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Attendance of Wandering Albatrosses (*Diomedea exulans*) at a small colony on Macquarie Island

R.J. Tomkins

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ATTENDANCE OF WANDERING ALBATROSSES (DIOMEDEA EXULANS) AT A SMALL COLONY ON MACQUARIE ISLAND

by

R.J. Tomkins

Department of Zoology,
Monash University,
Clayton, Victoria, Australia

(Present address: 64 Tompson Road, Revesby, NSW, 2212, Australia)

ABSTRACT

Attendance of breeding and non-breeding Wandering Albatrosses was recorded at Caroline Cove, Macquarie Island, during two austral summers. Older non-breeding birds visited the colony more frequently and regularly than younger non-breeders. There was a tendency for non-breeders to leave the colony late in the afternoon and return in the middle of the day, and to wait for favourable weather before visiting the colony. Activity in the colony increased significantly after sudden improvements in weather conditions. Non-breeders were often absent from the colony for two or more consecutive days just before Full Moon. There were no observed patterns of simultaneous absences or arrivals of specific non-breeders, but this was recorded for partners of some breeding pairs.

1. INTRODUCTION

Albatrosses seen flying over their colonies in summer are non-breeders, breeders or failed breeders. The behaviour of each group on the ground is different (Richdale 1950, Tomkins 1984a).

Little study has been made of the attendance of non-breeding Wandering Albatrosses Diomedea exulans at their colonies during the period between their first arrival and ultimate departure at the end of the summer four months later. It is known that non-breeding birds seek partners, and interact with other non-breeders on the ground, in the air, and probably at sea. This paper documents daily arrival and departure, simultaneous arrival of specific non-breeders, and absences from the colony for two or more consecutive days at a colony containing 59% of the Wandering Albatrosses found on Macquarie Island (54°30'S, 158°57'E).

2. METHODS

Observations were made at the small colony of birds at Caroline Cove for 41 consecutive days between 5 December 1975 and 14 January 1976. These observations varied in duration from 0.5 hours to 14.5 hours each day. Attendance (Figure 1) of all breeders and non-breeders seen at the colony was recorded. Most birds were identifiable by unique combinations of coloured leg bands. The author also made observations at this colony in the previous breeding season.

Observations at the same colony for 103 consecutive days between 25 November 1976 and 7 March 1977 (Figure 2) recorded attendance and interaction of all birds present. These observations averaged 8.5 hours daily. Whenever possible observations commenced at 0900 hours and finished at 1800 hours. Sunrise and sunset on 21 December were at approximately 0324 hours and 2033 hours, and at 0537 hours and 1844 hours on 7 March. Occasional observations were made by the author and other field workers of birds at other locations on Macquarie Island.

All birds were banded with numbered monel bands (supplied by CSIRO, Canberra) and unique combinations of coloured plastic leg bands and marked with stripes of fluorescent spray paint. Each bird was sexed (Tomkins 1984b) and its plumage scored using Gibson's (1967) Plumage Key. Thus each bird was identifiable on the ground and in the air. Using binoculars from a central observation point most of the nests used by breeders and the smaller, rough "display" nests of non-breeding males could be seen, and activities of most birds in the colony observed. Weather conditions were noted irregularly through each day.

3. RESULTS

3.1 FIRST ARRIVAL

Recording of attendance at the start of each season began too late to document when breeding birds first arrived. For non-breeders there was a clear tendency for males to arrive before females; in the 1976/77 season there was an average difference of 17 days (Figure 2). Combining both summers, breeding males spent ashore an average of 13.4 (66.1%) of the average total of 20.3 days between first sighting and egg-laying, and females 5.4 (31.6%) of their average of 17 days. Thus breeding males were ashore on 2 to 3 times as many days as females during this pre-egg period.

3.2 FREQUENCY OF ATTENDANCE AND DURATION OF VISITS OF NON-BREEDERS

The following tendencies can be highlighted although there are too few birds in each group of non-breeders to be able to subject data in Figure 2 to statistical analyses.

The average duration of visits of males older than 8 years (most of which were known to have bred previously) was 3.9 days (range 1 to 13 days, see Table 1). The 2 youngest males (7 and 8 years old), which had never bred, visited the colony less frequently than did their older counterparts, and the average duration of each of their visits was 2.6 days.

The attendance of females of all ages was inconsistent. The average duration of visits of the 2 young females was longer (4.8 days) than the old female (2.7 days), and was also longer than the average duration of visits of the 2 younger males (2.6 days). One young male and female visited the colony on a higher percentage of days (64% and 71% respectively) during the short period between their first and last sightings than did some older birds. Because the age and history of a female (30904) was not known she was excluded from calculations.

Individuals had highly variable patterns of attendance, as illustrated by the 22+ year old non-breeding male 30040. During the 1975/76 summer this male's average stay per visit was 5.6 days (Figure 1), but in 1976/77 he was seen at his display nest for 33 consecutive days, and disappeared soon after.

3.3 DAILY AFTERNOON DEPARTURE AND MORNING ARRIVAL OF NON-BREEDERS

Non-breeders frequently departed from the colony for short periods during their days of attendance (Figures 3 and 4). Males normally left the colony for 1 or 2 hours during the day. Circumstantial evidence strongly suggests that they were usually absent at night. They tended to depart in the late afternoon and to re-appear during the middle of the next day. However, departures and arrivals, particularly of males, occurred throughout the day.

To test whether these tendencies were real or a characteristic of the time of commencement or completion of daily observations, the author compared the number of last departures (or first arrivals) of birds each day in each half hour group of observations to the total number of observations made in each group throughout the study period. The usual daily observation period (0900 - 1800 hours) was divided into 3 hour periods called Morning, Midday and Afternoon.

The 2 young males (7 and 8 years old) departed significantly more in the Afternoon than did the older males (Fisher Exact Test $p = 0.0255$). The arrival patterns of the 2 young males did not differ significantly from those of the 4 older males ($p > 0.05$), and their frequencies were combined for the following calculations. Arrivals of all males were not spread evenly throughout the day ($X^2 = 21.34$, $df = 2$, $p < 0.01$) as males arrived significantly more in Midday than in Morning ($X^2 = 4.48$, $df = 1$, $p < 0.05$) and Afternoon ($X^2 = 21.25$, $df = 1$, $p < 0.01$).

