

March (2), 27 March (1), 27 April (1 male, 1 female), 5 August (1), 29 August (2 males, 1 female), 2 October (3), 27 November (1 male, 1 female); 1965, 9 February (1 male), 15 February (1 male), and 17 February (3); 1966, 21 October (2).

The August records are of interest since according to Mayfield (*op. cit.*: 39) most of the birds are thought to remain in Michigan until late August or early September.

On Grand Bahama almost all birds were seen in areas of Caribbean pine (*Pinus caribaea*) with an understory of poisonwood (*Metopium toxiferum*) and palmetto (*Serenoa repens*). The winter habitat is generally reported as being scrub growth only. The Eleuthera records were from scrub growth, but this and many other islands of the group are devoid of pines.

On several occasions an individual warbler landed on the lower section of a pine trunk and then worked its way upward, circling the tree and probing beneath the bark much as a Brown Creeper (*Certhia familiaris*) does. After reaching the branched portion of the tree, the warbler would fly to the base of another tree and repeat the performance. Mayfield and others (*pers. comm.*), who have observed the species in Michigan, have not seen this type of feeding behavior there.

A 1,500-acre tract of large pine near Freeport, Grand Bahama, has been set aside as a wildlife sanctuary by the Freeport Garden Club and the Colonial Research Institute in cooperation with the Florida Audubon Society. Additional areas should be established on Grand Bahama before increased urban development eliminates all suitable wintering locations.—MARGARET H. HUNDLEY, *Florida Audubon Society*, P. O. Drawer 7, Maitland, Florida.

Polynesian rat predation on nesting Laysan Albatrosses and other Pacific seabirds.—In September, 1963, the Smithsonian Institution began a study of Kure Atoll, the westernmost atoll in the Hawaiian Leeward Islands. As part of this program, predator-prey interactions between the Polynesian rat (*Rattus exulans*) and seabirds were observed.

Green Island, the only permanent land in the atoll, supports a dense growth of *Scaevola taccada* surrounding an open plain where the low-lying plants *Tribulus cistoides*, *Solanum nelsoni*, *Boerhavia diffusa*, and *Eragrostis variabilis* are found. C. H. Lamoureux (*Atoll Res. Bull.*, 79: 1-10, 1961) describes the botanical aspects of the island in detail. There are 14 species of sea birds which nest on the island (see K. W. Kenyon and D. W. Rice, *Condor*, 60: 188-190, 1958). Only two native mammals, the Polynesian rat and the Hawaiian monk seal (*Monachus schauinslandi*), occur there.

The Laysan Albatross (*Diomedea immutabilis*) is the most conspicuous bird on the island during its breeding season, which extends from November through July. Approximately 5,000 of these birds use the island, and about 1,000 pairs generally breed each year. Large-scale banding programs and studies of individual nesting pairs permitted regular observation of these birds through two consecutive breeding seasons.

The other workers on the program and I frequently encountered injured Laysan Albatrosses and noticed dying and dead adults with large gaping wounds in their backs; 12 such birds were found in the 1963-64 breeding season. In 1964-65, similarly injured birds were also seen. Over 50 individuals were found and many others may have been concealed by the dense *Scaevola*.

The open wounds were always found on the birds' backs, either slightly anterior to the uropygial gland, or forward between the scapulae. Small holes, one to two inches in diameter, were occasionally found. At this stage, wounds were sometimes obscured by feathers, and the injury did not cripple the bird (Figure 1). More often,

sores five to seven inches in diameter were seen. The thoracic cavity was often exposed, and ribs and scapulae, or even lungs, were visible through the gaping hole. The wings drooped when the bird stood or walked, as a result of severed muscles. Birds that had wounds on their rumps often limped or were unable to walk. The injuries were often infested with the eggs of flies, and occasionally harbored maggots (W. O. Wirtz, II, pers. comm.). The feathers surrounding the hole were caked with blood, and the birds' bills were stained from probing into the wound. Birds in these advanced stages rarely survived the night following their discovery.

