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LONGEVITY OF THE LAYSAN ALBATROSS, *DIOMEDEA IMMUTABILIS*

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Although it is generally accepted that albatrosses (Family Diomedidae of the Order Procellariiformes) are long-lived, the evidence is scattered and incomplete. It is my purpose here to review the information available to me and to present additional data on longevity in the Laysan Albatross (*Diomedea immutabilis*).

For a long period the only definite information on the length of life among albatrosses was the classical example of the Black-browed Albatross (*D. melanophris*), which lived among the gannets of the Faeroe Islands for some 34 years (Murphy, 1936:511). Lack (1954:92) proposed an "adult life" of 36 years for the Royal Albatross (*D. epomophora*). However, this was based upon a calculated and too-low 3% annual mortality among the small samples studied by L. E. Richdale in 1952. Kerry (1972) reported that four Light-mantled Sooty Albatrosses (*Phoebastria palpebrata*) reached at least 17 years of age and that two reproduced over this span of years. Richdale (1952:146) noted that nine of his 14 Royal Albatrosses breeding at Tairarora Head were ". . . not less than 21 years old," and Jameson (1958) calculated the average age of this colony to be 17 years. Robertson (1972) reported one banded Royal as being a minimum of 27 years old.

Not until the 1960's was there more than fragmentary evidence. Westerskov (1963:808-809) proposed a theoretical life table for the Royal Albatross and indicated that some Royals might live to 70 or 80 years. Tickell (1968:49) used a modification of Westerskov's method to establish a life table for the Wandering Albatross (*D. exulans*). He thought that 1% lived to 70 years and a few to 80.

Richdale and Warham (1973) found an approximate 8% survival for 22 years among 159 Buller's Mollymawks (*D. bulleri*), banded as they incubated. Considering the known delayed breeding, these birds must have been a minimum of 30 years old. The observed survival rate was probably too low; the authors stated that their recapture efforts were uneven and the terrain difficult.

Calculations from Harris's data (1973) on the Waved Albatross (*D. irrorata*), using 95% annual survival of adults and initiation of breeding at ages 5 and 6 years, indicated that perhaps 10 to 12% survive to 25 years.

Published information on longevity in the Laysan Albatross is even less satisfactory, as is indicated by the fact that Rice (1959), Palmer (1962), Ryzdewski (1963), and Clapp and Sibley (1966)

deemed it worthwhile to report life spans of 18 or fewer years. These reports emphasized the desirability of assembling my data on the Laysan.

The information presented here on the longevity of the Laysan Albatross came from two sources: (1) the data in the files of the U. S. Fish and Wildlife Service on the recapture of birds over extended periods of time (In many instances, however, there was no information on the total number banded, or *exactly* where they had been banded on Midway Atoll, on the age at banding, or on their sex.); and (2) our recapture of specific percentages of birds of unknown sex banded by other persons in areas we regularly searched and to which we could justifiably assign minimum ages on the basis of the season of banding, according to the expected occurrence of different age groups on Midway (Fisher and Fisher, 1969).

The first sample source included 1,057 albatrosses recaptured prior to 1967, none of which we had banded, and 14,420 albatrosses we recaptured in 1972-73 (Table 1). The second source was 40

TABLE 1.
Minimum ages of Laysan Albatrosses at recapture.

Recaptures		Recaptured at minimum ages (years):						
Date	Total No. ¹	10-14	15-19	20-24	25-29	30-34	35-39	40+
Up to 1967	1,057	196	83	139	25	9	—	—
1972-73	14,420	7,979	790	30	13	23	18	11

¹Birds fewer than 10 years of age at time of recapture are not included.

recaptures we made in 1972-73 of 742 birds banded prior to July 1944, as ascertained from examination of the original banding schedules (Table 2). Some of the birds represented in Table 2 are also represented in the first line of Table 1. A number of bands believed to belong to birds of these years could not be read by us or by the technicians of the Fish and Wildlife Service. Further, we probably missed some survivors because we did not always know exactly where to search. Thus, the percentages of recaptures are almost certainly too low.

It was thought to be useless, in a study of longevity of this long-lived species, to include data on survival for fewer than 10 years.

In their entirety, and without any further theoretical extensions, the data on the Laysan showed a minimum percent survival of adults to various minimum ages as follows: 13% to 20 years, 24% to 25 years, 9% to 30 years, 2% to 35 years, 7% to 38 years, and 3% to 40 or more years. It is also to be noted that a minimum of 5% of the fledglings survived to 29 years in one sample.

There are some obvious inconsistencies that require explanation. The 13% survival to 20 years may be too low; the recapture data came from records accumulated over the years, records obviously obtained incidental to other efforts. The possible discrepancy is

TABLE 2.
Records of longevity in Laysan Albatrosses.