Data from 30904 have been excluded from the following calculations because her age and history were not known. When data for the other 4 females are combined, they departed significantly more in Afternoon than in Midday and Morning combined ($X^2 = 9.80$, $df = 1$, $p < 0.01$). The arrivals of the old females were significantly more spread throughout the day than were the arrivals of younger females ($X^2 = 7.72$, $df = 1$, $p < 0.01$ - Trend X^2) (Maxwell 1961). When data for all females were combined they arrived significantly less often in the Afternoon than in Morning or Midday ($X^2 = 10.71$, $df = 2$, $p < 0.01$), but there was no significant difference between arrivals in Morning and Midday ($p > 0.05$).

Some birds left after observations ceased for the day. However, some birds that were on their display nest at the cessation of observations were absent at 0600 hours next morning. Also, some birds that were absent at 0600 hours were present at 0900 hours. Sporadic observations near sunset indicated that non-breeders rarely returned between 1800 hours and nightfall.

3.4 DAILY ARRIVAL OF NON-BREEDERS IN RELATION TO WEATHER CONDITIONS

The effect of weather conditions on the times at which non-breeders first arrived at the colony each day was investigated. Predominant weather conditions associated with 135 such arrivals of 9 non-breeding males and 5 non-breeding females were allocated to 6 mutually exclusive catagories: Windy (wind stronger than an approximate mean speed of 20 knots gusting to 30 knots); Low Cloud (cloud base below most nests i.e. less than 150 m above sea level); Unusual Wind (wind blowing from any direction other than the predominant south-west to north-west quarter); Calm (wind less than 5 knots); Hot (air temperature above approximately 9.5°C and wind less than 5 knots); and Average (all weather experienced not already detailed).

Table 2 shows the recorded frequency of daily first arrivals for the different weather categories. Male and female arrival rates were similarly affected by weather, and when the sexes were combined the differences in arrival rates for certain conditions were highly significant ($X^2 = 107.2$, $df = 5$, $p < 0.001$). It seemed that Average and Windy conditions promoted arrival, and Low Cloud, Unusual Winds and Calm and Hot conditions inhibited it.

Unfortunately data for females (74%) pertained to only 2 birds, one 6 years old and the other 14 years old. Thirty percent of the former's and 41% of the latter's landings were in non-Average conditions. This small percentage difference does not reflect adequately the difference in their landing ability in non-Average conditions that was so noticeable in the field.

A marked difference in aerial activity, expressed here as the number of landings by non-breeders in the colony, occurred before and after an abrupt change in the weather (Plate 1).

Twenty-one of the 33 changes examined were from Low Cloud, Unusual Winds, Calm and Hot to Average or Windy. This was examined by placing each landing in 1 of the 8 half-hour periods from 2 hours before the change until 2 hours after. There was a significant overall difference ($X^2 = 86.41$, df = 7, $p < 0.01$) in the number of landings in half hour groups. Figure 6 shows that many more landings were made after the change than before. The average time of day at which these 33 changes were noted was 1430 hours. The lower number of landings before the changes was probably not influenced by the average time of commencement of observations (1000 hours) since only twice did observations commence within 2 hours of a weather change. It was noticeable that low cloud usually lifted between 1200 hours and 1500 hours.

3.5 LUNAR PHASES

The author considered that the time of daily first arrival of birds at their colony might be related to phenomenon other than weather e.g. lunar phase. These data were analysed with reference to the moon's phases by dividing its monthly cycle of 28 days into 8 approximately equal phases. Males did not arrive before or after 1200 hours noon significantly more often in any particular phase of the moon's cycle ($p > 0.05$). The frequencies of females' arrivals were too small to test.

Non-breeders were sometimes absent for 2 or more consecutive days during the summer. These absences of both males and females occurred most often during the last phase before Full Moon. Their pooled absences are shown in Figure 7 (frequencies of absences greatest in last phase before Full Moon ($X = 26.6$, df = 7, $p < 0.01$)).

The occurrence of Average conditions and days of Low Cloud were not significantly correlated with lunar phases ($p > 0.05$ each test), nor did the remaining weather categories appear to be correlated with lunar phases.

3.6 SIMULTANEOUS ABSENCES AND ARRIVALS

On most days there were several arrivals and departures of non-breeders, and there were indications that some individuals timed their movements to synchronise with other birds. Some breeding partners were absent simultaneously for 1 or more days (i.e. at least part of their absences coincided).

Both partners of 7 of the 8 pairs that bred at Caroline Cove in 1976 and 1977 were simultaneously absent from the colony for 1 or more periods of 1 or more days at a time during the pre-egg period, though the absences of each sex were not always of the same duration. The averages of 13 simultaneous absences of males and females were 3.5 days (SD 3.1) and 5.3 days (SD 3.0) respectively; 4 non-simultaneous absences of females averaged 3.3 days (SD 1.8). On 5 occasions both partners were seen to leave the colony. On 2 of these occasions the partners left within 15 minutes of each other, and the partners of another pair left within 1 hour of each other. One pair left within a few minutes of each other and returned within a few minutes of each other 11 days later. These patterns were similar for a male and female who had reached an advanced stage of pair bonding (30182 and 30168) but they have not been included in the calculations for breeders' absences.

Non-breeders returning to the colony after an absence of 1 or more days, or only an hour or so, often did not arrive alone, but in the company of 1 or 2

