

no record is known for *T. subruficollis* from Hawaii. Other than a record of this species from Japan by Hartert (1920:1598), no date given, our specimen represents the only known record of a range extension for *T. subruficollis* in the Western Pacific area.

Although Baker (1951:150) records the Sanderling (*Crocethia alba*) as a regular visitor in eastern Micronesia, we did not observe this species in 1965, and Woodbury (1962:70) reports only two individuals, 13 March and 19 April.

*Sterna sumatrana*. Black-naped Terns were common throughout the period and were found nesting from 8 March to 1 May along the beaches of many sites.

*Sterna fuscata*. Sooty Terns were seen flying over many areas of the atoll, but the large nesting colony of 20,000 birds reported by Woodbury (1962:71) on Rojoa (Ursala) was not present in 1965, possibly due to a significant increase in vegetation; indeed, we saw no more than 50 individuals on any one day and were unable to locate any further nesting activity of this species.

*Thalasseus bergii*. A Crested Tern was first observed on 13 March at Igurin (Glenn). Mottling on the back made it apparent that it was immature. This species was observed more and more frequently into April and May. Two immatures were seen on 28 March at Aniyaanii (Bruce); three immatures and one adult were seen 30 March at Igurin (Glenn); one adult was seen at Engebi (Janet) on 8 April; one adult was present on Rigili (Leroy) on 14 April; five immatures and one adult were observed on 21 April at Igurin (Glenn).

*Anous* spp. Brown Noddies, *A. stolidus*, and White-capped Noddies, *A. tenuirostris*, were common nesters throughout the period on sites with more than a minimum amount of vegetation. *A. tenuirostris* was found as a colonial nester in trees scattered through the interior of the individual sites. *A. stolidus* nested generally in the leaf litter of small clearings and openings, but approximately one out of 30 nests was found built about one meter above the ground in low bushes. When this occurred, it was noted that the shallow cup of the stick nest was invariably lined with dead coral and discarded mollusk shells, upon which the single egg was laid.

*Gygis alba*. Fairy Terns were present everywhere, and numerous "nests" of single eggs balanced precariously on branches were found throughout the period on almost all of the sites.

Woodbury (1962:72, 75) reported the presence of two additional larids during his period of observation—Gray-backed Tern (*Sterna lunata*) and Blue-gray Noddy (*Procelsterna cerulea*). Woodbury collected a specimen of the former species in March, and he observed an individual of the latter species on 22 February. *S. lunata* is widespread throughout Micronesia due to its pelagic habits; *P. cerulea* is accidental. Baker records eight specimens taken by Yamashina (1940: 678) at Bikar Atoll, Marshall Islands, as the only previous known record for *P. cerulea* in Micronesia.

Our observations, together with the additional records from other observers, constitute the known occurrences of the various species of birds on Eniwetok, including 30 species of 10 families.

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**Orientation of Zugunruhe in the Rose-breasted Grosbeak, *Pheucticus ludovicianus*.**—On 20 May 1964, while netting Indigo Buntings (*Passerina cyanea*) near Ann Arbor, Michigan, for use in migratory orientation studies, I captured an adult female Rose-breasted Grosbeak (*Pheucticus*

