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THE BREEDING PHENOLOGY OF THE ROYAL ALBATROSS (*Diomedea epomophora sanfordi*) 1937-1974

(Short Answers in Conservation Science)

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THE BREEDING PHENOLOGY OF THE ROYAL ALBATROSS (*Diomedea epomophora sanfordi*) 1937-1974

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NOTE

This paper was read at the 16th International Ornithological Congress, Canberra Australia in 1974. The results were interim analyses within a long term study and only the abstract was published at the time. Further analyses undertaken by the remaining author in 1993, which will be published elsewhere, have indicated some significant changes during the further development of the colony at Taiaroa Head Accordingly this paper is published to provide a reference point for other publications.

The royal albatross (*Diomedea epomophora*) breeds only in the New Zealand region as two subspecies, the northern *sanfordi* and the southern *epomophora*.

Though the populations and the basic elements of breeding appear to be similar, the northern royal differs in commencing its breeding cycle some three weeks earlier, and is both smaller and darker than the southern royal.

The main breeding population of *sanfordi* (Figure 1) is in the Chatham Islands where a population of some 7,500 breeding pairs is estimated. However, a small overflow population has established itself at Taiaroa Head, Dunedin, on the mainland of southern New Zealand.

This colony has since 1937 been subject to extensive protective measures designed to prevent the depredations of curious humans and their associated introduced predators. The early protective efforts which resulted in the now well known studies of Dr Lancelot Richdale have been continued since 1951 by the New Zealand Wildlife Service through the efforts of two dedicated field officers, Messrs. Stan Sharpe and Alan Wright, without whom the present continuation of Dr Richdale's studies would have been impossible.

From 1937-1973 some 94 chicks were fledged at Taiaroa Head, and 62% have survived to the age of 5 years. This high survival rate is combined with a mean expectation of further life of 46 years at the commencement of breeding. With assistance from sporadic bursts of immigration the breeding population has increased from 2 birds in 1937, to some 30 birds in 1974, twenty-three of which are known age progeny of the colony.

Accordingly the following data are based almost entirely on the detailed studies of the past six years (1968-74) using a fully identifiable population containing a high proportion of known age birds.

For the purposes of this discussion the following broad definitions will apply:

1. **Breeding adults.** Those birds which have been associated in the production of an egg in any season used for analysis.

2. **Bereaved breeders.** Birds which had bred previously but had lost their mate, and were not currently engaged in breeding during any season used for analysis.

3. **Keeping company.** Adult birds which formed firm pair bonds for one or more seasons before egg laying and may consist of adults which have not previously bred, bereaved breeders, or a combination of the two.

4. **Adolescents.** Birds from 4 to 8 years old which have not formed a pair bond.

The breeding cycle of the northern royal albatross (Figure 2) starts in late September and consists of 5 stages:

1. **Pre-egg stage** - re-establishment of the nesting territory, nest building and copulation.

2. **Egg laying** - late October to late November round a mean of 12-14 November.

3. **Incubation and Hatching** - shared by both sexes for a mean of 79 days.

4. **Guard stage** - where the newly hatched chick is guarded on the nest by at least one parent at a time for a mean of 36 days.

5. **Post-Guard Stage** - where the chick remains on the nest site and is visited by both parents for feeding during a further mean 204 days before fledging.

These five stages cover 11 to 12 months depending on the variable ability of parents to rear their chicks. This ensures that successful breeding adults are biennial breeders which spend their 'holiday' year wintering in the south-west Atlantic before returning to the breeding colony. A study in 1972 of the dispersal movements of the royal albatross (Robertson & Kinsky, 1972) indicated the likelihood of a synchronized circumpolar movement not only of breeding birds but also of various age classes of adults and adolescents.

Analyses of the presence of breeding, bereaved breeders, keeping company and adolescent birds (Figure 3) indicates a markedly set pattern of arrival and departure according to status. Breeders and keeping company birds establish themselves on the colony before and during egg laying. Unsuccessful breeders and the potential breeders not laying eggs start to vacate the colony by mid December and have all dispersed by the end of the guard stage. Even birds still sitting on eggs desert at the end of the guard stage. In contrast, adolescents build up steadily during incubation to reach a peak just prior to hatching, while some stay well past the guard stage.

The presentation of the mean arrival dates (Figure 4) illustrates and establishes the basis of an important time progression through adolescence to pair formation and subsequent breeding.