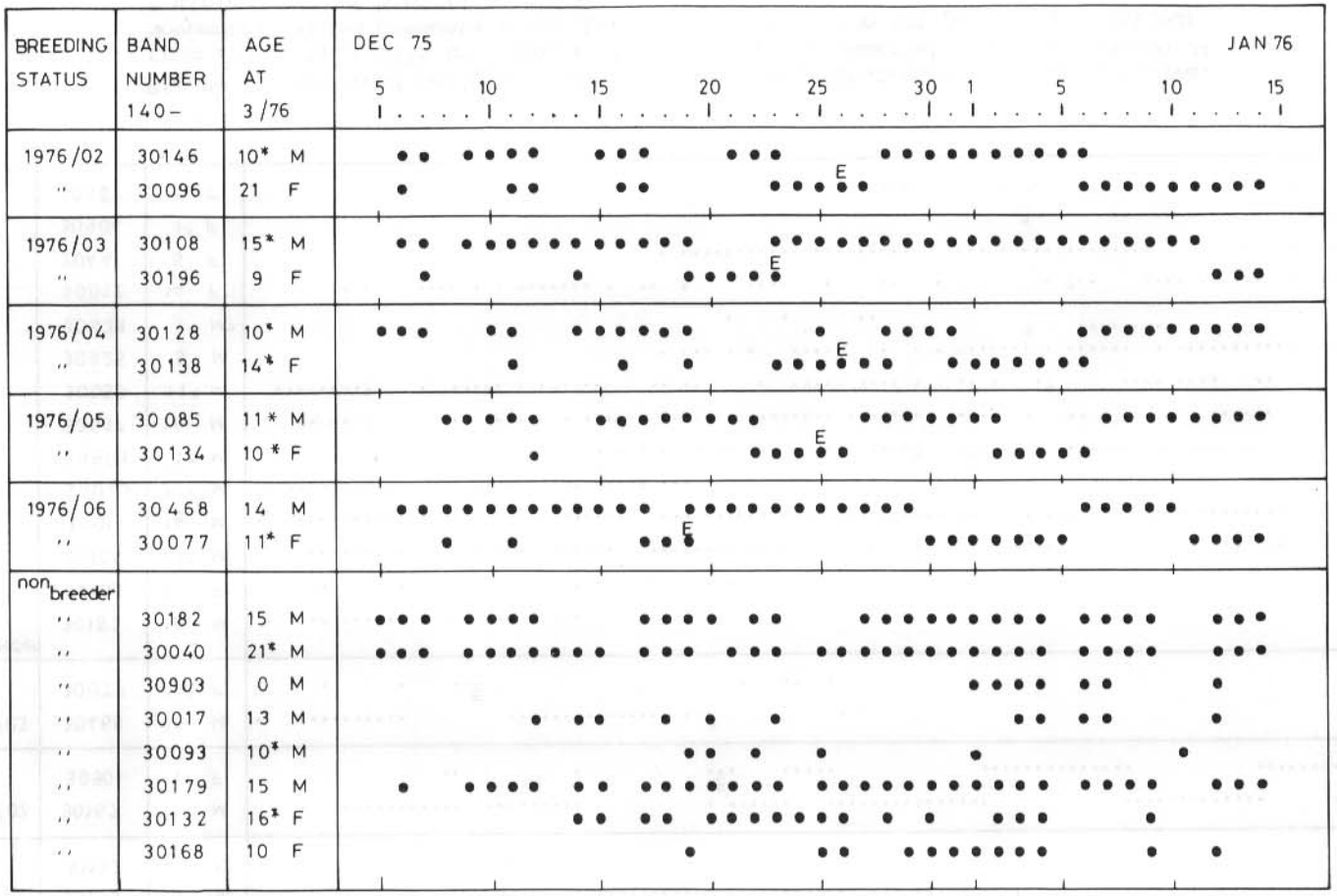
others. Such associations did not seem to be random, as individuals appeared to have their favourite companions. Usually males arrived with males, although 1 male arrived more often with the same female than with any other bird. Unfortunately not all birds involved were of known age. In cases for which the age was known it seemed that relatively young males (11 to 17 years old), most of whom had bred previously, tended to return with relatively older males (> 17 years). Unfortunately no tests for statistical significance have been applied to these data because of insufficient frequencies.

On some days of non-Average weather conditions most non-breeders were absent from the colony. However, just before or soon after these changed to Average or Windy conditions non-breeders often returned within 30 minutes of each other and the change.

3.7 FINAL DEPARTURE FOR THE SEASON BY NON-BREEDERS AND FAILED BREEDERS

In 1975 there was a noticeable decrease in the number of non-breeders at Caroline Cove in the first week of April, and from 16 to 28 April no non-breeders were observed. Not all non-breeders continued to visit the colony until April. For example, 1 old male left Caroline Cove on 4 January 1977, and 2 'pairs' (1 at Caroline Cove and the other at the north end of Macquarie Island) that had reached an advanced stage of pair bonding departed in the last 2 weeks of January (Plate 2).

Unsuccessful breeders either visited the colony for several days after the egg failed, or left immediately after failure. Parents returning to feed a chick after it had fledged remained in the immediate vicinity of the nest for 1 to 3 days, then left the colony and neither they nor their partners were seen until next season. This rapid departure of parents may also occur soon after the discovery of a dead chick or if a chick has disappeared.



NOTE – 140-30903 was banded in austral summer of 1976/77

Figure 1. Recorded daily attendance of Wandering Albatrosses at Caroline Cove, from 5 December 1975 to 14 January 1976. • bird present; E egg laid; * minimum age of bird (i.e. banded as adult).

