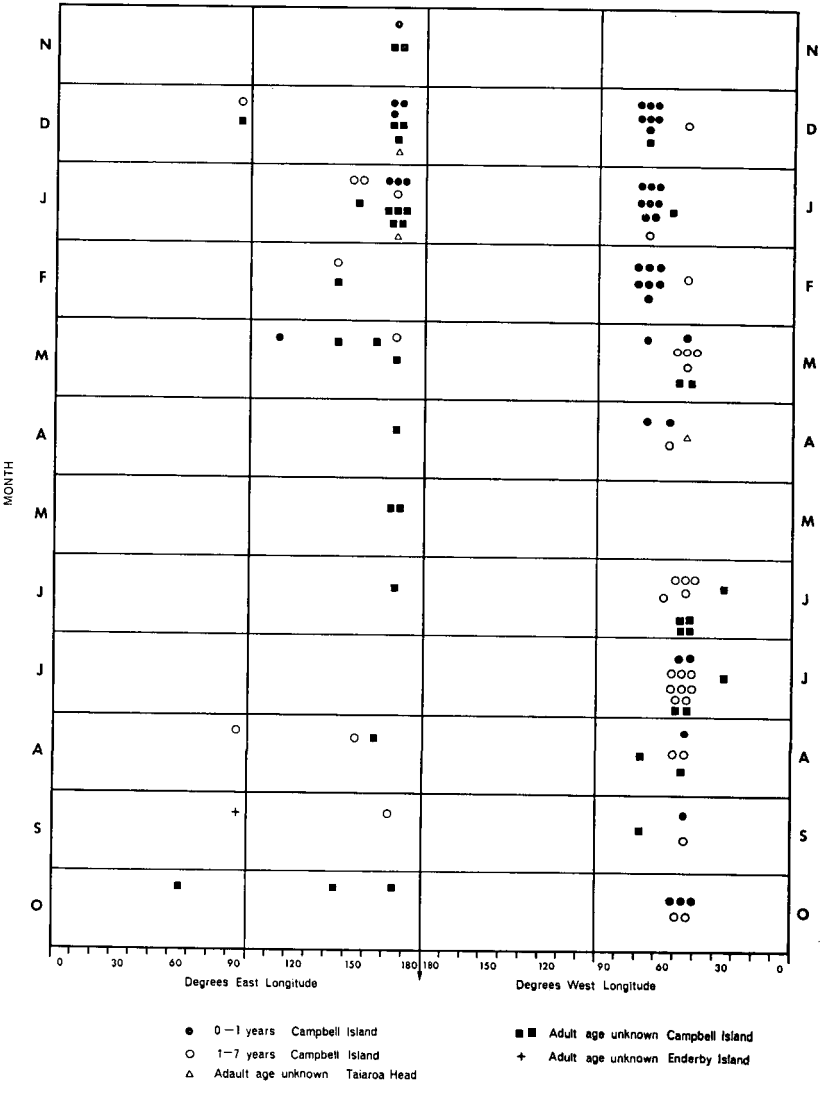

FIGURE 4: Longitudinal distribution of Royal Albatross band recoveries according to month and age when recovered. (N.B.: Tahitian recovery not shown).

(7) It has been stated that birds breeding successfully are not present on breeding grounds during the following year. The case of D13, a bird banded as an adult at Taiaroa Head in 1938 some 20 years before recovery overseas, is significant as it is at present the only record of movement to South America in the non breeding "holiday" year between two years of successful breeding. (Richdale 1965: 144, and in litt.).

The movements of failed breeding birds and immatures during the period from late summer to spring when they are not present at the breeding grounds are open to conjecture. Though more evidence is required on this point one record of a bird banded in March at Campbell Island as either an immature, or a failed breeder and later recovered in the S.W. Atlantic suggests a similar movement to that occurring in fledglings and successfully breeding adults going on "holiday". Further, the recovery of two birds under 3 years old (see Table 2) in New Zealand waters can indicate that full circumpolar wanderings may occur during the period before return to the breeding area, or that some immatures remain in New Zealand waters without wider dispersal. However, the evidence already presented does not enhance this latter view.

DISCUSSION

The recovery of banded Royal Albatrosses gives support to the observations of Dixon (1933) that the *Diomedea* species move with the prevailing winds during a circumpolar dispersal.