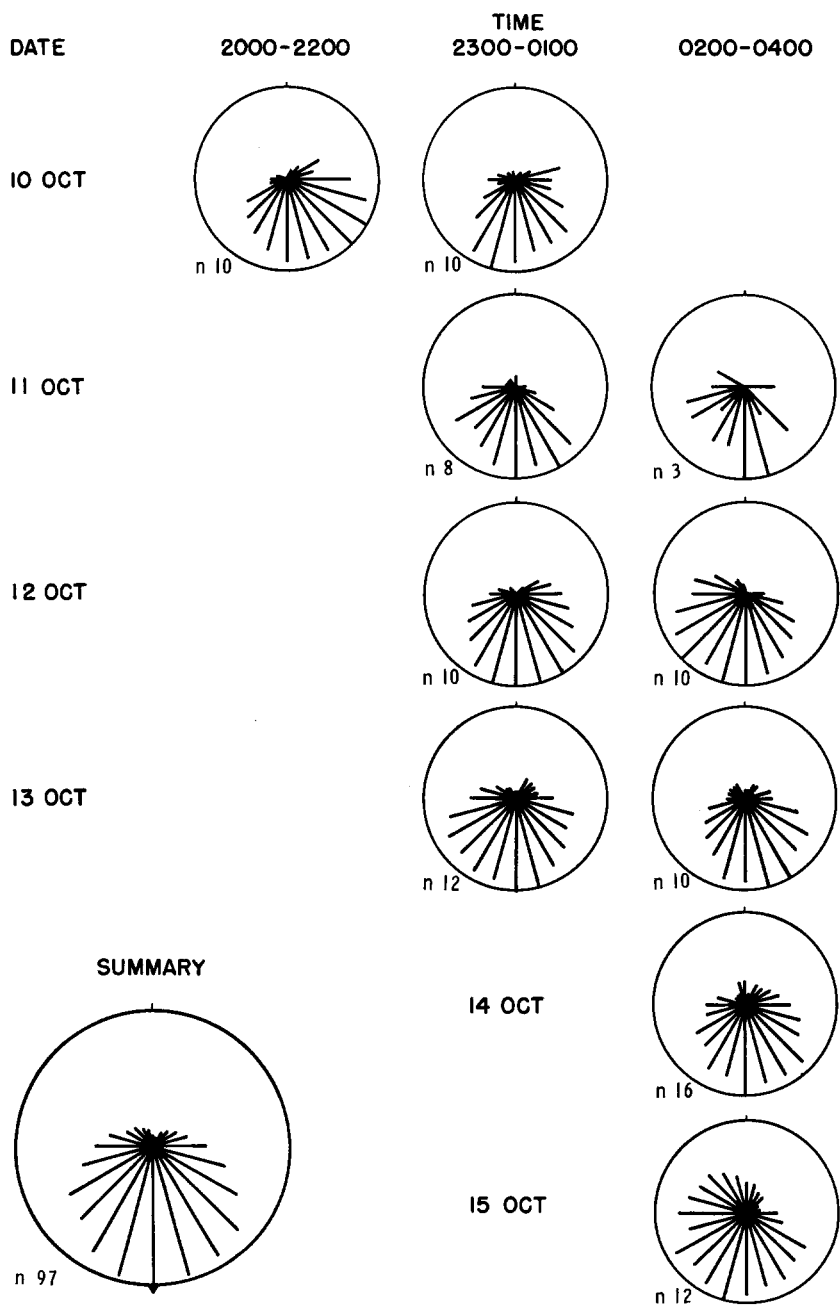


Figure 1. Orientation of nocturnal activity of an adult female Rose-breasted Grosbeak during the fall of 1964. Vector diagrams are plotted on a proportionality basis, the radius equalling the greatest number of units of activity (n) present in any one 15° sector.

*ludovicianus*). Since the Rose-breasted Grosbeak, like the Indigo Bunting, is a long-distance, nocturnal migrant, this individual was kept in captivity through the summer in order that its behavior might be observed in the following autumn migration season.

The bird was housed with several Indigo Buntings in an outdoor aviary ( $4 \times 8 \times 6$  feet). Shelter, food (consisting of white millet and canary and sunflower seeds plus occasional lettuce greens), and water (to which ABDEC liquid vitamins were added once a week) were continuously available.

The bird remained in good health and molted normally between late July and early September. By late September noticeable quantities of fat had been deposited in the furcular and abdominal regions of the body, and nocturnal restlessness, or *Zugunruhe*, had commenced.

Because I was concentrating on Indigo Bunting experiments, the orientation of the grosbeak's nocturnal activity was not recorded until the week of 10–15 October, when the bird was tested outdoors under the natural night sky in an open field 25 miles northwest of Ann Arbor. This location was selected to minimize the possibility of interference from phototactic responses to horizon glows produced by city lights. All tests were conducted under moonless conditions, a fact which necessitated the abandonment of early-evening observations after 10 October.

Prior to each experiment, the bird was placed in a small, funnel-shaped cage (upper diameter 41 cm; lower diameter 10 cm). The sides of this cage were constructed from a cone of white blotter paper and rested on the rim of an aluminum pan. A thin sponge sheet, moistened with black printers' ink, covered the inside bottom of this pan and formed the cage's floor, while a square of one-half-inch hardware cloth capped the funnel, folded down at the four corners to hold it in place (Emlen and Emlen, *Auk*, 83:361–367, 1966). From inside the funnel-cage, the sky overhead is clearly visible, but all terrestrial and celestial objects within  $25^\circ$  of the horizon are blocked from view.

Every time the bird jumped forward onto the sloping paper sides of this cage, it left a footprint record before sliding back to the ink-covered floor, and the accumulation of these inked footprints produced the orientation record of the bird's activity. The footprint density in each  $15^\circ$  sector of the funnel was then evaluated numerically by direct comparison with densities on a reference key designed to represent 20 equally increasing units of activity. The quantified results could then be plotted in vector form and subjected to appropriate statistical treatment (Emlen and Emlen, *ibid.*).

The results obtained from this Rose-breasted Grosbeak show a clear, consistent, southerly orientation of nocturnal activity (fig. 1). In fact, vector analysis of the data yields a mean direction of exactly  $180^\circ$ —due south (angular deviation =  $60^\circ$ ). This coincides well with the presumed autumn migratory flight path of the species, which breeds in southern Canada and northeastern and north-central United States and winters in Central America and northern South America.

This caged grosbeak was therefore able to determine its correct migratory direction in the absence of visual, terrestrial cues. This suggests a reliance upon celestial cues. However, since overcast conditions were not encountered, and planetarium tests were not conducted with this individual, the chance that geophysical factors influenced its directional behavior cannot be ruled out.

Although results obtained from a single bird cannot be regarded as conclusive, the present experiment suggests that the Rose-breasted Grosbeak might be an excellent subject for further studies of the mechanisms involved in migratory orientation.

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**Pintail Banded in Northwestern California Taken at Baykal Lake, Russia.**—On 12 February 1956 an adult male Pintail (*Anas acuta*) was banded with band number 546 43449 at Humboldt Bay, Humboldt County, California.

This bird was shot apparently in 1963 at Baykal Lake, Central Siberian Uplands, Russia. The