A study of the occupance levels of non-breeding birds (Figure 5) suggests the following hypothesis:

> *That the development of individual feeding experience or ranges whereby food can be obtained with a minimum of effort is as important as obtaining nesting territories.*

Firstly, five year old birds arrive as the bereaved breeders and keeping company birds depart, but spend little time on the colony. This can be considered as an establishment year when future breeding and feeding ranges are explored. Secondly, six year old birds spend considerably more time at sea when it is assumed that individual feeding ranges are firmly established. Thirdly, by the 7th year more time is spent on the colony in social activity preparatory to pair formation and establishment of nesting territories. Fourthly, the keeping company stage is more sedentary with the shorter span of occupance more evenly spread between land and sea. This is the only time in the breeding history of a pair when male and female are regularly together on the breeding territory. The keeping company stage is used to firmly establish and defend the nesting site, and though at least one year is required before breeding, more are needed if one or both birds are young adults.

Though spending as long in the breeding zone as six year old's, bereaved breeders like seven year old's have to spend more time on the colony, to make contact with suitably qualified birds so that pair formation may be commenced. This they could not do without a known and established feeding base. The direct effect of any age or sex imbalance in the colony is to prevent potential breeders from establishing contact with a mate.

Support for the importance of established feeding abilities and ranges is found both in the individual abilities of breeding birds to feed their young, and the fact that 20% of adolescents do not survive more than three years after return to the colony.

Thus we propose that the establishment of a feeding range close to the nesting colony, as distinct from random feeding methods while on dispersal, is a prerequisite for a successful progression to breeding status.

Data on the age of sexual maturity are as yet too few to accept with certainty the presently indicated 8-9 years for both sexes. First eggs with young breeders have a high failure rate, and at present this seems to relate to the age of both sexes, but more especially to that of the male.

Prior to egg laying, males return first, a mean of 31 days before laying, and females 27 days. However, at first laying, older females generally precede younger males. Males spend 44% of pre-egg time present on the nest site. In contrast the female only spends 7 days or 26% of her time at the nest site. Two to three days of this are immediately prior to egg laying. This gives the female a very limited chance of copulation and suggests some form of relationship or communication away from the nesting colony possibly on the feeding range, to assist with synchronization.

As copulation is rarely attempted in keeping company birds, copulatory inexperience must constitute an important factor in first egg failure. Even when the egg is laid there is a high incidence of loss through breakage among young males during their first incubation stint. However, further investigation is needed to determine the relationship between experience and maturity in determining fertility especially in males.

We have seen evidence so far of a highly restrictive progression towards breeding status. This continues into the egg laying period (Figure 6) where 96% of the eggs are laid within a 20 day period round a mean of 12 November. This is shown in the combined figures for Taiaroa Head and one season for the Chatham Islands. Reduction in the amount of laying was observed in the Chathams when more than 3mm of rain was recorded during daylight hours. However, there was probably an associated correlation with weather at sea over the prior two to three days.

Even within the short laying period, individual females show a propensity for laying at a constant point in the general range (Figure 7). This distribution of individuals when their earliest eggs are plotted against their latest eggs shows a marked ranking from early to consistently late layers. The Correlation Coefficient of .828 is significant to a level of $p = < 0.001$. The mean range of laying for individuals of 8-9 days should be attributable to climatic and seasonal differences as partly indicated by the relationship between rainfall and laying in the Chatham Islands data.

Only when the chick is hatched do we find any relaxation in the rigid time scale of breeding shown so far (Figure 8). However, the time for rearing the chick is directly related to the regularity of feeding by its parents. Two female chicks hatched on the same day demonstrate the range of fledging round the colony mean of 240 days. Chick "A" was visited some 3 days per week after hatching compared with some 2 days per week for chick "B". When we find that the parents of chick

"A" spent a total of 18 incubation stints on the nest that season compared with 8 for "B"'s parents we are left with the strong impression that "A"'s parents have a better feeding range and ability than "B"s.

Accordingly it is feasible to relate the restrictive breeding timetable of the northern Royal Albatross, with its access to specific feeding ranges. We suggest that breeding differences between northern and southern royals may be food based and can ponder whether earlier breeding maturity may be induced by a more plentiful supply of food closer to the breeding colony. However, we do not yet know enough about the feeding ecology of sea-birds generally and royal albatrosses in particular to speculate further.

ACKNOWLEDGEMENTS.

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REFERENCES

Richdale, L.E., 1950. Pre-egg stage in the albatross family. Biol. Mono. 4: the author.

Richdale, L.E., 1952. Post-egg period in albatrosses. Biol. Mono. 4: the author.