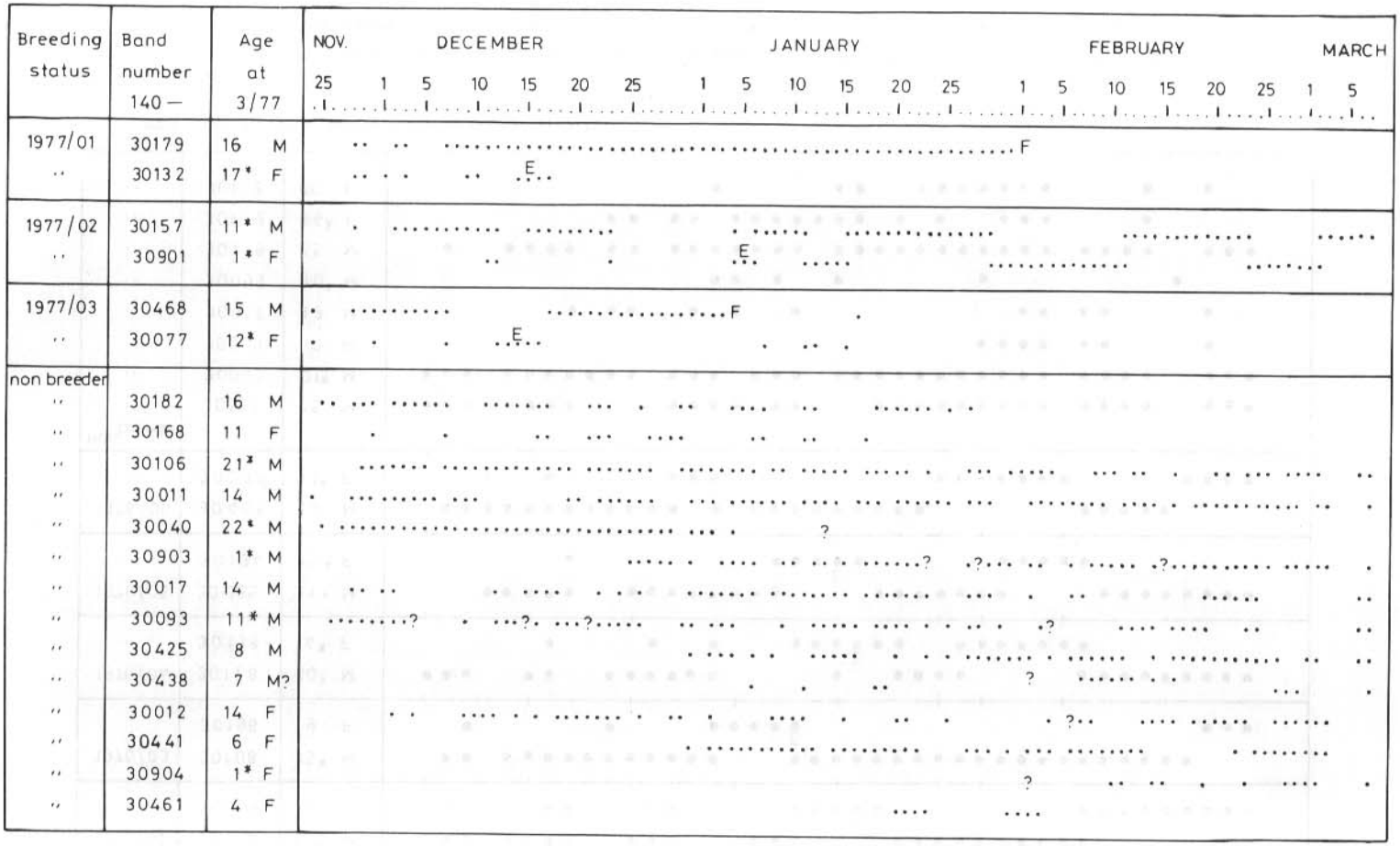


Figure 2. Recorded daily attendance of Wandering Albatrosses at Caroline Cove, from 25 November 1976 to 7 March 1977. Incomplete observations were made on 24 November. •bird present; E egg laid; ? identification not positive; F failed; * minimum age of bird (i.e. banded as adult).

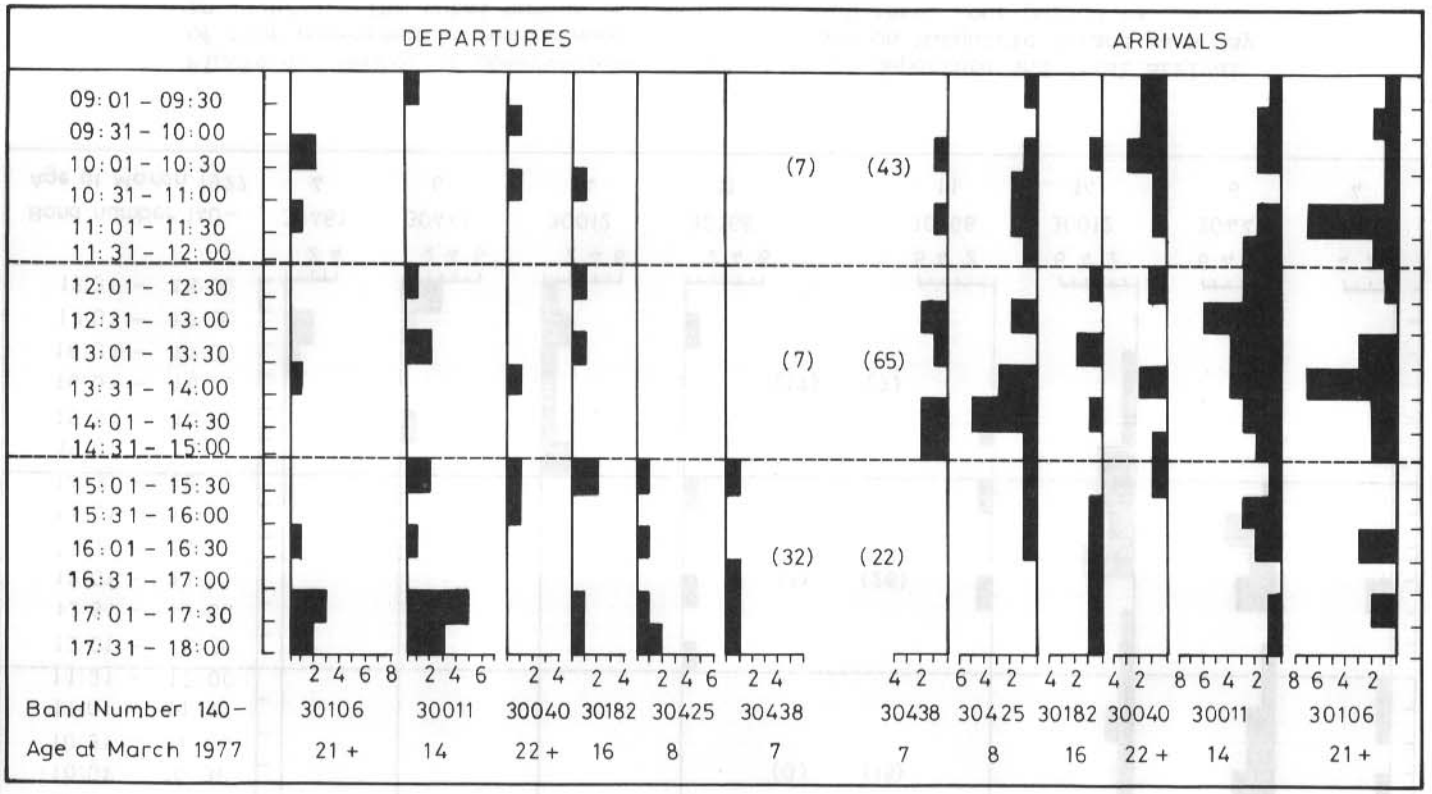


Figure 3. Number of observations of last time of departure and first arrival of six non-breeding male Wandering Albatrosses on Macquarie Island each day in 1976/77. The total number of records for each three hour period is indicated in parentheses.

