

THE LIFE HISTORY OF THE LAYSAN RAIL

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The Laysan Rail (*Porzana palmeri*) was never made the subject of an extended study and hence information on this apparently extinct species is fragmentary and scattered. Since further observation of the living bird is probably not possible, the time is appropriate for the compilation of information from all sources in a species biography, however lacking in completeness it may be. The bird is of biological interest as an example of a species isolated on an oceanic island, where it lost the ability to fly and in other ways displayed the effects of its removal from a complex to a simplified environment. The biology of the Laysan Rail is probably similar to that of other island-dwelling rails such as *Porzana tabuensis* and to such continental forms as the black rails (*Laterallus*) and the yellow rails (*Coturniculus*). Published sources of information cover the span of years between 1843 and 1945. Unpublished records were sought, and a number are made available here for the first time. Informative conversations were had with G. C. Munro, E. L. Caum, T. M. Blackman, and others who had seen the living rail.

The principal observers of the Laysan Rail and the dates of their observations in the field on Laysan Island are: Palmer and Munro, June 16-28, 1891; Schauinsland, June 24 and throughout the summer of 1896; Fisher, May 16-23, 1902; and Dill, April 25-June 5, 1911. Blackman observed from December 6, 1939, through May, 1940, on the Midway Islands. All months except October and November are represented by field observations, and the records provide a fairly good basis for dating seasonal events in the life of the rail.

The rail was seen by sailors of the *Moller* in 1828, on Laysan Island, according to Kittlitz (Rothschild, 1900:v). A presumably identical or similar bird, not subsequently known, was also recorded by Kittlitz as seen on nearby Lisianski Island. The Laysan bird was first collected when the Rothschild expedition visited Laysan in 1891; it was named by Frohawk in 1892.

During the next 30 years the rail managed to survive on Laysan in spite of guano digging operations that lasted about 15 years, but it ultimately died out as a result of the destruction of vegetation by rabbits liberated by the guano diggers. A colony of rails had been started on Midway by importation in 1891, and this continued in existence for about 43 years, apparently suffering extinction from rats and human disturbance in 1944. In 1929 a third colony was started on Pearl and Hermes Reef, but this apparently was destroyed by storms in 1930. Further details of these happenings are given by Baldwin (1945) and Fisher and Baldwin (1946). In spite of these circumstances Munro (1945:26) continues to hope that the rail may be found on Midway or some other island of the leeward Hawaiian chain. Since no complete bird survey of the leeward Hawaiian chain has been made in the past few years, it is impossible to say that this is a vain hope. With 1828 the year of its discovery and 1944 the year of its apparent extinction, the species had a historical life of 116 years.

The Laysan Rail was one of the smaller species of the family Rallidae, the total length being about 150 mm. The short tail, only 25.4 mm. long, had probably degenerated simultaneously with the flightless wings. The wings were small and rounded, 54 mm. long. The primaries were reduced in number to 8 with the loss or extreme reduction of the 9th and 10th primaries normally found in rails. As in other rails, the legs and feet

were large in proportion to general body size. The bill was stout, straight, and 18 mm. in length. The feet and bill were green, the iris ruby red and the breast mouse gray. The back was pale brown with strongly contrasting chocolate or russet brown shaft streaks. The scapulars, flanks, and sides were sandy brown, while the top of the head was pale brown with dark streaks. The sides of the head, a line over each eye, and the throat were slate gray. None of the colors was brilliant. In size of body and limbs and in shape of bill the Laysan Rail resembled the black rails of the genus *Laterallus*. In plumage pattern it is strikingly similar, the principal difference being a somewhat variable tendency toward an absence of dark pigments in the feathers of the back. This may be of protective significance in view of the whiteness of the coral sand and soil of Laysan.



Fig. 3. Laysan Rail captured in 1923 on Laysan Island.
Photograph by Donald R. Dickey.

The environment.—Laysan Island is a member of the Hawaiian archipelago situated 790 sea miles to the northwest of Honolulu, latitude $25^{\circ} 2' 14''$ N, longitude $170^{\circ} 44' 06''$ W. It is oval in shape, approximately two miles long by one mile wide, and has a maximum elevation of about 30 feet. A fringing reef surrounds the island protecting its shores from violent wave action. The central part of the island holds a salty lake, or lagoon, about one mile long by one-third mile wide. The ground surface of Laysan is loosely packed coral sand with flat surfaces of exposed coral reef and phosphate rock on the south and west sides (Bryan, 1942:83). South of the lake, a pool and spring existed at one time.