Robertson, C.J.R. and Kinsky, F .C., 1972. The Dispersal Movements of the Royal Albatross (*Diomedea epomophora*). Notornis 19: 289-301.

Robertson, C.J.R. and Richdale, L.E., 1975. Breeding phenology of the Royal albatross. Paper delivered at the 16th International Ornithological Congress. (Abstract) Emu Vol. 74 [Suppl.]: 292

Robertson, C.J.R. and Wright, A., 1973. Successful hand-rearing of an abandoned Royal Albatross chick. Notornis 20 (1): 49-58.

FIGURE 1.
Location and estimated total size of Royal Albatross breeding colonies. (Breeding pairs)

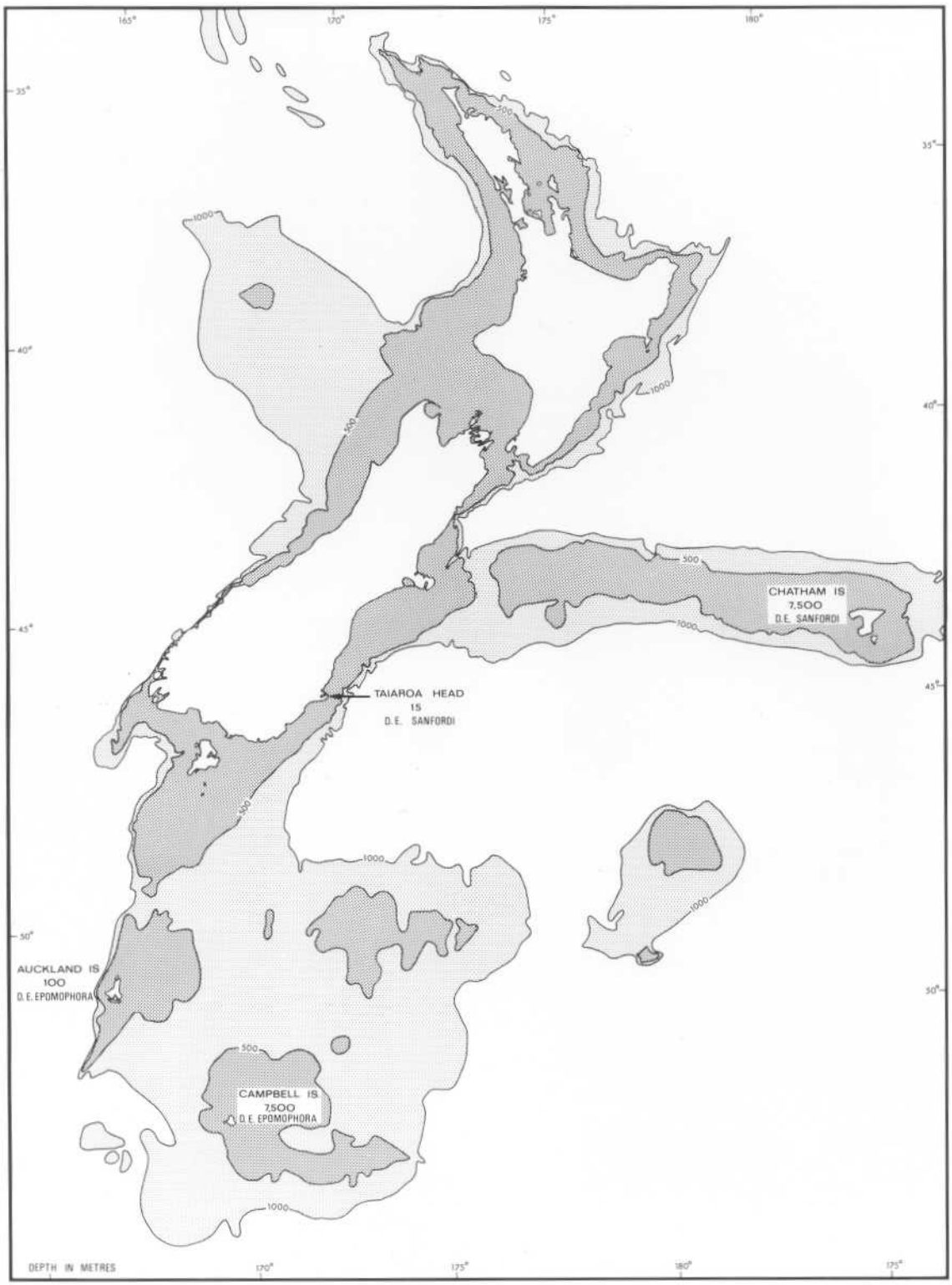

FIGURE 2.
Breeding cycle of the Northern Royal Albatross at Taiaroa Head 1937-1974.