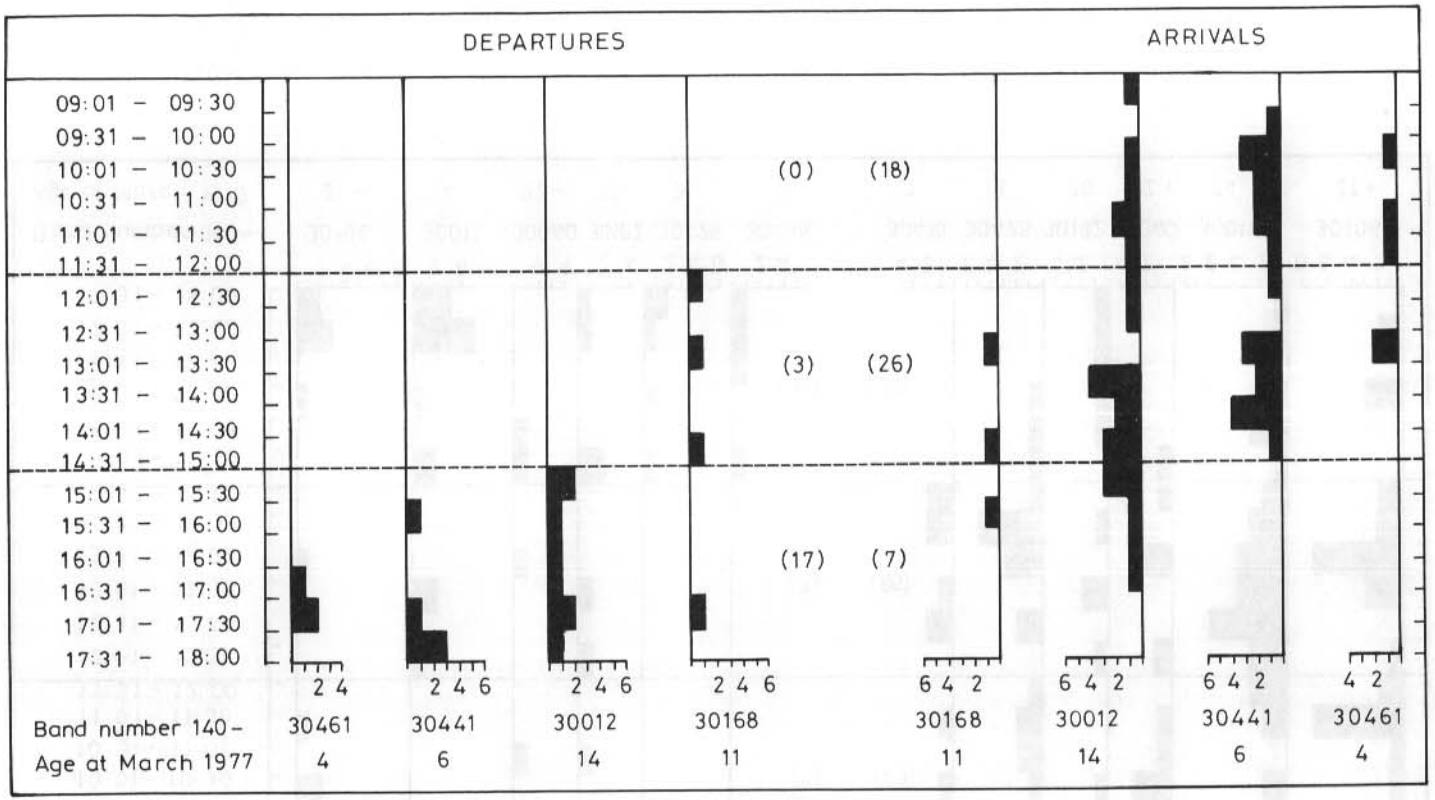


Figure 4. Number of observations of last time of departure and first arrival of four non-breeding female Wandering Albatrosses on Macquarie Island each day in 1976/77. The total number of records for each three hour period is indicated in parentheses.