The climate is sufficiently subtropical to allow such birds as Fairy Terns, Red-tailed Tropic Birds, and Frigate Birds to breed there. At the Midway Islands, about 400 miles to the northwest of Laysan, the temperature ranges from 50° to 85° F., winds blow occasionally up to 80 miles per hour, and the rainfall is 50 to 60 inches per year, with the months from May to December relatively dry (Hadden, 1941:11-12). Laysan prob-

ably has a similar but somewhat milder climate because of its more southern location.

For a description of the vegetation, the reader is referred to Christopher and Caum (1931) and for a general account of the complex bird life to Fisher (1906).

The rail had no important enemies on Laysan. Fisher thought the habit of slinking about in the shade of grass tussocks or bushes suggested they might have winged enemies, possibly the Frigate Birds. However, he noted that the rails did not hesitate to come out into the sunlight after food and reasoned that perhaps it was the hot sun that caused them to retire to cooler byways. Dill states that Frigate Birds captured rabbits on Laysan, as several times he saw them pick up full grown individuals. The albatrosses, shearwaters, and petrels did not molest the rails. No observations indicate that the egg-breaking Laysan Finch entered rail nests in search of eggs.

Adult activity.—Rails as a group are characterized by weak flight and there is complete loss of the ability to fly in many rails that inhabit islands. Examples of flightless rails other than the Laysan bird are the Hawaiian Rail (*Penula millsii*) and the Wake Island Rail (*Rallus wakensis*). In spite of weak flight many rails are able to make extended migrations or to disperse widely by flight. Probably the ancestral Laysan Rail reached Laysan Island on wing. Once established there, its powers of flight degenerated in correlation with the lack of terrestrial enemies. Individuals making long flights from Laysan, moreover, might have stayed at other places or have become lost at sea. The existence of flightless rails at Lisianski Island, if it actually occurred, may have resulted from this type of dispersal.

Fisher (1906:807) says of the Laysan Rail that it does not seem to exhibit any predisposition to fly. He only saw them spread their wings when hopping up to a perch or when running fast, and then they made no attempt to rise off the ground. In photographs of Laysan Rails taken by Blackman at Midway in 1940, several views of the birds showed blurred wings. This indicates that they probably used their wings for balancing and in bathing and other activities more frequently than was recorded. The motions no doubt were so rapid that they frequently escaped notice.

In its habits the rail was active, swift, and restless. It sped lightly over the sand running from one grass tussock to another, or it crept mouse-like in and out of burrows and through the grass, thrusting its head forward and from side to side inquisitively. It would stop in the shade of plants to peer at an object with one foot poised in air and tail drooped, then progress again with many stops and starts. When pursued, it would dodge in and out of petrel burrows.

It was able to leap and was observed to spring up to a perch or often on to a table where it would search for scraps of meat. It probably could jump in evasive running, and it used its wings freely in such activity. On Midway it was found incapable of jumping out of pits four or five feet deep, and it remained trapped in excavations of this character (Caum, personal communication).

The rails came to buildings in the presence of human beings with far less fear than did chickens. Hadden and Blackman found that they showed little fear if a person remained motionless. In fact, the birds would bathe when Blackman sat three feet from a water pan he set out. During the life of the Midway colony the rails developed no marked fear of man.

A significant contrast in fear reactions in comparable situations is evident in the manner in which incubating adults of the insular Laysan Rail and the continental Black Rail (*Laterallus jamaicensis*) behave in the presence of human beings and their photographic gear. Fisher (1906:802) states that while photographing a nest of a Laysan Rail, he propped back the mass of juncus stems which obscured it. During the adjusting of

apparatus the rail crept on to the nest and began to cover herself with the soft lining, although the camera was only two feet away. He lifted her off, but almost at once she slipped back again and settled down. Then with the dark-cloth he persuaded her to retire to the tall grass, and again she returned immediately.

Walker (1941:246) had a different experience when he tried to photograph a Black Rail at a nest with five eggs. While the camera was being set up, the rail made a short flight from one clump of salicornia to another. During the following five hours while Walker was there, the rail did not go to the nest. A twig laid across the nest when he left at dusk was undisturbed the following morning at daylight. Two of the eggs were now pipped, and from the salicornia nearby the rasping call of one of the watchfully waiting adults could occasionally be heard. In the course of the day the pipped eggs hatched without parental aid. Walker concluded that this event "supported published accounts of the sensitiveness of this rail to intrusions upon its nest."