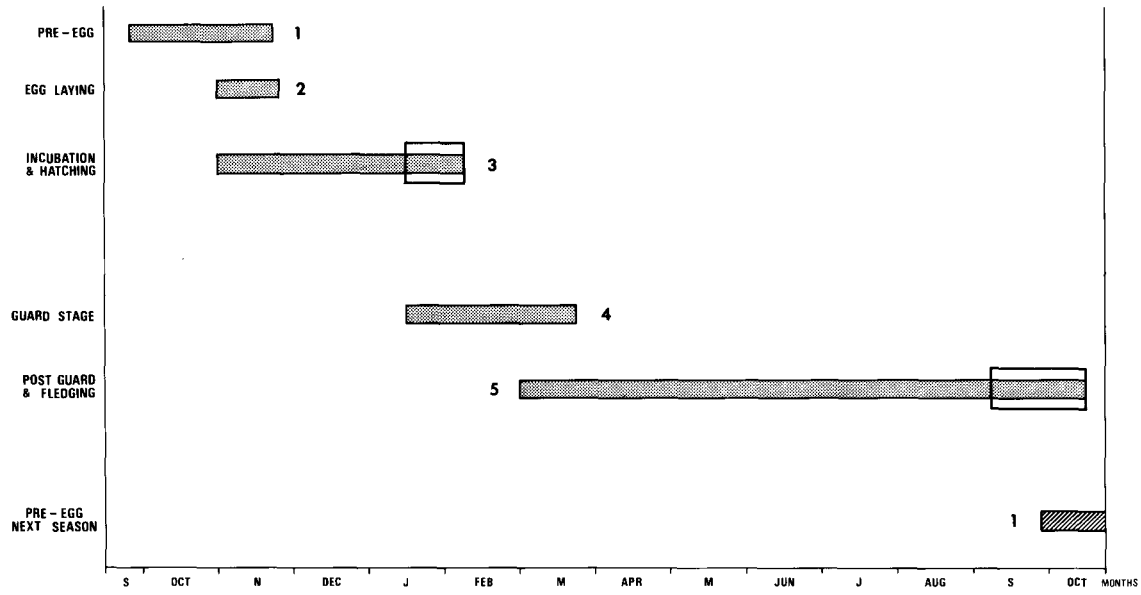

FIGURE 3.
The presence and absence of breeding and non-breeding Northern Royal Albatross from September to May at Taiaroa Head 1968-1974.