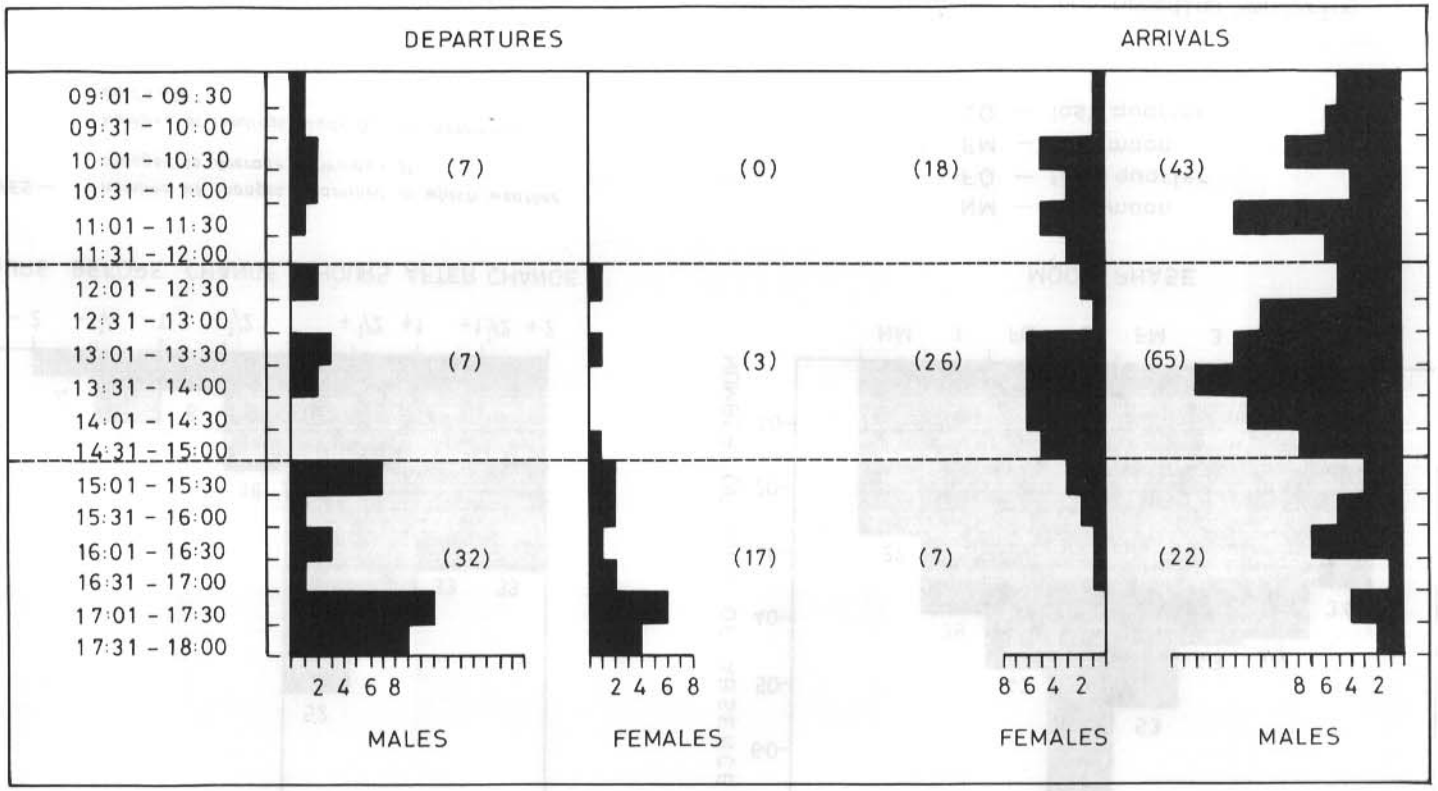


Figure 5. Pooled data of number of observations of last time of departure and first arrival of six non-breeding male and four non-breeding female Wandering Albatrosses on Macquarie Island each day in 1976/77. The total number of records for each three hour period is indicated in parentheses.

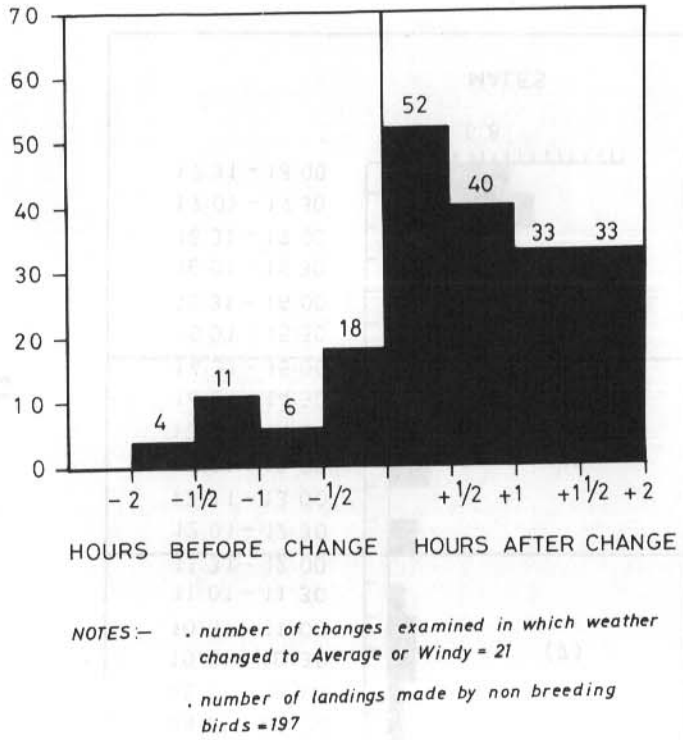


Figure 6. Number of landings by non-breeding Wandering Albatrosses in the colony before and after abrupt changes in weather occurred.

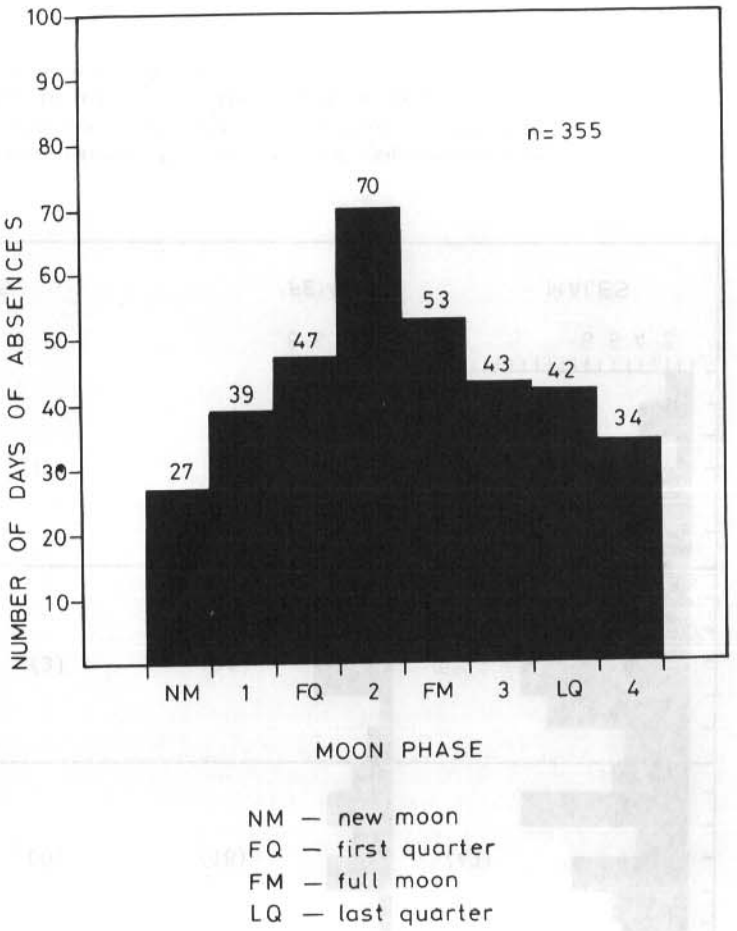


Figure 7. Absences of non-breeding Wandering Albatrosses from Caroline Cove during the moon's 28-day cycle in the austral summer of 1976/77.