A graphical representation in Fig. 5 of Dixon's data (1933: Table 2) shows some match with the seasonal distribution of Royals obtained from banded birds. The major complication in comparison of the two sets of data lies in the fact that whereas Wanderers breed in a circumpolar distribution, breeding Royals are confined to only one geographical sector. Hence, if Wanderers do move with the prevailing winds to distant winter feeding grounds the combination of all *Diomedea* observations becomes clouded by the movements of Wanderers from different geographical areas. Gibson (1967) suggested that the range of measurements of captured Wanderers is sufficiently varied to show that the Australian region is visited by representatives of all breeding areas.

Accordingly, the recorded movement of Royals may lend support to any hypothesis on the movement of Wanderers in spite of the slight evidence of a reverse movement reported by Tickell & Gibson (1968). As these reverse movements are of only short distance, it is possible to rationalise them as local movements caused by adverse local climatic and feeding conditions.

There is little evidence in Royals to confirm Dixon's observations of a latitudinal movement according to season. This may indicate a difference between the movements of Royals and Wanderers emphasised by the more northerly range of the Royal Albatross (30°S - 45°S) shown here within Dixon's range for *Diomedea* of 30°S - 60°S.

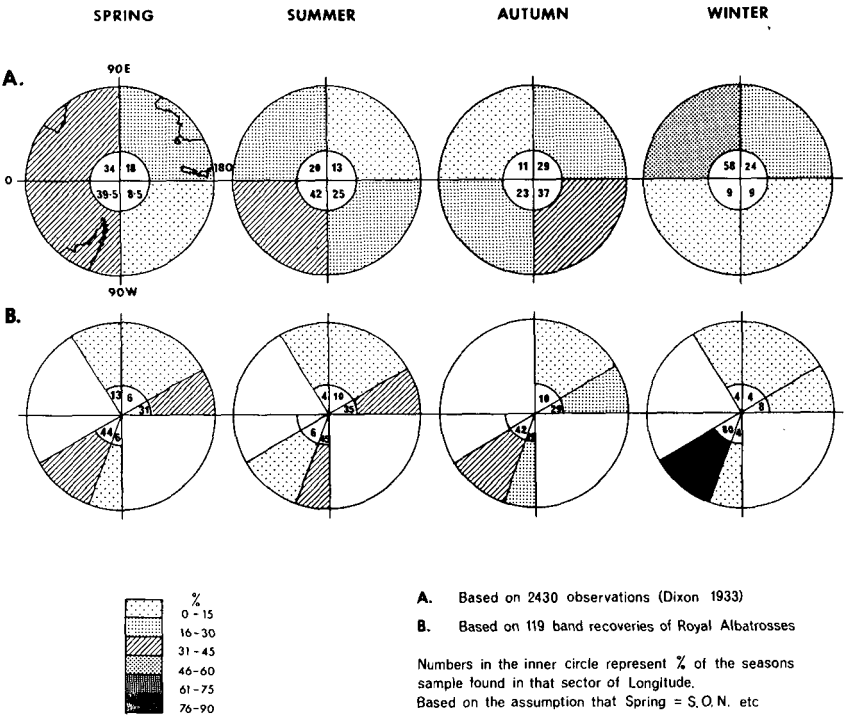

FIGURE 5: Percentage seasonal longitudinal distribution of *Diomedea* species

(A) For *Diomedea* spp. according to Dixon 1933 Table 2

(B) For *Diomedea epomophora* sp. based on recoveries of banded birds (in detail Fig. 4).

A major reason for the seasonal latitudinal movement in Wanderers however, would seem to be the concentration of birds round their summer breeding grounds in generally more southern latitudes than Royals.

The type specimen of an immature *sanfordi* collected off Chile in 1913 (Murphy 1936, 1950) and the recovery of an adult breeding bird (D13) from Taiaroa Head in the S.W. Atlantic indicate that *sanfordi* has a similar range to *epomophora*. The case of D13 also emphasises the circumpolar movement in the " holiday " year following successful breeding. The evidence shown for an annual circumpolar dispersal of immature non-breeders and adult failed breeders is not strong, but is supported by the absence of contrary evidence. We have no evidence to support Tickell's (1970) suggestion of several circumpolar movements within one year, but there is some implication, although tenuous, that this may not generally occur.

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