Types of behavior that have impressed the various observers were: restless activity, inquisitiveness, fearlessness, rapid alarm reaction, persistence. Changes in responses which seem likely to have occurred owing to isolation at Laysan were associated with fearlessness. Inquisitiveness probably was given greater play when fear inhibitions were removed, and the ability to recognize terrestrial enemies may have become somewhat dulled. The general alertness of the rail was not lost, as shown by its inquisitive and industrious behavior.

In the morning the bird was extremely active and on occasion kept up the activity throughout the day. In the middle of the day it was reported less active by Fisher, who made summer observations at Laysan. Blackman's observations at Midway were contrary to this, for he found little difference in activity in the course of the day. It is possible that in the summer heat of the more southern island the birds became inactive and sought shade to a greater extent than they did in the milder winter climate of the more northern island. All observers report that the activity was again great in the late afternoon and continued until dark. The rail was not seen abroad at night, although Blackman (1945:298) heard its cry at all hours of the night and supposed it was active in the darkness.

During foraging, notes were uttered intermittently; Schauinsland (1899:45) saw them stop their hunt from time to time to warble a "song." Frohawk's captive rails chirped incessantly during the day, uttering from one to three short, soft notes. Wild rails "rattled" with swollen throats and bills slightly opened while standing in the shade. The calls may have been louder and more frequent during the breeding season and were perhaps associated with individual territories, as Blackman recorded that an adult male gave the loud rattling call at a spot most frequented by this bird and its mate. Perhaps an incident described by Fisher (1906:801) had similar significance. He "saw two approach each other with feathers erect and when close together begin rattling in each other's face. Then they suddenly ceased and slunk away in opposite directions." An evening manifestation of communal song terminating the daytime voicings was noted by Frohawk (1899:248), who wrote: "Soon after dusk they all, as if by one given signal, strike up a most peculiar chorus, which lasts but a few seconds, and then all remain silent. I can only compare the sound to a handful or two of marbles being thrown on a glass roof and then descending in a succession of bounds."

Blackman (1940:27) saw a male and female, apparently mates, perform as follows: "They sat several minutes close together close to main stem of a bush on the shady side and in turn held their heads down close to the ground while the other picked among the feathers at the top of head and back of neck." This seems to be mutual preening.

Food and feeding.—Schauinsland was impressed with the fact that this rail had become virtually an omnivore, whereas originally, he thought, it must have fed largely on worms and other aquatic invertebrates. Many statements in the accounts consulted show that the Laysan Rails ate mainly insects, secondarily, the contents of sea birds' eggs and, additionally, flesh from corpses of birds, green vegetable material (Fisher, 1906:801) and seeds (Fisher, *loc. cit.*; Caum, personal communication referring to captive birds). All these foods were abundant on Laysan and most were available at all seasons of the year. Some foods were subject to seasonal fluctuations in availability, such as eggs and carrion.

Among the arthropods consumed, flies, maggots, moths, caterpillars, beetles, earwigs and spiders are mentioned. The flies were principally "blow flies" of the family Sarcophagidae and the beetles were of the Dermestidae. Both bred on the bird corpses. The maggots of the flies were eagerly consumed when emerging and going into the ground to pupate. The rails dug them up by flipping the sand sidewise with the beak. The bird was sufficiently swift in its movements to catch flies out of the air and while they were at rest on the corpses and broken eggs. Blackman (1940:3) noted that when they caught a fly at a corpse, "they usually made a sudden run away from the dead bird, devouring the fly a few feet away before returning." Moths and caterpillars were sought on vegetation, and moths were chased in the evening when the insects were in flight.

The eggs of terns and petrels were eaten at every opportunity. As related by Fisher (1906:801), "Mr. Snyder soon found that he had only to break a tern's egg and place it in the open, when a rail would appear and begin to eat it. In this way it was not difficult to secure good photographs. Porzanulas lurk about the outskirts of tern settlements all the time, and I once had to frighten one from a tropic bird's nest while attempting to photograph the egg. I also saw a rail ruffle its feathers and rush at three telespizas, driving them from a *Sterna* egg on which they were feeding. The rail then set to and finished the repast, dragging the embryo about in a vain attempt to swallow it."