Band number 140 –	Age at 3/77	Number of days seen at colony				Duration of visits to colony			Duration of absences from colony		
		days between first and last sighting	total days seen at colony	col. 4 as % of col. 3	col. 4 as % of period of obs.	number of visits	$\bar{x}$	SD	number of absences	$\bar{x}$	SD
Males											
30040*	22+	40	37	92.5	35.9	3	–	–	3	–	–
30106	21+	97	71	73.2	68.9	16	4.44	3.14	16	1.63	0.89
30011	14	102	71	69.6	68.9	15	4.73	2.87	16	1.94	1.84
30017	14	98	46	46.9	44.7	14	3.29	2.61	14	3.70	3.41
30093	11+	100	56	56.0	54.4	17	3.29	2.57	17	2.59	2.21
30903	1+	72	52	72.2	50.5	13	4.00	3.10	13	1.54	0.78
30425	8	65	42	64.6	40.8	14	3.00	3.11	14	1.64	0.84
30438	7	60	17	28.3	16.5	9	1.89	1.69	9	4.78	3.99
Females											
30012	14	92	48	52.2	46.6	18	2.67	2.11	17	2.59	2.09
30904	1+	33	11	33.3	10.7	6	1.83	1.17	6	3.67	1.75
30441	6	63	45	71.4	43.7	9	5.00	3.97	8	2.25	2.55
30461	4	15	8	53.3	7.8	2	4.00	–	1	–	–

*excluded from calculations because of unusual attendance pattern

Table 1. Frequency of attendance on non-breeding Wandering Albatrosses in the austral summer of 1967/77. Male 30182 and female 30168, having reached an advanced stage of pair bonding, have been omitted as their attendance patterns were not typical of non-breeders.

Weather category at arrival	Number of arrivals M	F	% of total arrivals M	F	No of days in which each category predominated	Expected no.* of arrivals M	F
Average	83	34	61	62	35	45.9	18.7
Windy	20	9	15	17	7	9.2	3.8
Low cloud	12	3	9	5	18	23.6	9.6
Hot	9	4	7	7	21	27.4	11.2
Unusual wind direction	7	2	5	4	6	7.9	3.2
Calm	4	3	3	5	16	21.0	8.5
TOTAL	135	55	100	100	103	135	55

* calculated by the relationship

$$\frac{\text{number of days each category predominated}}{\text{total number of days of observations}} \times \text{total number of arrivals}$$

Table 2. Daily arrival of non-breeding Wandering Albatrosses at the colony for the first time in relation to weather categories.

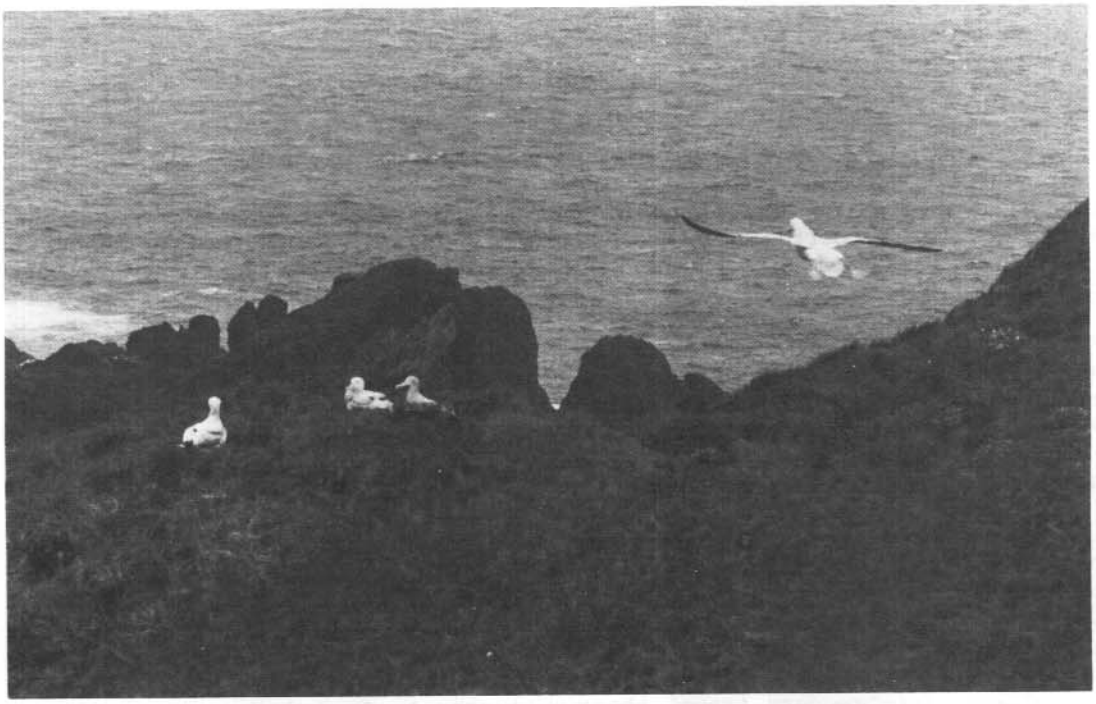


Plate 1. Aerial and terrestrial activity increased immediately after strong winds cleared low cloud.