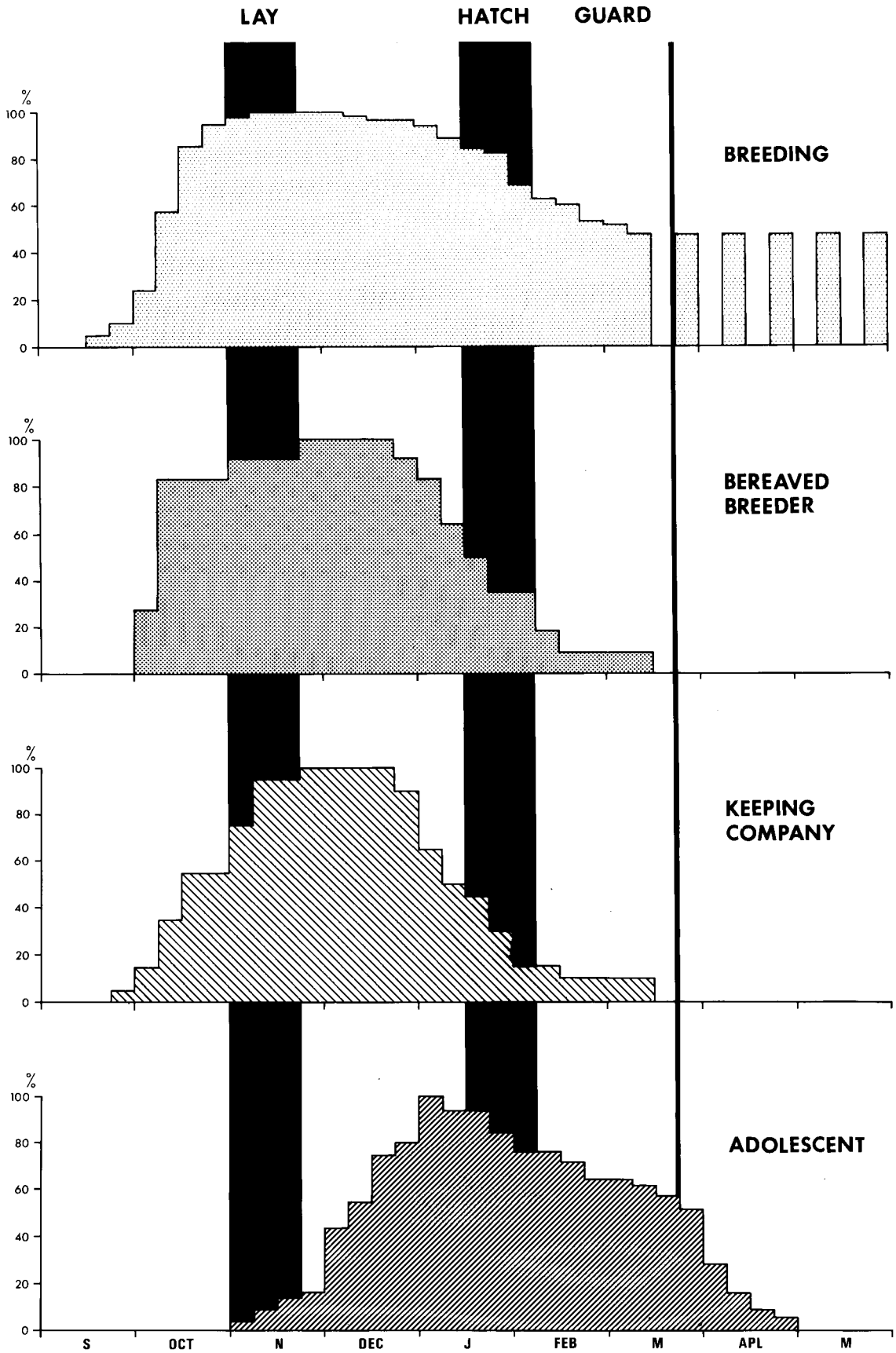

FIGURE 4.
Mean arrival dates of Royal Albatross according to age and breeding status at Taiaroa Head 1969-1974.