The rail largely depended on the finch to open the eggs, but Munro and Palmer once saw a rail break a tern's egg. In Munro's words (1930:687), "It leaned well back, brought the end of its bill down on top of an egg with all the force it could muster and, flapping its wings and jumping off the ground, eventually broke through. Then it cleared a channel across the top of the egg and was about to enjoy its hard-earned meal when the tern came back and drove it off." In Palmer's account the rail is said to have eaten the contents before being driven off. Petrel eggs, of course, were normally laid underground by species that burrowed, but on Midway in 1940, the several hundred human inhabitants trampling on the breeding grounds caused the collapse of large numbers of burrows. This may have accounted for Bonin Island Petrel eggs found on the surface in fairly large numbers by Blackman. Many of these were seen broken and partly eaten, and rails were actually observed eating them. Blackman saw rails run down petrel burrows, often to dash out again immediately but frequently to stay three or four minutes or even longer. They may have eaten eggs or caught small insects while there.

The rail was fond of flesh and frequently it picked shreds of flesh and fat from carcasses of birds; in houses it sought tidbits scraped from skins of birds by collectors.

The presence of the afore-mentioned food resources had the following influences on the rail: (1) made possible the colonization of the island; (2) contributed indirectly to loss of flight; (3) encouraged retention of swiftness of foot and keenness of vision for capture of insects; (4) encouraged aggressiveness and pugnacity in obtaining egg contents from bird colonies and in driving competitors (finches) from the eggs, and (5) led to development of an omnivorous habit.

Blackman found that the rails would come readily and repeatedly to a small pan of fresh water to bathe and drink. Thus it is seen that they would use fresh water when available even though they doubtless got along without it much of the time. Since other rails inhabit dry areas remote from water on Pacific islands, it appears that the rails as a group are adaptable in their fresh-water requirements.

Reproduction.—On Laysan Island, nest building was under way in April, and nests were definitely present in June and July. The records of various observers indicate that the height of the nesting season came in these months. At Midway in 1940, Blackman found nests and young rails in late March, which appears to be earlier than usual.

A ring of juncus thicket growing around the lagoon on Laysan was the preferred nesting site, but bunch grass was also much used. On Midway, grass tufts were used for shelter, and one nest was reported under a trailing plant growing beneath ironwood trees. Most of the shelter available at Midway was *Scaevola*, and it is likely that nests were built under this shrub as well as in the grass.

Nests were made on the ground or on matted vegetation. Sometimes they were hollowed out of accumulations of dried juncus leaves which were more or less rearranged in place. In one such nest an opening between the stems close to the ground led into the nest through a runway about 6 inches long. The round cavity was within the clump of matted rushes, hence roofed, and was lined above and on all sides with soft, dried stems. The entrance way was not so lined. In grass tussocks the bulky nest was hollowed out of the mass of dried stems and leaves. In a nest in this situation the lining of the cavity was of finer shredded stems with some down from young albatrosses. Rothschild's (1900:9) description seems somewhat at variance with the foregoing, for it gives the impression that the nest was more or less wholly constructed, with a "cover placed over it"; however, his figure (*loc. cit.*, opp. p. 58) shows an open-cupped type of nest. Perhaps the amount of material hauled and built into the nest varied with the amount of matted grass already present in a suitable spot.

The first eggs were recorded at Laysan in May, the latest in June. All the eggs Fisher found in May were "fresh," and he thought they would have hatched about the middle of June. About a dozen clutches seem to have been recorded, and of them about two-thirds consisted of three eggs and the rest of two. This contrasts with 8-10 eggs per clutch for the Black Rail and 6-10 for the Yellow Rail of North America. The sizes of eggs are recorded as follows: average of 3 eggs, 29.2 mm. \times 21.8 (Rothschild, 1900:10); typical of about 2 dozen eggs, 31.0 \times 21.1 (Fisher, 1906:801). Fisher says they do not vary more than a millimeter from 31 \times 21, but "occasionally one is slightly longer and wider." The eggs are not pointed but are subequal at the two ends, judging from Rothschild's figure. Fisher called them "bluntly ovate or elliptical ovate." The ground color was pale olive buff, while the maculations were predominantly pale raw sienna but also faint lilac gray, evenly distributed or sometimes more concentrated at the larger end.

Fisher thought the females stayed closer to the nests than the males, as more males were collected than females. The few nests he watched always contained old birds when visited.

Observations on Laysan showed that the chicks hatched out in numbers in June, but they appeared as early as March at Midway. The down of the newly hatched chicks was black, the bill was yellow, and the legs and feet were black. Immature birds with contour feathers were pale buffy tan underneath. Hadden says the downy young soon learned to feed themselves, and they developed an ability to run as fast as the older birds within the first five days. Very young chicks were able to give vent to much noise. He

believed the young were guarded for the first month, and Blackman saw an old rail accompanying a downy young on March 17.