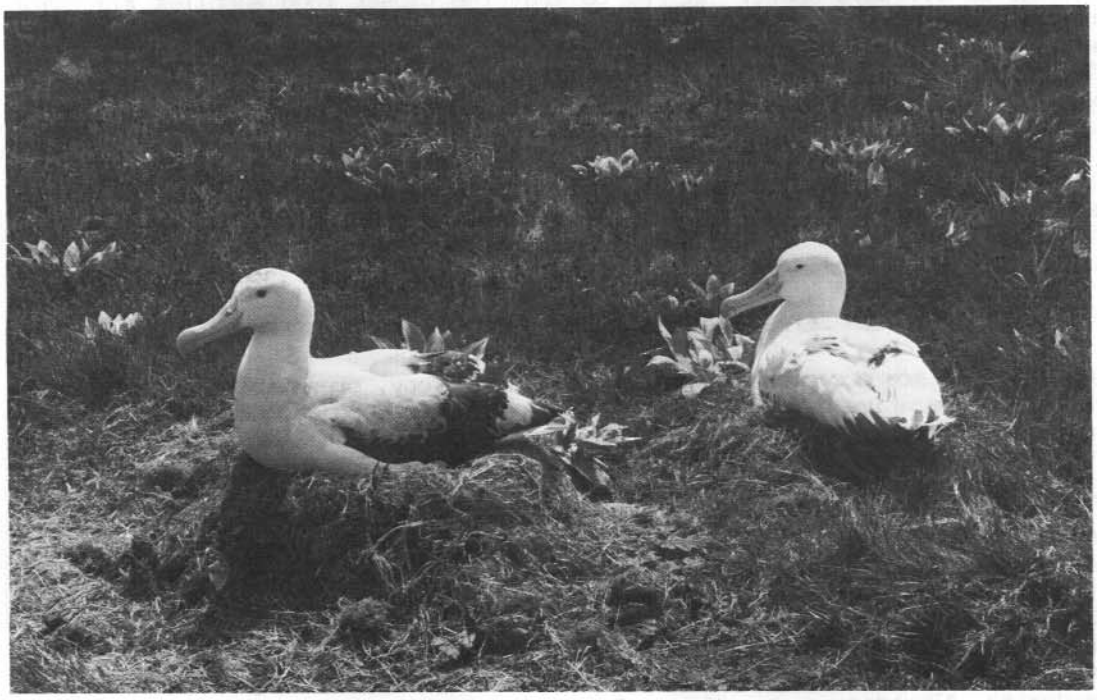


Plate 2. This pair of Wandering Albatrosses reached an advanced stage of pair bonding, and atypically, each built a nest in at least two seasons. No eggs were seen.

4. DISCUSSION

4.1 FREQUENCY OF ATTENDANCE BY NON-BREEDERS, AND FEEDING RANGE

The pattern of first arrival of non-breeders at their colony was consistent with data for Wandering Albatrosses at Bird Island, South Georgia (Tickell 1968), and for Royal Albatrosses D. epomophora at Taiaroa Head, New Zealand (Richdale 1950).

Young males and young females visited the colony sporadically, but visits probably become more frequent and regular with age. Older males tended to establish a regular attendance pattern, and visited more than older females. Older females attended more frequently than young females. These patterns of various age classes are probably related to territory (display nest) establishment, and to mate selection (Tickell 1968, Richdale 1950).

It is not known where the birds from Macquarie Island feed. Distant live recoveries of 2 banded breeders (140-30051 on 26 December 1978 near Tasmania 1600 km from Macquarie Island, and 140-20029 on 26 July 1970 at Ballambi, NSW, 2240 km from Macquarie Island; Australian Bird Banding Scheme) demonstrate that they sometimes fly more than 1500 km from Macquarie Island during their current breeding season. Probably not all breeders feed in the same area. It is unlikely non-breeders travel these distances to feed during the courtship period (i.e. austral summer) as the average number of days male non-breeders older than 11 years were absent from the colony was 2.3 days (Table 1) on an average of 3.9 days apart. It may be that the closer food supplies fluctuate and are unreliable but the distant ones more constant. If so it could be advantageous for breeders to spend more time flying to a dependable source. The regularity of food supply may not be so important for non-breeders; possibly they can gamble on fluctuating supplies, and search more frequently locally.

The difference in the number of consecutive days spent at the colony by non-breeding males (3.9 days) and the early incubation shifts of males (10.2, 8.5 days, from Figure 2) probably reflects differences not only in the feeding habits but also in the energy requirements of courting and incubating birds.

4.2 DAILY AFTERNOON DEPARTURE AND MORNING ARRIVAL OF NON-BREEDERS

Non-breeders are occasionally absent from the colony, presumably to feed, for 2 or more consecutive days. However, it is not understood why non-breeding males had a consistent tendency to leave the colony in the late afternoon and stay away overnight. Following this exodus, congregations of birds were frequently seen offshore, bathing and interacting socially but these usually dispersed in an hour or so. Non-breeding females were almost always absent overnight and the males' exodus may be an attempt to spend more time with them, perhaps in offshore congregations or somewhere else at sea. Because of the birds' size and the isolated subantarctic location of their breeding islands, the exodus is unlikely to be a predator avoidance strategy. It may be warmer and more comfortable to float and sleep at sea than to sit on a display nest overnight. This evening exodus has not been reported for any other colony of Wandering Albatrosses or the related Royal Albatross, but it would be interesting to know if it occurs in larger colonies, and in colonies in different climates.

4.3 DAILY ARRIVAL IN RELATION TO WEATHER CONDITIONS

During summer most nests were frequently enveloped in the morning by low stratus cloud. Birds did not usually fly about the colony in these periods of relatively calm winds and greatly reduced visibility. Most birds stayed at sea whilst unfavourable conditions prevailed at the colony, and when these changed the birds returned to the colony.

4.4 ABSENCES NEAR FULL MOON

Non-breeders were most often absent for 2 or more consecutive days just before Full Moon than at any other lunar phase, and least often during New Moon. The author suggests that this indicates that more time is needed near Full Moon to capture food prey than during New Moon. Much of the diet of Wandering Albatrosses is squid which undertakes a diurnal vertical migration (Imber and Russ 1975). The squid may be most visible at the surface during periods of the darkness of New Moon because of their bioluminescence, and may be easier to catch. Also, because of the high light intensity at night near Full Moon the zooplankton on which the squid feed and therefore the squid, do not come to the surface of the ocean as they do in the darkness of New Moon (Wickstead 1976). This would make squid much scarcer to albatrosses and would require longer periods of time to catch sufficient for their periods of fasting ashore (see also Imber and Russ 1975, and Clarke et al 1981 who disagree with them). Even more time would be needed if they had to search out additional food to supplement their lowered squid intake around Full Moon.

4.5 SIMULTANEOUS ABSENCES AND ARRIVALS

Given that both partners of a pair must spend some time at sea feeding during the period from their first arrival at the colony to egg laying, it is obviously advantageous for them to synchronise their time ashore to allow them maximum opportunity for pair bonding and copulation. This seemed to be achieved by 1 bird generally leaving the nest very soon (usually less than 60 minutes) after the other, and the male usually returning to the colony before the female. Thus he would be present at his partner's infrequent visits.

Several authors, including Harris (1973) and Nelson (1968), suggested that young albatrosses gain experience and perfect courting sequences while they attend the breeding colony over a number of years. This may also be true on Macquarie Island, as the results of this study suggest that arrival, presence and absences of young birds usually coincided with those of older and therefore more experienced non-breeders.

The reason for the combinations of the same 2 non-breeding males frequently flying together over the colony (Tomkins, unpublished) and arriving at the colony at the same time is not yet understood: it may be that they are participating in the dominance-based male hierarchical structure which the author believes exists at Caroline Cove (Tomkins, unpublished). The need for such a hierarchy could be related to mate selection, and be the result of the sex imbalance of non-breeders (Tomkins 1985).

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