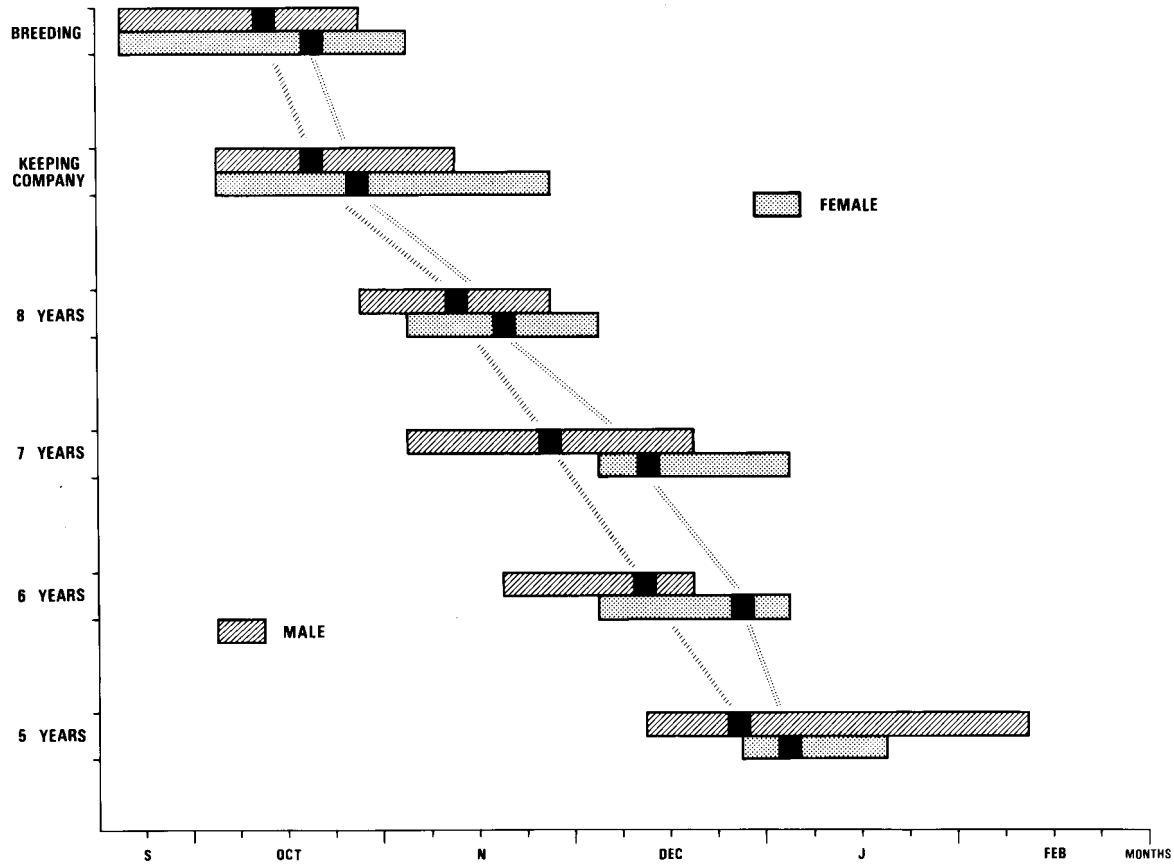

FIGURE 5.
Presence and occupance levels of non-breeding Royal Albatross at Taiaroa Head 1969-1974.