I had the first indication that Polynesian rats were involved in this situation on 22 January 1965. At 2200 hours a Laysan Albatross was found sitting in the open plain. As I approached, rats fled from my flashlight beam. The bird had a large wound on its back. I shut out my light and sat down to watch, waiting a few moments before shining the headlight again on the albatross. When I did so, many rats



Figure 1. Small wound on the back of an adult Laysan Albatross. (Photo courtesy of W. O. Wirtz, II.)



Figure 2. Polynesian rat approaching an open wound on the back of a Laysan Albatross. The bird's bill is blood-stained from his probing into the wound. The dark stripe on the bird's head is a painted mark. (This photograph has been retouched slightly to show the rat clearly against the bird's dark back.)

scampered off his back where they had been feeding. Sitting quietly, with the light on, I could see rats approach the live bird, crawl upon his back, and feed on the exposed flesh. Every now and then the bird would twitch, turn back to try to get the rats, and then look forward again. There were over 20 rats feeding on the bird when I left. It was dead the following morning.

The next day another wounded Laysan Albatross was found and rats were feeding on this bird in full daylight. Although fewer rats were present, they attacked as had those of the previous night. They approached from the flanks or rear of the bird, climbed up over the tail and forward to the wound, where they fed (Figure 2). Although the albatross turned and seized two rats, throwing them aside, others took their places. This albatross was also found dead the following morning. Rats also fed on the dead birds, picking the bones clean and often burying the carcass as they burrowed around and under it to get at the flesh.

Another incident illustrates how quickly the birds may be immobilized. One incubating male, in perfect health on 28 January, was found the following day sitting beside his nest, a six by seven inch wound in his back. The bird was unable to walk, and could barely hold up his head.

I still did not know whether or not the rats had initially caused the wound. Nesting in the central plain with the Laysans were two colonies of Blue-faced Boobies (*Sula dactylatra*), which vigorously defended nesting territories and often attacked Laysans walking in the area. Laysans occasionally fought among themselves. Although feathers were often lost during these conflicts, we never observed the infliction of bleeding wounds on the backs of the contestants.

On 23 January 1965, four incubating Laysans within 100 feet of each other were found surrounded by a circle of feathers which had been cleanly cut across the shaft; the cuts were extremely even and could not have been made by a bird's bill. The stubs of these feathers were still attached to the birds' backs, all in the area over the rump where wounds occur. No open sores were found. On 26 January one of these Laysans had a one-half inch diameter hole in the area where the feathers had been cut. Subsequent nest abandonment precluded tracing the development of the wound.

In order to determine if the albatrosses were diseased, we collected three afflicted birds and sent them to Dr. L. W. Locke at the Patuxent Wildlife Research Center, Laurel, Maryland. Dr. Locke reports that "no evidence of infectious disease was found in any of these three albatrosses." All birds had considerable amounts of subcutaneous fat. Thus it seems obvious that the rats prey on healthy, incubating birds, first by removing their feathers and then by feeding on the exposed flesh.

Laysan Albatrosses, which weigh up to five pounds, should be able to destroy these predators. The following observation may be instructive. I approached several incubating birds, moving slowly and low to the ground. Many birds not only permitted me to agitate the feathers on their rump, but failed to respond when sharply pinched. They looked back, but continued to incubate. Laysans under attack by rats behaved in a similar manner, and appeared to have no adequate defense against such an attack. The reports of the reluctance of Laysan Albatrosses to leave their nests under adverse conditions are legion (see J. W. Aldrich, *National Geogr.*, 125: 838-851, 1964), so such indifference is not unexpected.