Date	Banding		Actual age 29 years	Percent recaptured in December 1972 at:			
	No.	Age		35	38	40	42
21 June 44	100	fledglings	5	—	—	—	—
Jan. 44	44	adults-7 ¹	—	2	—	—	—
Nov. 38	98	adults-8	—	—	—	—	3
late Dec. 39 to early							
Jan. 40	300	adults-7	—	—	—	3	—
Feb. 41	200	adults-6	—	—	7	—	—

¹Numeral indicates estimated, minimum age (see text).

further emphasized by the observed 24% survival to 25 years, from the same accumulation of records. However, the 13% is in reasonable agreement with derivations from our data on mortality, being published elsewhere, which makes suspect the observed 24% survival to 25 years.

The 9% survival to 30 years (Table 1) is perhaps atypically high, in view of the observed 5% survival of fledglings to age 29. The 2% survival to 35 years, based on a sample of 44 birds of assigned age appears low. There is no reason, other than the possible bias created by assigning ages, to question the percentages observed surviving to 38 or more years. They do appear high, especially in view of the fact that the birds' lives must have spanned all the period of disruptions on Midway caused by World War II.

Although percentages of survival cannot be assigned to the raw data on recaptures in 1972-73 (Table 1), it is evident that there were at least 51 birds 30 or more years old and at least 11 that were 40 or more years of age. It is further significant that 39 of these old birds were known to be nesting.

In summary, we may generalize that observed longevity in the Laysan Albatross is in the general order of 13% to 20 years, and, summing the data of Table 2 into a single sample of 742 albatrosses, we obtain the percentages indicated (Table 3) for birds 30 or more years of age.

The information on life expectancy is presented in Table 3 for easier comparison. I have included from the literature only those years for which I have definite information on the Laysan Albatross.

Westerskov's basic data (1963) for the Royal were drawn from a small sample during one year's observation on Campbell Island,

TABLE 3.
Life tables for three species of albatrosses.

Age (years)	Percentage of eggs surviving as birds		
	Laysan	Royal ¹	Wandering ²
4	41	56	21
6	38	47	19
7	35	42	19
8	37	39	18
9	31	35	17
10	29	32	16
20	13	12	10
30	4.3	4.7	6.1
35	3.6	2.9	4.8
38	2.8	2.2	—
40	1.6	1.8	3.8

¹From Westerskov (1963:809)

²From Tickell (1968:49)

and he assumed a flat 9.1% annual mortality after the birds fledged, as well as a static population. Tickell (1968:48) has suggested that the 9.1% mortality may be twice too high. It would also appear, as Westerskov noted, that the assumption of any constant rate of mortality was invalid, and no evidence was presented to show that the population was stable in numbers.

Tickell (1968) believed that the Bird Island colony of Wandering Albatrosses, on which he based his projections, was increasing only very slowly, if at all. His investigation covered several seasons, but, despite his criticism of Westerskov's use of a constant mortality, Tickell assumed a flat rate after the third year of age. He based this assumption (p. 49) on ". . . what we know of mortality in other sea birds."

The data on the Laysan Albatrosses are based on actual records of survival of fairly large samples to known or closely approximated ages. Thus, they are, I believe, more reliable in portraying the true biological situation. However, as I have stated several times, the breeding populations on Midway Atoll are expanding greatly.

With these known weaknesses in the sets of information, it is difficult, and perhaps not profitable, to compare details. The expectancies for Laysans and Royals are remarkably similar especially after the seventh year of life. Both show greater survival than the Wanderer to 20 years of age, and both exhibit lesser survival than the Wanderer thereafter. It is difficult for me to

conceive of such major differences between the two great albatrosses.

Although sex could not be considered in this report, it is unlikely that there are sexual differences in longevity. We have found no sexual variation in the mortality in the Laysan Albatross, and none has been reported in the mortality studies on other albatrosses.

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Although birds banded by the personnel of the U.S. Fish and Wildlife Service and Glenn A. Wilson in the 1950's are included in the numbers of recaptures of albatrosses 10 to 19 years of age (Table 1), they were not used in the analyses because I was not interested in such relatively short-term survival.

It is not possible to list all those persons who recaptured albatrosses over the many years, but special note must be taken of the 1972-73 Southern Illinois University research group which recaptured more than 14,000 Laysans used in this study, as well as more than 2,000 others for our work on breeding biology. It included: Dr. Earl Meseth, Donald Sparling, Peggy VanRyzin, George Jabonek, Mitchell Stokes, and Peter Wood. Miss VanRyzin also aided in assembling the data.

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