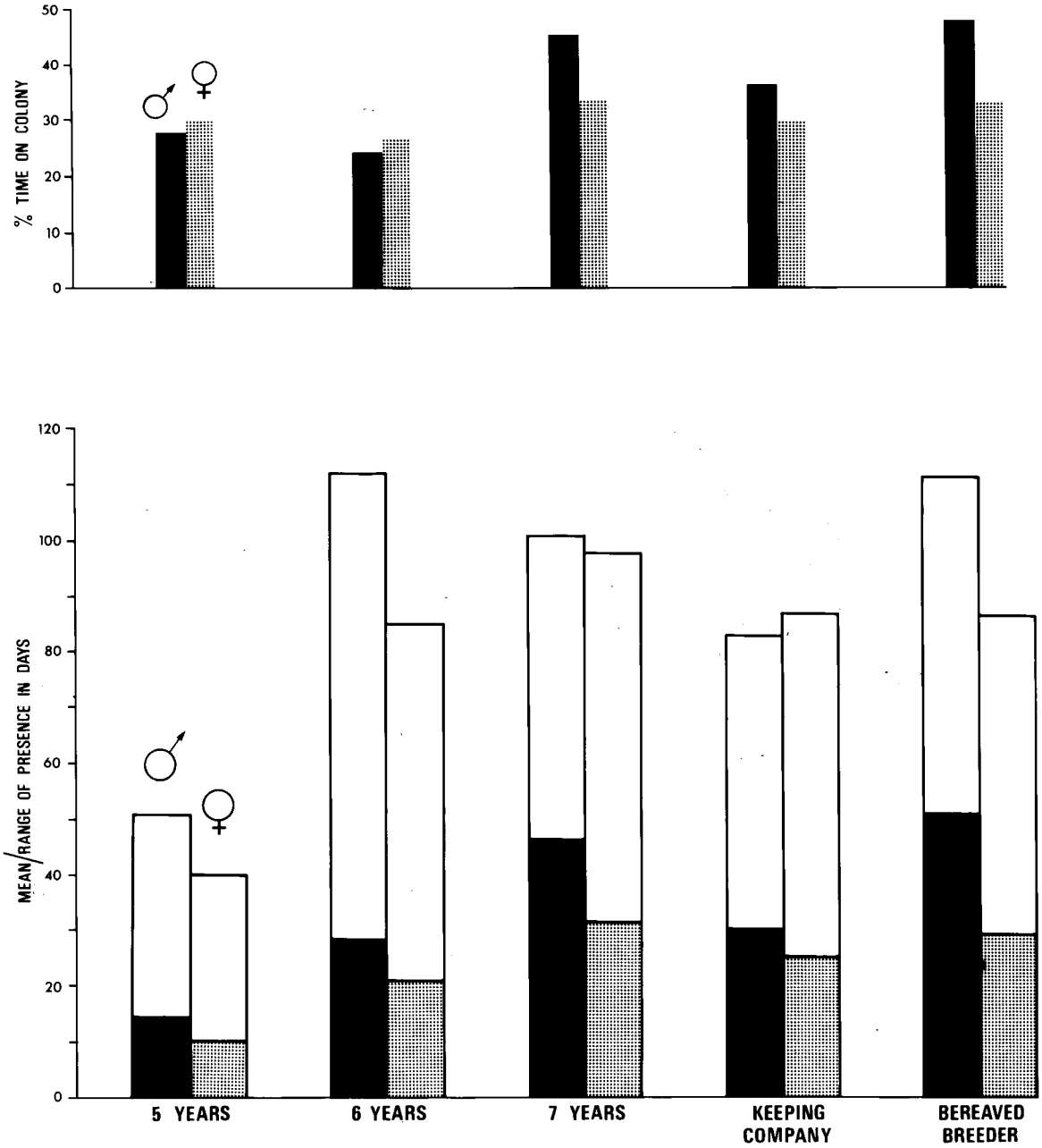

FIGURE 6.
Distribution of egg laying for Royal Albatross at Taiaroa Head 1937-1973 (Combined), and at Middle Sister Island (Chatham Is) 1973.

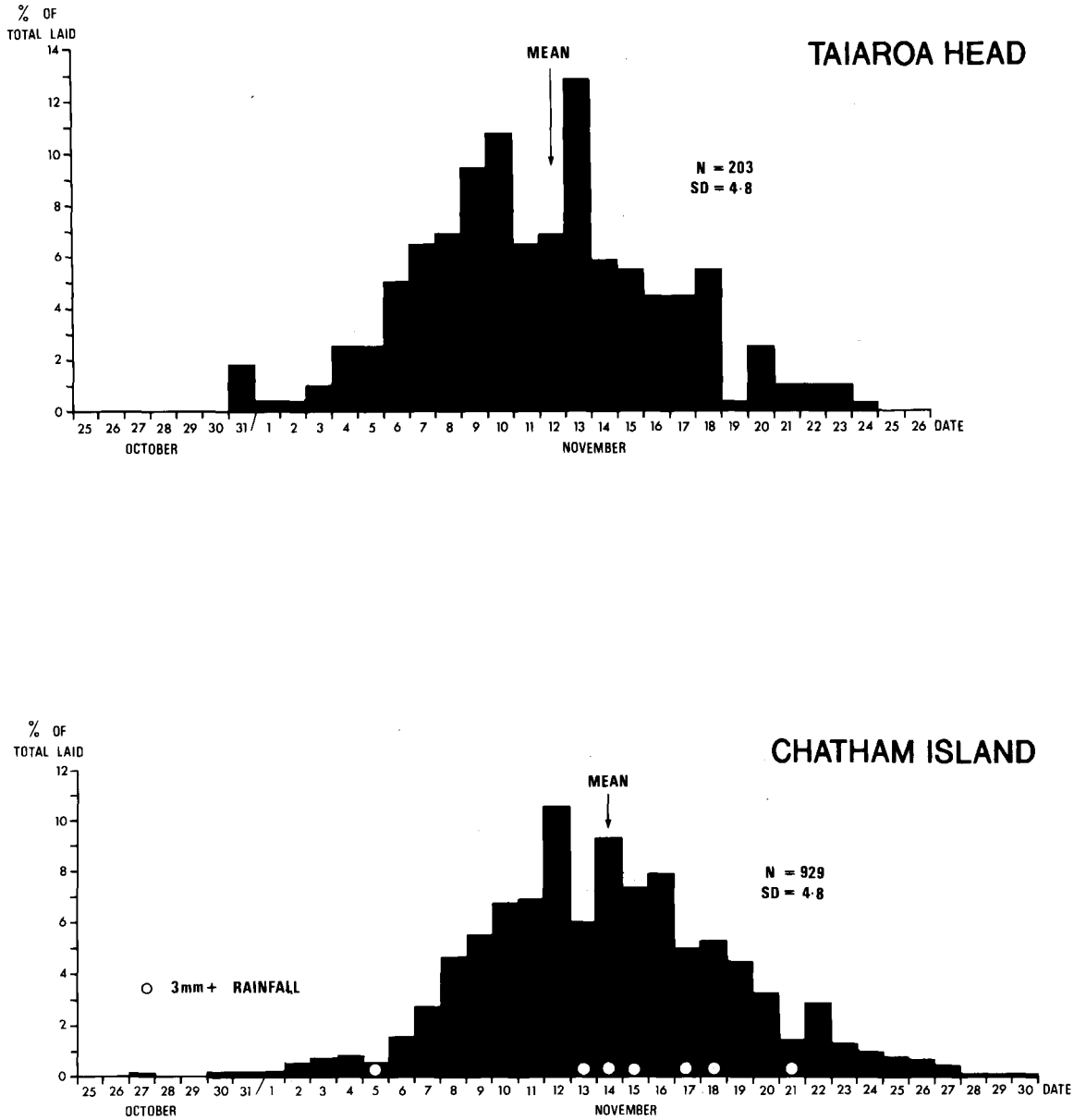

FIGURE 7.
Individual distribution of the range of egg laying for Royal Albatross at Taiaroa Head 1937-1973) where each individual has laid at least 4 eggs.