The only estimate of the rail population available for Laysan is Dill's (1912:21), that "there are about 2,000 rails on the island." Impressions of abundance were received by himself and other authors, for he says "they were everywhere fairly abundant on all parts of the island excepting the beaches," while Fisher (1906:800) said they were "everywhere on Laysan in great numbers." Dill's estimate compares well with a computation based on a statement of Bryan's (1915:319) that "almost every square rod of the grassy portion of the island has its pair of rails." A rough calculation shows that a maximum of about 0.9 square miles, or 922 square rods, of grass land and vegetated land existed. This would account for 922 pairs of rails, or 1,844 breeding adults. Perhaps unpaired adults would have raised the number to more than 2,000.

Bryan remarked that rails in 1902 were almost as abundant at Midway as they were at Laysan. Caum thought there were 600 to 750 rails at Midway in 1923, which would give the figure of about 0.25 pairs per square rod of vegetated area, a density in keeping with Caum's opinion that these pugnacious birds "need plenty of room." In captivity Caum found that two pairs existed amicably in an enclosure of 6 × 12 feet, but that when more were present they fought. In 1939-1940, Blackman found them very numerous over almost the entire area of both the islands at Midway (1945:298).

SUMMARY

1. The Laysan Rail was discovered in 1828 and persisted for the following 116 years. No colonies were known to survive the year 1944.
2. The Laysan Rail lost the ability to fly. It used its wings in running, jumping and the intimidation of other small birds.
3. The rail was generally alert, comparatively fearless and highly inquisitive.
4. The food of the rail consisted of insects, birds' eggs, scraps of meat and vegetable matter.
5. Two or three eggs were laid per clutch. Downy young appeared from March through June, but May and June were the height of the nesting season.
6. In 1911, the population of rails on Laysan Island was about 2,000 individuals, or one pair per square rod of vegetated area.

LITERATURE CITED

- Baldwin, P. H.
1945. Fate of the Laysan rail. *Audubon Mag.*, 47:343-348.
- Blackman, T. M.
1940. Notes on the birds of Midway Islands. MS., 33 pp. (in library of Bernice P. Bishop Museum).
1945. War casualties among the birds. *Natural History*, 54:298-299.
- Bryan, E. H., Jr.
1942. *American Polynesia and the Hawaiian chain* (Honolulu, Tongg), 253 pp.
- Bryan, W. A.
1915. *Natural history of Hawaii* (Honolulu, *Hawaiian Gazette*), 596 pp.
- Chapman, F. M.
1940. *Handbook of birds of eastern North America*. 2nd rev. ed. (New York, Appleton), 581 pp.
- Christophersen, E., and Caum, E. L.
1931. Vascular plants of the Leeward Islands, Hawaii. *Bernice P. Bishop Museum, Bull.* 81, 41 pp., pls. I-XVI.
- Dill, H. R., and Bryan, W. A.
1912. Report of an expedition to Laysan Island in 1911. U. S. Dept. Agr., *Biol. Surv.*, *Bull.* 42, 30 pp.

Fisher, H. I., and Baldwin, P. H.

1946. War and the birds of Midway atoll. *Condor*, 48:3-15.

Fisher, W. K.

1906. Birds of Laysan and the Leeward Islands. *Bull. U. S. Fish Comm. for 1903*, 23:767-807.

Frohawk, F. W.

1892. Description of a new species of rail from Laysan Island (North Pacific). *Ann. and Mag. Nat. Hist.*, 9:247-249.

Hadden, F. C.

1941. Midway Islands. *Hawaiian Planters' Record*, 45:179-221.

Munro, G. C.

1930. Myriad-nested Laysan. *Asia*, 30:687-689.

1945. Notes on the bird life of Midway Islands. *Elepaio*, 6:22-26.

Rothschild, W.

1893. The avifauna of Laysan and the neighbouring islands (London, Porter), part I:i-xiv, 1-58.

Schauinsland, H.

1899. *Drei Monate auf einer Korallen-Insel (Laysan)* (Bremen, M. Nössler), 104 pp.

Walker, L. W.

1941. Young California black rails. *Condor*, 43:256.

Bernice P. Bishop Museum, Honolulu, Hawaii, August 26, 1946.