Although many albatrosses remained on their nests, others abandoned them when attacked. Table 1 shows the monthly change in numbers of active Laysan Albatross nests for the 1964-65 season. A severe storm in late December, normal abandonment of infertile eggs, and disturbance to nesting birds by the banding operations may have been responsible for many losses. In addition, it is assumed that the 50 or more adults found dead and eaten had been breeding birds. However, the 51.8 per cent net loss for the season far exceeds the 6 per cent per month losses found by Rice and Kenyon (*Auk*, 79: 372, 1962) on Midway and the 15 per cent seasonal loss estimated for Kure Atoll (Kenyon and Rice, *op. cit.*: 189). The much higher loss found in this study may in part represent the abandonments caused by the rats. My co-workers and I found over 30 abandoned nests surrounded by cut feathers. We did not make a thorough survey of abandoned nests, and the numbers involved may have been much higher. Although rats (*Rattus rattus*) occur on Midway, no predation on albatrosses there has been reported.

TABLE 1
MONTHLY CHANGE IN NUMBERS OF ACTIVE LAYSAN ALBATROSS NESTS,
1964-65, GREEN ISLAND, KURE ATOLL

| Date | Number of nests | Per cent loss |
|-------------|------------------|---------------|
| 28 November | 174 | — |
| 26 December | 841 | — |
| 31 December | 729 | 13.3 |
| 30 January | 631 | 13.4 |
| 27 February | 402 | 36.3 |
| 27 March | 405 ¹ | — |
| 18 April | 416 ¹ | — |

¹These increases resulted from a more accurate survey in dense *Scaevola* thickets.

Other instances of predation on seabirds have been observed during this project. Occasionally we found Laysan chicks that had been eaten. The exposed heel of the nestling often had been bitten; resultant bleeding may have killed the chick (Wirtz, pers. comm.). Bonin Petrels (*Pterodroma hypoleuca*) lay up to 500 eggs per season on Kure, but as yet no chick has been found. Excavation of petrel burrows has revealed fragments of their eggs. Rats have been observed carrying Sooty Tern (*Sterna fuscata*) eggs away from a disturbed colony. They straddle the eggs and puncture the end of the egg before carrying it off (David Bratley, pers. comm.). In July, 1965, Bratley also found rats preying on Noddy Tern (*Anous stolidus*) chicks. These chicks have been found with wounds into the body cavity. In a two-week period the number of Noddy Tern chicks dropped from 528 to 381, a loss of 27.9 per cent. Of the 147 chicks lost, only 8 were found and all had wounds into the body cavity. Two live chicks were also found with similar wounds. Rat predation may have been the major factor involved in this loss. Reports in the literature of such predation are rare (see, however, J. D. Hague, *Amer. J. Sci. Art.*, 34: 224-243, 1862; and L. Howland, *Pacific Sci.*, 9: 95-106, 1955).

The lack of observations of Polynesian rats feeding on Laysan Albatrosses is understandable. Kure, infrequently visited by biologists in the past, is the only island in the world where Laysan Albatrosses and Polynesian rats are sympatric. Also, we found predation only from December through April; thus, anyone visiting the island at other times would probably not detect this event. A. Wetmore (unpubl. field notes) visited the island in April, 1923, and found a dozen Laysan Albatross skeletons in the central plain. He concluded that the large birds landed in the area, could not take flight, and starved to death. Kenyon and Rice (*op. cit.*: 189) also found albatross skeletons. Our observations are that the Laysan Albatrosses experience no difficulty in flying from the plain. Thus, many skeletons found by observers in the past may have been victims of the rats. If so, this predation is long established and of regular occurrence on Kure. Similar predation should be looked for wherever *R. exulans* and seabirds occur together.

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Turkey Vultures attack living prey.—In his review of K. E. Stager's "The role of olfaction in food location by the Turkey Vulture (*Cathartes aura*)," A. Wetmore (*Auk*, 82: 662, 1965) makes the following statement: "It is interesting that while Black and King vultures attack living animals unable to defend themselves, it is doubtful that this is true with *Cathartes*, regardless of published statements to the contrary."

The following contrary observations might therefore be of interest. Both of the incidents listed below were observed from our hawk-trapping blind at the Cedar Grove Ornithological Station, Sheboygan County, Wisconsin. Our traps are not more than 125 feet from the blind.

On 5 October 1961 David E. Seal and Berger observed the following. At 1205 hours a juvenal Turkey Vulture appeared in the north, swooped low over a tethered