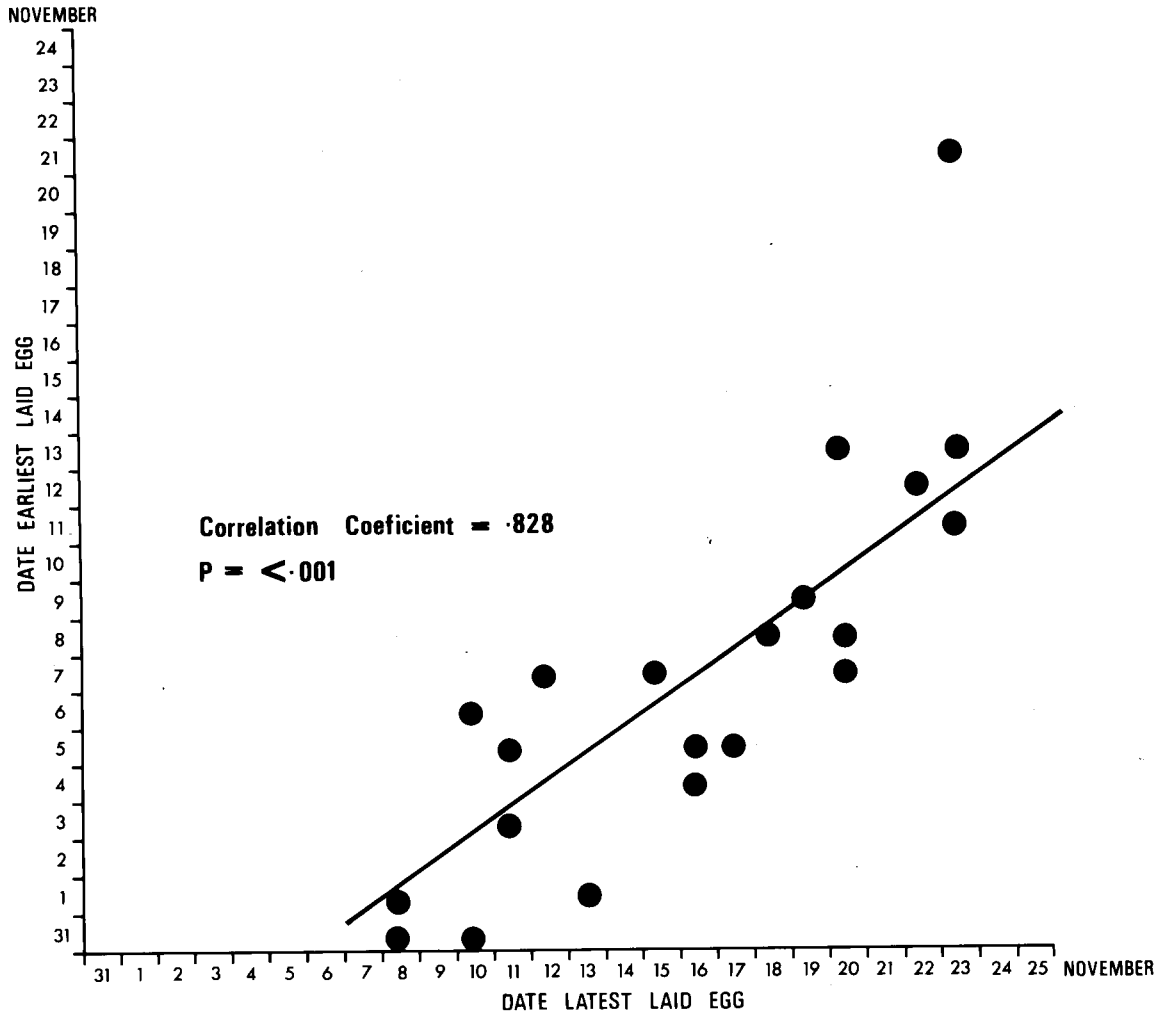

FIGURE 8.
Relationship of parental visits to the growth and fledging date of two female Royal Albatross Chicks at Taiaroa Head.